How spatial planning can enable pathways toward wildfire mitigation within the fire-prone wildland and urban interface, City of Cape Town.

Dissertation presented as part fulfilment of the degree of Masters of City and Regional Planning

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Ewan Pieters

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Abstract

18th of April 2021, a wildfire raged through parts of the University of Cape Towns upper campus, with damage assessed at approximately R500 million. There were calls from senior leadership that UCT "will rebuild facilities". The post-disaster rhetoric of rebuilding is problematic, as we should never rebuild what was because the old geographic, economic and social position is no longer sustainable.

Critical disaster management frameworks strongly advocate more emphasis on preventing disasters; without compromising the much-needed reactive qualities of the discipline. It places responsibility on spatial planning – development restrictions, land uses, building regulations, tenure boundaries, spatial layout and road patterns –as the critical juncture toward achieving long-term disaster risk reduction. Due to climate change, wildfire anomalies and associated destructiveness oblige humankind to revise pieces of knowledge calibrated to conditions that no longer exist. This research responds to this call for "different ways of thinking", investigating the local merging of planning and disaster disciplines in hopes of creating new knowledge to realise long-term wildfire risk reduction within flammable Wild and Urban Interface, City of Cape Town.

This qualitative dissertation collected primary data using online semi-structured interviews with local spatial planners, engineers, disaster management officials and insurance brokers. Secondary data was collected through a review of published journals; and regulations and policies from California, Victoria and Western Cape. Both data sets are used to investigate spatial planning as leverage to realise long-term wildfire risk reduction for the University of Cape Town and Spanish Farm Somerset West sites (the case studies of the dissertation).

Even the best firefighting equipment will not help much during an extreme weather wildfire due to ember storms making fire breaks redundant. Fire-fighting and suppression technologies are less effective than perceived during wildfire extreme weather events. When it comes to traditional wildfire disaster measures such as prescribed burnings and alien vegetation removal – locally, these mitigation techniques are well established. However, the study found that disaster management respondents and best practice policy analysis, local and abroad, unanimously agree

that focus must be placed on protecting urban structures for overall wildfire risk reduction.

The study found that local planners and disaster management officials rarely collaborate on wildfire disaster matters due to misaligned goals and ideals. In the context of climate change, the study found that the local zoning scheme needs an overlay zone dedicated fully to wildfire mitigation, as local overlays have the unique ability to guide development in a potential "fire-safe manner". Within the City of Cape Town, spatial planning has the unique potential to realise this focus through an amended provincial zoning scheme.

The study proposes a Western Cape veld and forest fire management overlay zone that demarcates high-fire risk regions on the urban edge, pre and post-development. The proposed overlay imposes restrictions on these sites to bypass "rebuilding" unsustainably and initiate "build back better" post disaster. This theorises a wildfire-resilient City of Cape Town wild land urban interface. The study employs this proposed fire-specific overlay zone over the projects case studies (UCT and Spanish Farm) – to show how it could potentially mitigate wildfire risk in these flammable sites. The basis of this idea is formed from a cross-contextual analysis of Victoria, California and Western Cape regulation; and from the insights of planning, engineer, wildfire disaster management and insurance industry respondents from the Western Cape region.

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Abbreviations

CCT – City of Cape Town Municipality

City – City of Cape Town Municipality

CoCT – City of Cape Town

CPFPA – Cape Peninsula Fire Protection Association

CSIR – Council for Scientific Industrial Research

DEA – Department of Environmental Affairs

DFFE – Department of Forest, Fisheries and the Environment

DRM – Disaster risk management

ECSA – Engineering Council of South Africa

FPA – Fire Protection Association

IDP – Integrated Development Plan

IPCC – Intergovernmental panel on climate change

MCRP – Master of City and Regional Planning

NEMA – National Environmental Management act 107 of 1998

NVFFA – National Veld and Forest act 101 of 1998

SAB – South African Building Regulations or SAN10400

SDP – Site development plan

SPLUMA – Spatial planning and land use management act 16 of 2013

UCT – University of Cape Town

Veld – Forest or Bush

WC – Western Cape

WCG – Western Cape Government

WUI – Wildland urban interface

2. **Introduction**

2.1 Overview

On April 18 2021, a wildfire raged through parts of the University of Cape Town's upper campus – *see Figure 1* (Bhengu, 2021). After damage assessment post-wildfire disaster, senior management assessed the loss at approximately R500 million – *see Figure 2* (Enca, 2021). The vice-chancellor responded that UCT "will rebuild facilities" (Bhengu, 2021; Enca, 2021). On February 7 2009, Victoria, Melbourne, Australia, experienced a wildfire that destroyed 2100 homes, killed 173 people and resulted in damage totalling $4 billion (Blakely, 2017). The then premier John Brumby said, "they (the dead) unite us all in the task of rebuilding. Because we will rebuild" (Blakely, 2017:63; Jazebi & et al, 2020). In November 2018, the United States of America, California, experienced one of the most destructive fire seasons – the Woolsey fire costing $4 billion and a campfire destroying 18,800 structures, causing 11 billion dollars in damage (Jazebi & et al, 2020). Again the response in California was to rebuild. The disaster management rhetoric of "rebuild" is problematic, as we should never rebuild what was because the old settlement's geographic, economic, and social position is no longer sustainable (Blakely, 2017:63).

Figure 1: 2021 Table Mountain fire that spread to the University of Cape Town causing massive destruction (Charles, 2021).

Figure 2: University of Cape Town, Jagger Library on fire (Charles, 2021).

Due to climate change, wildfire behaviour is predicted with little accuracy (Petryna, 2018). From a global perspective, according to forestry fuels specialist Bill Armstrong, the USA Los Conchas fire burnt through areas where "there was nothing left to burn. Usually, fires move with the wind. However, the Los Conchas fire pushed up against the wind in this case. It had a weather system made up of internal winds. Meaning it was feeding itself. It burned through old wildfire scars" (Petryna, 2018:577).

Furthermore, technology seems to fail to keep up with these wildfire anomalies. For example, to protect firefighters (1994 south canyon fire in Colorado), the invention of aluminium-covered heat resistance shelters was produced (Petryna, 2018:580). However, during the fire, the heat was much more than expected; when fire shelters were deployed, the fire melted the aluminium outer covering exposing the inner covering of the shelter – 14 firefighters died (Petryna, 2018:580). The aforementioned shows that fire predictability is not always accurate. Deploying firefighters and such flawed predictions can be costly and deadly. What does this mean for the city of Cape Town?

Cape Town is not isolated from climate change. Currie et al (2017:94) statistically show a steady increase in average temperature – resulting in significant variability in climate, from increased frequency of drought to intensity and frequency of rainfall, leading to changes in fire intensity and frequency, resulting in the destruction or migration of sensitive plant and animal species. Both at their limits of temperature and rainfall tolerance (Currie & et al, 2017:94). Furthermore, Cape Town has unique topographical, wind and climatic conditions; meaning that fire danger models are not accurate in predicting the risk of fire ignition (Lall & Mathibela, 2016:2). Additionally, fynbos is a heterogeneous fuel type, coupled with the above variability of winds, mountain slopes and now increase in temperature – fire risk models are further unlikely to be successful (Lall & Mathibela, 2016:2). Adding to the unpredictability is the presence of alien plant species in the wild urban interface of the City of Cape Town.

Whilst many alien plants are less flammable than fynbos due to higher moisture content in their foliage, they burn readily once ignited because they tend to have greater biomass than the indigenous fynbos – *see figure 3 and 4* (Mukheibir & Ziervogel, 2006:37). Some of the alien invasive plants have adapted to fire, and hence spread when fires become more frequent (species such as the Australian acacias) (Mukheibir & Ziervogel, 2006:37). If the fire continues to be more frequent and intense, this will favour alien vegetation, harming biodiversity, soil structure enhancing fuel loads, and rising fire hazard overall – plantations and buildings will be subject to more increased risk. On the opposite spectrum, if the frequency of fires is reduced from once in fifteen years to once in five years, many plant species that are killed by fire and that rely on reseeding to survive would become extinct as they would not have enough time to mature and set seeds between fires (Mukheibir & Ziervogel, 2006:36). The

aforementioned abrupt ecological change and associated destructiveness obligates us to revise knowledge calibrated to conditions that no longer exist (Petryna, 2018:589).

Figure 3: UCT alien vegetation (Stone Pines) fuelling and intensifying the wildfire (Charles, 2021).

Figure 4: The Somerset West wildfire 2022, which caused residents to evacuate their homes (Mthethwa, 2022).

There is a need to address urban planning and recovery from disaster, particularly in a time of rapid change and urbanisation. By the year 2050, approximately 68% (around 6250 million people) of the global population will be urban; by 2025, there will be 37 megacities with more than 10 million inhabitants in the world, 22 located in developing countries (March & et al, 2017:6). Lewis Mumford (1961) stated that as humans interact with their environment, use new technologies, and engage in trade, politics, theology, and war history is also replete with human settlements as the core manifestation of civilisation, even though this story is matched with the histories of decline, destruction and ruin (March & et al, 2018). There is a need to manage changes and processes to deal with emergent risks as a core aspect of urban planning.

Spatial planning has significant potential to contribute to disaster recovery through facilitation, encouraging public involvement, improving resilience, and ensuring ongoing maintenance, mitigation, and improvement of human settlements' overall

performance (beyond disaster resilience). The recovery mantra of "build back better", in terms of spatial planning, is tensioned against the challenge of retention of pre-event settings, for it is expected that many aspects of the community may be in a serviceable state and which represent a significant level of investment – as seen by statements the University of Cape Town vice-chancellor (March & et al, 2017:28; Enca, 2021). The prospect of modifying road patterns, tenure boundaries, building regulations, and ways of using land generally, particularly those that are expensive to comply with, may mean that trade-offs are made that erode the ability to improve risk levels during recovery (March & et al, 2017). The underlying principle is to link post-disaster reconstruction with longer-term risk reduction and mitigation to ensure that the same conditions of exposure and vulnerability are not repeated (March & et al, 2017:28).

A holistic approach must be taken to develop resilient settlements, including community development. There should be an acknowledgement that settlements are dynamic rather than static entities, and recovery should not obstruct or limit broader development processes. Moreover, suppose more care is taken to ensure that recovery-related processes are not undertaken in isolation but include all aspects of community development. In that case, the result will be a more adaptive and disaster-resilient settlement (March & et al, 2018). The disaster recovery process is made up of three elements, physical elements (buildings, roads, spatial layout); human systems, including governance of settlements; its social and economic elements (community inclusion, buyback schemes); and environmental systems, referring to how ecological and natural elements interact with the settlement (fuels for bushfires) (March & Kornakova, 2017:233). Spatial planning is a crucial discipline in the recovery process, able to bridge the elements above and inform space in a manner that could increase resilience in cities (March & Kornakova, 2017:233).

2.2 Research Question

Based on the abovementioned situation, the dissertation investigates tools and methods used to identify fire hazards and mitigation measures used in general plans to minimise damage to property in the context of a wildfire (Rice & Davis, 1991). The dissertation draws this information from the local and international contexts. All in the pursuit to formulate informed, multi-dimensional, cross-contextual guidelines; to do with wildfire mitigation within the fire-prone wildland-urban interface (WUI).

Wildfire is a significant threat within the wildland-urban interface – and this issue is not isolated in the Cape Town context. After thoroughly analysing the wildfire WUI issue within Australia, Victoria and California, USA, the dissertation extracts essential lessons that the City of Cape Town can adopt. These cases are not unwarranted, as Cape Town, California and Victoria possess strong commonalities in fire-prone wildland-urban interfaces. The alluded to case studies share a Mediterranean climate (wet winters and dry summers), are negatively affected by climate change, and possess pronounced wildland-urban interfaces where regular wildfire disaster occurs (Currie & et al, 2017; Jazebi & et al, 2020; March & et al, 2018).

The dissertation's main research question asks: *"How can spatial planning be harnessed to mitigate wildfire risk and assist in disaster management within the context of climate change?"* This question is formulated to capture the subject's layered complexity and multi-disciplinary nature. Thus, sub-questions were formulated to break down critical parts of the question and, if answered in its specific parts – begin to paint the picture that would answer the main question. Sub questions are as follows:

"What effects do climate change and associated water scarcity have on city regions with a fire-prone wildland-urban interface?"

The dissertation investigates the role of climate change and associated water scarcity effects on wildfire severity within the fire-prone wildland and urban interface and the local fire industry capabilities and technology used to suppress fire vulnerability. The respondents working within the disaster risk management and veld/forest fire provide a local on-ground perspective of these issues. At the same time, an international perspective is gained from the literature review analysis on areas where wildfire and associated destruction are colossal: Australia, Victoria and California.

"What are the pathways and gaps within spatial planning and wildfire disaster management legislation and policies – capable of championing fire-safe urban structures and properties within the fire-prone wildland and urban interface?"

The question intends to uncover the respondents views on the current wildfire issue facing urban structures and properties within the fire-prone wildland and urban interface. Furthermore, the question interrogates the current legislation and policies and how they perform in practice/implementation. What are some of the pitfalls and successes? The interview gathered relevant answers. Most profound, insightful answers were successfully answered as respondents drew on thoughts and ideas from their vast experience in their respective fields. The types of legislation scrutinised here are the Spatial planning and land use management act 16 of 2013 (SPLUMA), Western cape provincial zoning scheme (WCG, 2004), Cape Town natural interface veld fire planning guidelines (CoCT, 2004), National Veld and Forest act 101 of 1998 (NVFFA), Disaster management act 57 of 2002 and National building regulations of South Africa (SANS10400).

The literature review provided an international perspective of how "best practice" Victoria and California contexts deal with the fire-prone wildland-urban interface and associated destruction. The respondents comprised various spatial/land-use/development planners, disaster risk management officials, insurance industry brokers, fire engineers and veld/forest fire municipal officials. The respondents were interviewed to gain a local understanding of the wildland-urban interface fire problem.

"What is the state of institutional collaboration between spatial planning and disaster management within the City of Cape Town?"

The dissertation investigates the state of collaboration and the lack thereof between planning, forestry, disaster management and firefighting officials – all to do with the future resilience of the wildland-urban interface within the City of Cape Town (Mukheibir & Ziervogel, 2007). This is an essential part of the research because, as alluded to before, abrupt climate change and associated destructiveness have rendered wildfire disasters wildly unpredictable, leaving disaster management officials fighting fires they are unprepared for in some cases. The literature review showcases that the relevant knowledge systems collide through collaboration, and great efforts can be made to combat and mitigate the "new treacherous conditions". Petryna

(2018:589) obligates us to revise knowledge calibrated to "conditions" that no longer exist.

Every respondent interviewed was asked this question to uncover the extent to which professionals and relevant role-players put heads together to solve a problem that needs a multifaceted and multi-disciplinary solution. Uncovered during the research journey is an apparent disjuncture in disciplines working together towards a common goal. Different timelines and scales are some of the impediments to successful collaboration. The types of local regulation and policy under scrutiny relevant to collaboration are the National environmental management act 107 of 1998, Municipal systems act 32 of 2000, and Disaster management act 57 of 2002.

2.3 Ethical position

What prompted the decision to focus on this research was the wildland fire that occurred on April 18 2021, which raged through parts of the University of Cape Town's upper campus (Bhengu, 2021). In response to that fire disaster, the vice-chancellor stated, "we will rebuild" (ENCA, 2021). The prominent ethical position toward this conundrum is adopted from Blakely (2017:63): "we should never rebuild what was because the old settlement's geographic, economic, and social position is no longer sustainable." Throughout my master of city and regional planning (MCRP) class, deep discussions were had on sustainable development – it puzzled me that out of the very same institution, the vice-chancellor would use such unsustainable language. On June 11 2022, the Somerset West fire gutted five homes, and numerous evacuations of communities within the wildland-urban interface took place – *see figure 5*. This was not the first time properties were lost, and evacuations took place – *see figure 6*. Hence spatial planning tools could provide a platform for increasing wildfire resilience within the mentioned fire-prone regions and can guide the "rebuilding process" to "build back better", – increasing overall sustainability.

Figure 5: Somerset west wildfire gaining momentum as it feeds on the alien vegetation (Mthethwa, 2022).

Figure 6: A private residence in Spanish farm Somerset West, destroyed by the brazen 2022 wildfire (Evans, 2022).

2.4 Overview of the case study area

The research will be undertaken using the case study method to spatially study the University of Cape Town (UCT) and Somerset West Spanish Farm – explicitly focusing on disaster risk management (DRM) utilising spatial planning to decrease wildfire vulnerability in these high fire risk areas – *see figure 7, 8, 9 and 10*. Temporally the focus will be on the current wildfire recovery happenings, with recommendations and interventions being made for the future of these sites – it will be necessary to look at other precedents, such as Victoria and California, to gain insight on "best practices" around wildfire mitigation within the fire-prone wildland-urban interface. The choice of these cases will significantly impact the Western Cape as the CoCT area alone has more than 100 kilometres of wildland and urban interface (properties or urban structures bordering the fire-prone wildland). Hence, this process can be replicated across high-fire risk regions on the vast wild and urban interface to decrease property vulnerability to wildfire.

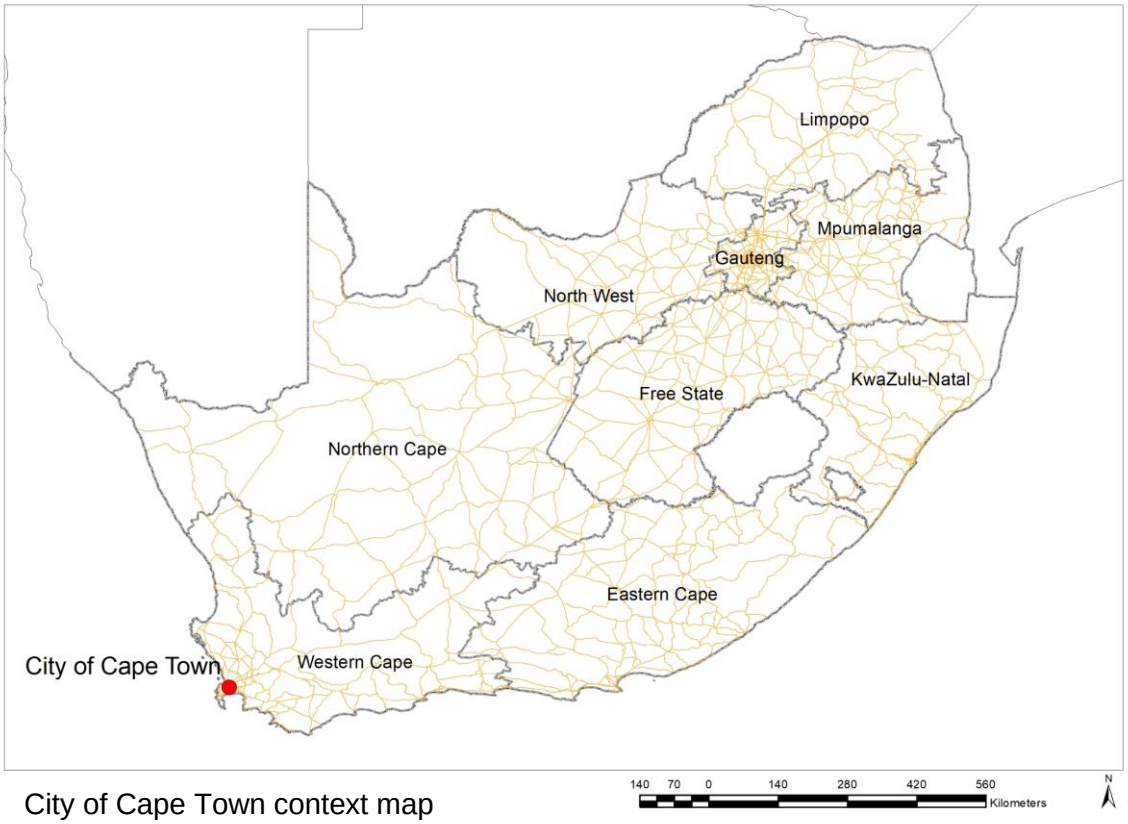
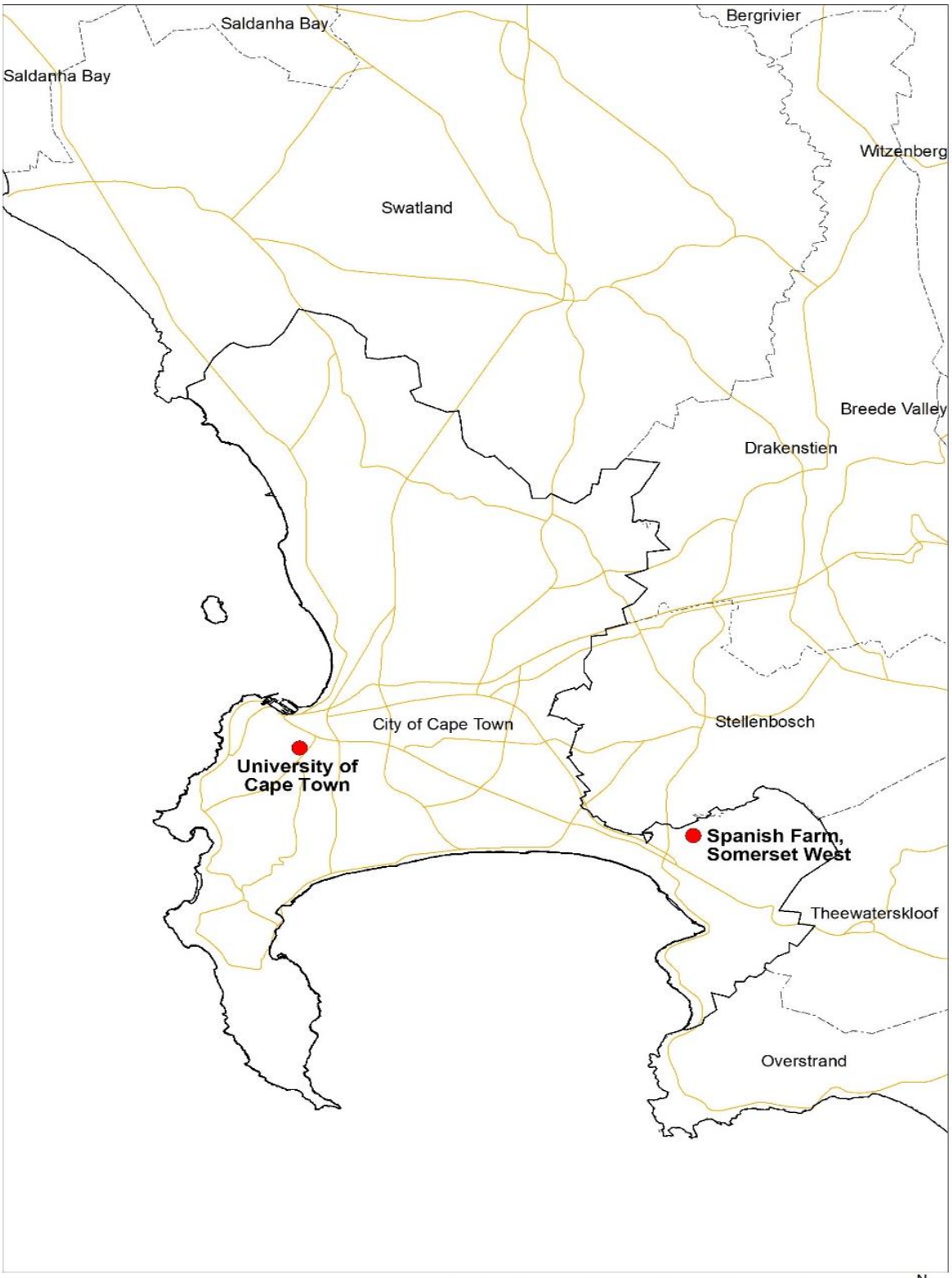


Figure 7: City of Cape Town in the context of South Africa (Author, 2022)



University of Cape Town and Somerset West context map

Figure 8: University of Cape Town and Somerset west Spanish farm context map within the City of Cape Town (Author, 2022).

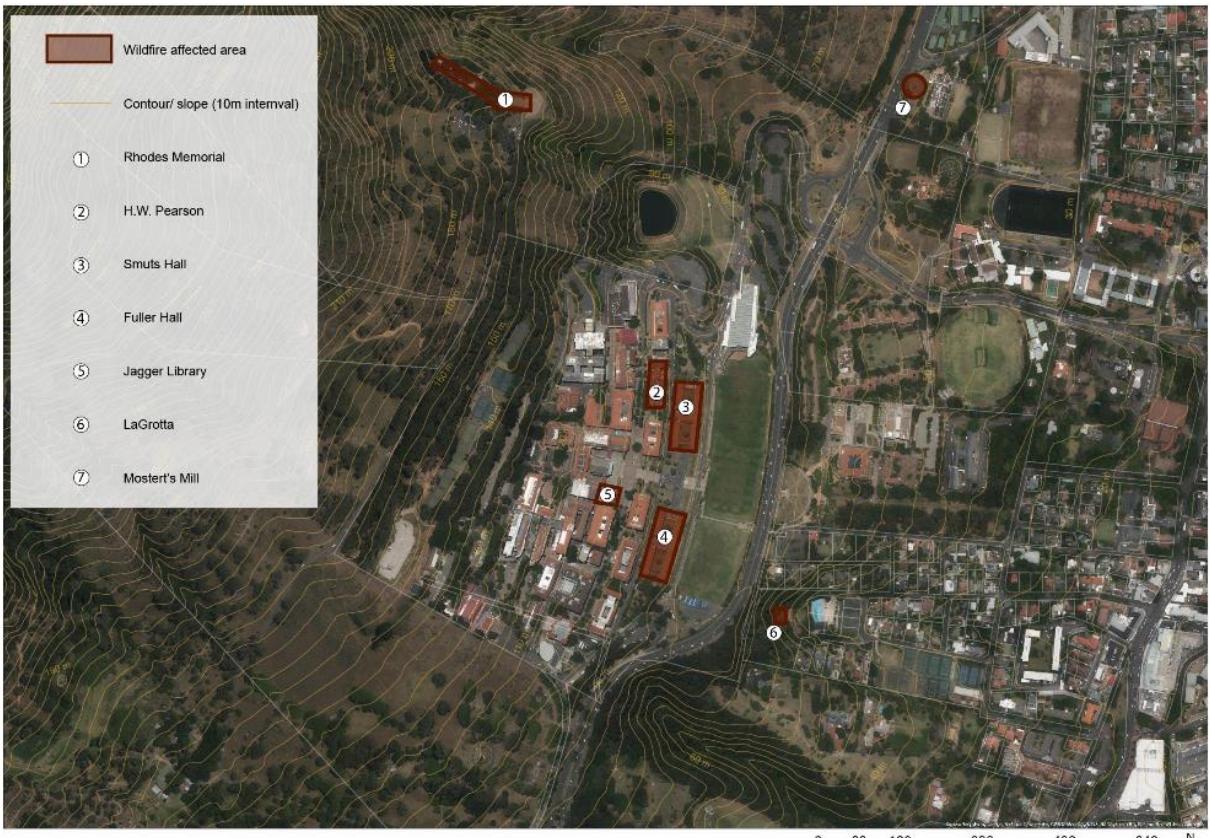


Figure 9: University of Cape Town and the buildings and urban structures that were destroyed during the 2021 Table Mountain wildfire (Author, 2022).

Figure 10: Spanish Farm Somerset West and private properties destroyed by the 2022 wildfire (Author, 2022).

3. Literature Review

3.1 Introduction

This review provides a theoretical basis and secondary data collection tool for the dissertation. It analyses, compares and contrasts various relevant documentation, reports, legislation and policy from various local and international "best practice" precedents (Victoria and California) as it pertains to wildfire mitigation for properties within the fire-prone wildland and urban interface (WUI).

The review investigates how climate change and the associated exacerbation of wildfire promote spatial planning as a critical tool in disaster risk management. Furthermore, the review uncovers the relationship between spatial planning and disaster risk management disciplines and the potential each has to decrease wildfire vulnerability for urban structures in a fire-prone WUI. Secondly, the review analyses the institutional, procedural and legislature of wildfire management within international "best practice" precedents in Victoria and California and how elements of spatial planning in these contexts are currently being leveraged to decrease fire vulnerability within their fire-prone WUI. Collaboratory pitfalls of these cases are similarly reviewed. Lastly, the review analyses local, national, provincial and municipal regulations to uncover pathways for spatial planning to contribute to disaster risk reduction within local fire-prone WUI.

The chapter is organised per the themes mentioned above, and the precedents Victoria and California are continuously referred to throughout South Africa (City of Cape Town), which can take lessons on how spatial planning can increase the fire-safety and, therefore, the sustainability of its fire-prone WUI. The precedents Victoria, Australia and the California United States are suitable due to their comparability to the city of Cape Town; they possess a fire-prone WUI that faces common wildfire disasters, share a Mediterranean climate and are similarly affected by climate change.

3.2 Climate change – disaster risk management as a core aspect of spatial planning

At the core of disaster risk management rhetoric and policy from its genesis, the focus has been on the suppression of disaster events. This means that a large portion of disaster risk management funds has been invested into fire-fighting capabilities, emergency response and how prepared those institutions are to react to a disaster event. In the context of climate change and the unpredictability of weather patterns and unprecedented disasters. It is noted that the focus on "suppression" has been proven time and time again to be insufficient in the long-term sustainability of disaster contexts. Both the Hyogo (2005-15) and Sendai (2015-30) international disaster risk management frameworks – have accepted this fact and pushed for a shift to the prevention of disaster, as suppression only is no longer sustainable. Hence spatial planning and its focus on urban structures, community and nature provide a catalyst to realise these "prevention" and "build back better" goals within international disaster management frameworks and rhetoric.

3.2.1 Climate change and wildfire disaster

Hunt and Watkiss (2011) concluded that global climate change would likely substantially impact settlements' development. This review revealed the effects of climate change for three relevant contexts with this study. Due to climate change, Western Cape/Cape Town has issues with water availability, drought and increased fire severity (Hunt & Watkiss, 2011; Mukheibir and Ziervogel, 2007). Due to climate change, the United States of America California will have issues of heat mortality, water availability and ecosystem changes resulting in increased fire severity (Hunt & Watkiss, 2011; Syphard & et al, 2007:431; Williams & et al, 2019). Lastly, in Melbourne, Victoria, Australia, due to climate change, by 2070, the temperature is expected to increase by 1 to 5 Degrees Celsius, meaning issues of urban water supply from 10% less rainfall and heat effects exacerbating fire severity and variability (Hunt & Watkiss, 2011; Hughes & Mercer, 2008; Di Virgilio & et al, 2020; Abatzoglou & et al, 2019; Neale & et al, 2016). Wildfire vulnerability and water scarcity are exacerbated by climate change.

Petryna (2018:570) noted that 2015 had been the worst wildfire-fighting year on record in the United States. Wildfires consumed 10 million acres, and the war on wildfires cost taxpayers $2.6 billion. About 3,400 wildfires were fought in California, 1,000 more

than the average over the previous five years. Due to climate change, fire seasons are, on average, eighty-six days longer than they have in four decades. For two weeks in 2015, recruiters in the national dispatch and coordination system hit a resource limit: there was simply nobody left to recruit to fight the fires. Military personnel, volunteers, and even prisoners were conscripted into emergency response efforts.

Climate change means wildfire behaviour is predicted with little accuracy (Petryna, 2018). Bill Armstrong, a forest fuels specialist, stated that the Los Conchos fire in New Mexico burnt through areas "where there was nothing left to burn", generating its internal winds, feeding itself, pushing against the winds, where frequent fires move with the wind. Petryna (2018:580) notes that in the 1994 Colorado south canyon fire, aluminium covers were invented to protect against firefighters; however, the fire heat was more than expected and melted the coverings – 14 firefighters died as a result. Climate change is causing wildfire anomalies like this, and the fire-fighting industry is not equipped to deal with it.

Because of climate change, fires of this magnitude are comparable with hurricanes as they are both hyper objects, fuelled by gradients in temperature, and speed and once going, cannot be reversed (Petryna, 2018:577). Disaster management services do not get in front of a hurricane or tornado with fans trying to change their direction; people defend their property by barricading or evacuating. Wildfire and its unpredictability, increased severity and destructive capability needs to be respected as a natural disaster (Petryna, 2018:589). This is an essential point to urge disaster risk management to change focus from suppression to prevention because you cannot extinguish everything. Spatial planning catalyses this shift to focus on urban structure protection and, therefore, the prevention of wildfire disasters.

3.2.2 Spatial planning as a core aspect of disaster risk management

Significant international disaster management frameworks Hyogo (2005-2015) and Sendai frameworks (2015) contains numerous references to the need for spatial planning to be integrated with natural hazard mitigation – however, authors note that actual mechanisms to do this are largely absent (March & et al, 2018). Historically, emergency/disaster management and spatial planning have highlights, such as the imposition of planning and building controls in London after the great fire of 1666 and

the relocation of Concepcion, Chile, after the devastating 1751 tsunami (March & et al, 2018:4).

Hall (2007) notes that urban/spatial planning is the ongoing process of bringing about improvements to avoid problems in new and existing human settlements that would otherwise be achieved without intervention, organisation and facilitation. This means that the elements of "build back better", that disaster risk management rhetoric has newly adopted, have been enshrined as a pillar of spatial planning for decades.

Blakely (2017) notes that the common mantra among politicians to rebuild-post disaster is patently incorrect and dangerous. The legislation in many nations requires and encourages rebuilding the same public buildings, where they were, to serve the same mission they did in the past (Blakely, 2017:73). Note that what was built years ago does not serve a new changing world. Rebuilding post-disaster is repeating conditions that contributed to the disaster, is a precursor to a new disaster based on a changed ecological terrain and climate change (Blakely, 2017). Blakely (2017:73) calls for post-disaster to look to the future and mitigate environmental, social and community political issues that harm the area from moving forward. The rebuilding rhetoric impedes an area from moving forward, failing to fulfil the "build back better" ideals in current international frameworks.

March and Kornakova (2017:231) agree with Blakely (2017:73) that simply bouncing back to a predisaster state as soon as possible is now understood as insufficient. A holistic approach must be taken to develop resilient settlements, including all aspects of community development, not just simply upgrading urban structures. For example, higher flood walls post-flooding disaster or wildfire asset protection zones being upgraded post-wildfire disaster means nothing without community support and initiative. March and Kornakova (2017) note that for the development of resilient settlements, a holistic approach must be taken, which includes all aspects of development.

March and et al (2018) and March and Kornakova (2017) note the shift of disaster risk management from reactive or suppressive toward a preventative ideology. As stated before, Sendai and Hyogo frameworks name spatial planning as the key discipline to initiate this shift within disaster risk management. Several vital priorities showcase the centrality of spatial planning in this shift in disaster risk reduction. Highlighted is the

need to promote mainstreaming disaster risk assessments into developing and implementing relevant land use policies. Secondly, relevant hazard mapping into planning policies. Thirdly, aim to develop in a disaster-resistant manner where development cannot be avoided; include the community in the assessment processes and promote resilience of new and existing infrastructure. Lastly, establish and facilitate a link between response, rehabilitation and future development; and relocate facilities and infrastructure to areas with reduced risk levels where possible (March & Kornakova, 2017:235).

The above sentiments showcase that spatial planning has the significant capability to enable pathways to enhance the disaster risk management process. Blakely (2017) and March and Kornakova (2017) all allude that merging disciplines to create new pieces of knowledge can cater to the increased severity of earthly disasters as a result of climate change. Because current revised pieces of knowledge are calibrated for conditions that no longer exist – climate change being the main driver (Petryna, 2018:589). However, March and et al (2018) note that it remains problematic to consistently draw these disciplines together to achieve the most significant risk reduction outcomes because of their broad scope and apparent static qualities compared with inherent dynamism and complexity. The upcoming reviews section interrogates this problematic "merger" between spatial planning and disaster risk management.

3.2.3 Merging spatial planning and disaster risk management

Spatial planning policies are often statements of instant such as "we will not allow new developments in areas designated 1:100 year flood zones", and this, through the planning process, will be backed up by law, regulations in an ordinance, by-law or zoning scheme (March & et al, 2017:25). So far the scholarly review has advocated that the disaster risk management processes lease the above no-nonsense sentiments of spatial planning, all in the hopes of progressing the fight against climate change and associated disaster exacerbation of which communities have not fathomed (March & et al, 2018; Blakely, 2017; March & Kornakova, 2017; Petryna, 2018; March & et al, 2017). However, these calls require a meaningful integration of spatial planning into the disaster management processes; however, in practice, the actual mechanisms remain largely absent.

March and Leon (2013) acknowledge the importance of urban planning being integrated with risk reduction practices – as acknowledged by the intergovernmental panel on climate change (IPCC 2012:460), and this is reinforced by the more current Hyogo and Sendai 2015 frameworks – but developing ways of achieving this integration remains challenging (March & Leon, 2013; March & et al, 2018). Thus, March and Leon (2013:2) identified six key points of intersection between spatial planning and disaster risk management – to assess the feasibility of this merger from a theoretical standpoint.

The first critical intersection between spatial planning and disaster risk management is modes of action. Spatial planning concerns advantageous future physical, social, economic and ecological outcomes in cities and regions. Whereas Disaster risk management has had a broad shift away from past cold war era reaction and relief approaches toward forward-oriented and proactive risk-reduction strategies (March & Leon, 2013:3). Integrating multiple modes of action is key to strengthening the importance of land use planning and disaster risk management. Warnings are not always wholly adequate because many do not obey or receive them, and risks are often not accurately measured. Within disaster risk management, structural hazard reduction can be costly and may fail, especially when there is an overreliance on engineered solutions alone. Land use planning to deal with disasters can reduce losses affecting both location and the design of urban development; as well as help create a knowledgeable constituency of citizens who support hazard mitigation programs (March & Leon, 2013:5). Lastly, as it pertains to the integration of spatial planning and disaster risk management – both approaches require an implementation to be meaningful; supported by policies and actions; and subjected to monitoring mechanisms that periodically assess the performance of the ongoing programs (March & Leon, 2013:5).

The second critical intersection between spatial planning and disaster risk management agencies is the Institutional settings in which they are located. Spatial planning in developing nations is integrated within governance structures, whereas disaster risk management agencies and processes are highly varied across different nations and jurisdictions (March & Leon, 2013). Institutional settings bring about a point of contention when it comes to the integration of disciplines: spatial planning is closely aligned to the provision of housing and a range of urban services such as

transport; disaster risk management allocates resources to the treatment of emergencies which may often be overshadowed by immediately more pressing and visible matters (March & Leon, 2013:6).

The third critical intersection between spatial planning and disaster risk management is knowledge, intelligence and decisions. Spatial planning legitimacy is founded upon developing knowledge sets that have their base in various knowledge systems. This seeks that improvement to spatial outcomes via planning actions are built upon a substratum of "intelligence" or "spatial modelling" where problems are defined and contexts are established (Godschalk & et al, 1998; Fry & Williams, 2013). An example of spatial planning “intelligence” is an information base containing socio-economic and geophysical characteristics, trends for future development and availability of human and material resources (March & Leon, 2013). Similarly, disaster risk management uses "intelligence" for accurate risk identification actions such as hazard, susceptibility and vulnerability characteristics (March & Leon, 2013). Ideally, both spatial planning and disaster risk management needs to be supported by strong community involvement because both disciplines serve this population and must remain intact to the demands, queries and questions from this group. Strong community involvement keeps spatial planning and disaster risk management processes accountable and relevant.

The fourth critical intersection between spatial planning and disaster risk management is temporal scales. Whilst spatial planning and disaster risk management both look at the future and can modify disaster risks – their respective orientations are often mismatched to the ideal for disaster risk management in the built form (March & Leon, 2013). Planners are often orientated to longer time frames (10, 20 or more years) or more immediate development control; planners develop plans that do not take into account the sudden onset of events (March & Leon, 2013:7). Disaster risk management efforts, in turn usually focus on a specific disaster or crises point, establishing actions of preparedness, response and recovery. Mitigation efforts aim at eliminating those crisis points or reducing their impact. This does not negate the great potential that spatial planning can undertake in “steering” overall development direction or characteristics of settlements toward alternative futures at a board level – this can include disaster risk management goals (Hopkins, 2001).

The fifth critical intersection between spatial planning and disaster risk management is spatial scales. The spatial realm of spatial planning is a continuum ranging from site and neighbourhood to inter-urban or regional scales. The distinctions between local-urban-regional planning emerge according to a specific target or plan, the dimensions addressed by it, the involved governance structures and stakeholders (March & Leon, 2013:9). For disaster risk management, hazards are complex phenomena existing from natural and human-made systems and come about via a myriad of environmental factors, occurring at different scales and via various modes within spatial territories. Note that disasters are inherently spatial in their characteristics across various disaster types. After the 2010 Chilean earthquake, the national emergency management agency based in the capital Santiago – did not release an official tsunami warning (due to a lack of technical information). No evacuation procedures were implemented, and hundreds died in tsunamis in small coastal towns located hundreds of kilometres from the city. Rigid organisation structures that are not suited to the scale of disasters often cannot provide the more expansive view required for disaster risk management, which typically requires significant amounts of cross-sectoral, multi-scale and multi-actor approaches.

The planning systems may provide means for connection between actors and systems at various spatial scales, particularly in terms of its ability to provide coordinating mechanisms during plan-making processes and regulation of change (March & Leon, 2013:10). Furthermore, spatial planning possesses an array of spatial tools that can be harnessed to shape or control physical outcomes: zoning, the broad process of establishing and implementing regulatory controls over development and land use based on spatially specific decision rules is a potentially powerful mechanism. Similarly, complementary controls integrate other related approaches over building standards, vegetation controls, or transport systems.

The sixth intersection between spatial planning and disaster risk management is coordination and social integration. Geis (2000) argues that the disaster-resistant community (DRC) is "the safest possible community that we know to design and build in a natural hazard context". The DRC approach must address physical aspects through building codes, land use plans, and other social dimensions related to development. In the 1970s, spatial planning was dominated by a top-down, expert-driven approach. However, since the 1970s, spatial planning has increasingly evolved

to incorporate public participation. Communicative or Collaborative planning emerged in the late 1980s and 1990s through attempts to satisfy many competing claims when confronted by “Social Diversity”. Spatial planning has, over its growth as a discipline, developed a range of mechanisms that range between the use of expert or elected representative-driven approaches, multi-agency referral processes, allocation of tasks to various government spheres, integration of democratic and corporate decision processes and use of participation techniques (March & Leon, 2013). Spatial planning has considerable experience with the possibilities of participation, where disaster risk management agencies are generally new to the challenges of “useful” participation (March & Leon, 2013).

In conclusion, with the merger between spatial planning and disaster risk management and associated mitigation for hazards, Godschalk, Kaiser and et al (1998) argue that much is to be gained. It is noted that spatial planning through disaster risk management: provides the rational basis between public interests and proposed policies; it educates the community about hazards and what can be done to deal with them spatially; it communicates the above to interested stakeholders, and the spatial plan is a means of implementing policy or regulation that can guide toward coordinating the community actions.

3.2.4 Conclusion

The previous section made known the issues of climate change and its role in exacerbating climate change and its associated disaster – with particular reference to wildfire anomaly. This reality has led to standard disaster management rhetoric of "suppression" and being purely "reactive" to be unsustainable, as climate change and disasters are occurring in unfathomable proportions that overwhelm typical suppression techniques. Major disaster risk management frameworks have responded to the above crises and called on a shift from suppression toward prevention, calling communities to stop rebuilding and "build back better" – spatial planning is viewed as the key discipline to realise these sentiments.

The review has identified some pitfalls in applying spatial planning through disaster risk management, as they often work at different scales and possess opposing or differing goals causing friction. Despite spatial planning working through disaster risk management to achieve overall disaster risk reduction not being seamless from a

theoretical basis, this does not negate its tremendous capacity to assist in the process. These new sentiments have been practised only a few times worldwide despite international calls. Hence, the review identifies California and Victoria as precedents to analyse how spatial planning elements are leveraged to decrease fire vulnerability within their fire-prone wildland-urban interface (WUI).

3.3 Foreign planning procedure and wildfire disaster management

Victoria and California have been tormented for decades by some of the greatest wildfire disasters on planet earth, where countless lives and properties were lost. These wildfires have occurred mainly within the WUI. This is coupled with the constant failure of disaster risk management to suppress or extinguish these events. Within both regions, there is a realisation that focusing on suppression has significant limitations when it comes to containing wildfire destruction within the fire-prone WUI. Hence, Victoria and California communities, government, and research institutions have spent considerable resources on attempting to develop pathways toward decreasing wildfire vulnerability for communities and properties of the fire-prone WUI. Spatial planning has been leveraged as a critical tool in decreasing fire vulnerability within the fire-prone WUI. The City of Cape Town can learn a lot from these "best practice" contexts, as it shares the same Mediterranean climate and wildfire issues within the WUI.

3.3.1 Australia, Melbourne Victoria

The focus on Victoria is deliberate. Despite representing only 3% of Australia's landmass, it is densely settled, has extensively been cleared for agriculture and over the last 150 years, has suffered a disproportionate 50% of the nationwide economic losses from bushfire events – *see figure 11* (Hughes & Mercer, 2008). Hughes and Mercer (2008) noted that at the time of their article, some 300 people lost their lives in the Victorian bush fires. These figures far exceed the total in other states in Australia. Note that this number has exacerbated in the current time but does not negate the significant leaps Victoria has taken in evolving and applying development spatial planning instruments to mitigate wildfire fire risk within the fire-prone WUI.

The history of spatial planning principles, building policies, and requirements dealing with wildfire in the Victoria region are extensive, as Australia has a rich fire history. Over the years, it has significantly impacted human settlements and assets. March and et al (2018:38) state: "urban or spatial planning in Victoria has its statutory basis in the Planning and Environment act – state parliament of Victoria 1987." The two main processes for spatial planning "permitted by the act" is the preparation and amendment of planning schemes and processing/making decisions related to permitting applications – which must be made per the planning scheme (March & et al, 2018). Overlays can then provide flexibility on regulation for these strict planning

schemes – it can determine the type of building, demolition, vegetation removal/retention and any other modification of the land (March & et al, 2018:39). On wildfire mitigation, subsection 2(e) of the planning and environmental act 1987 is to "regulate or prohibit any use or development in hazardous areas or in areas which are likely to become hazardous areas".

Evoking the above sentiments of spatial planning to manage disaster and the risk of wildfire: the first planning regulation that addressed bushfires in Australia was the special building overlay (SBO). If Victorian residents found themselves in a bushfire-prone area, they would need to design their building to suit a particular area – varying the level of risk (Kornakova & March, 2017:144). The base principle of demarcating risky areas or residents and applying restrictions through planning overlays stayed the same for all the regulations to come (wildfire management overlay of 1997, bushfire management overlay of 2011, and bushfire management overlay of 2014). This is an example of how planning can assist in managing risk with disaster, in this case, wildfire. However, the process was not uncomplicated, as, without community support, overall resilience cannot be realised.

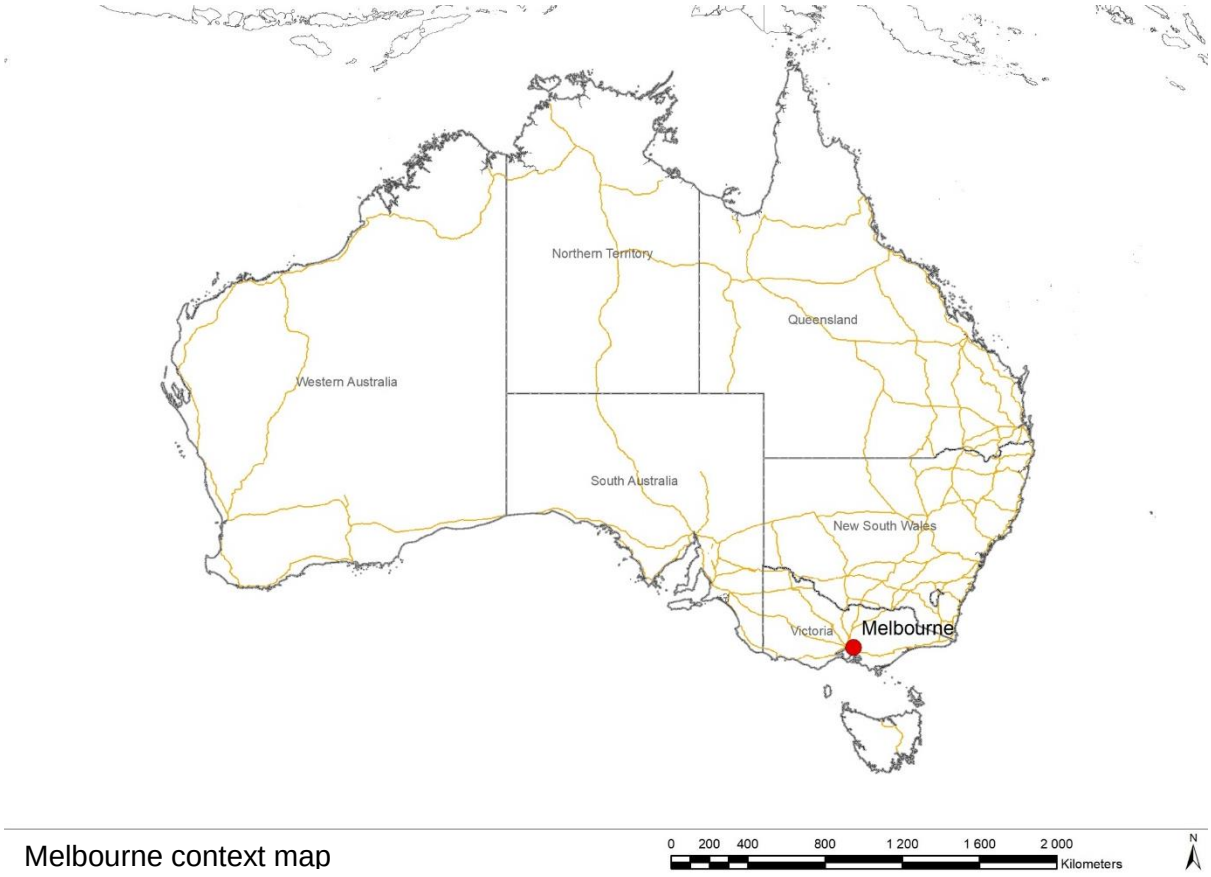


Figure 11: Australia, Melbourne, Victoria context map (Author, 2022).

3.3.2 Victoria bushfire management overlay

The 2009 Victoria fires were one of the most devastating bush fires disasters recorded – 39,987 individual fire events reported. February 2009, known as Black "Saturday" was the most severe wildfire event, killing 173, destroying 2056 houses and burning through 365, 020 hectares of land – *see figure 12, 13 and 14* (Kornakova & March, 2017:144). This severe fire event triggered a massive investigation via the Australian government, establishing the Victorian Bush Royal Commission (VBAC), which would seek to understand impacts, and develop recommendations for new practices, policies and mechanisms to minimise risks in unavoidable future disaster events (Kornakova & March, 2017:145).

Figure 12: Victoria 2009 "Black Saturday" wildfires satellite image (Niven, 2014).

Figure 13: Victoria 2009 "Black Saturday" Wildfire perspective (Niven, 2014).

Figure 14: Victoria 2009 "Black Saturday" wildfire destruction depiction (Niven, 2014).

The VBRC uncovered that current the current wildfire management overlay of 1997, spatial planning and building controls were inconsistent, affecting the risk to individual communities; a lack of planning requirements for wildfire bunkers – features such as defensible space, access was not specified, sprinklers and so forth (Kornakova & March, 2017:146). The VBRC noted, most notably, that despite the WMO's shortcomings, the communities affected the worst by the 2009 fires were Kinglake and Marysville (areas that did not have a WMO).

The minister considered this event to be of "state significance", evoking section 20(4) of the Planning and environment act (1987). The minister declared the whole of Victoria region a Bush Fire Management Overlay of 2011 (BMO 2011) – applying more stringent regulation through planning controls on development within the area without the need for consultation or opportunities for submission or appeal – *see figure 14* (Kornakova & March, 2017:147). It was viewed as a knee-jerk reaction from the government, falsely implying that bushfire risk levels are similar across the state, despite diverse vegetation conditions, weather and topography. Residents created significant backlash because who knows their surroundings better than those residing there?

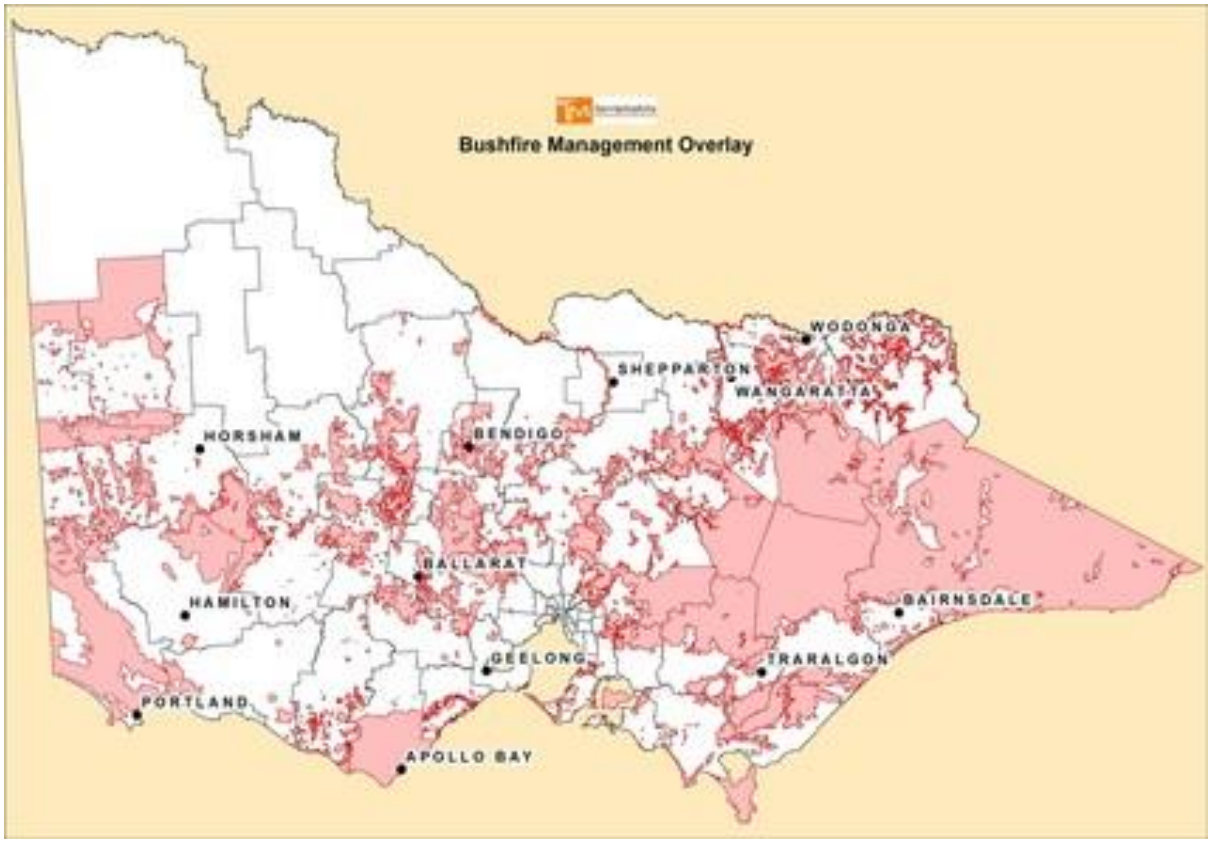


Figure 15: Victoria Bush Fire Management Overlay in red (Terramatrix, 2020).

3.3.3 Victoria wildfire management and public participation

This backlash was due to many strict new policies that felt punitive to residents and the lack of community involvement in the policy development process. Kornakova and March (2017) based these arguments on their rigorous analysis of the comments made by interview subjects that the community was not provided with an explanation of the new policies or residents were not educated on the risks and consequences of non-compliance. Another flaw was the lack of rights to object to or amend the policy to address risk more realistically. Cotter (2017), a Victorian resident affected by the limitations above of the BMO of 2011, provides a personal account and insight into how their land was sterilised and the importance of community advocacy.

Cotter (2017) and their partner were getting ready to start their housing project in mid-2011, hiring consultants to guide them through the planning application reports. A Bushfire site assessment (BAL) determined the level of bushfire risk corresponding to construction requirements) and ecological, geotechnical and water treatment studies – they finalised the house design drawings. Before submitting their planning application, the BMO was introduced on 18th November 2011. This triggered another required BAL rating and bushfire planning report to comply with new planning regulations (Cotter, 2017:2015). Although additional safety measures, such as sprinklers and approved private shelter, were proposed – the application was denied (Cotter, 2017). The land was worthless, and the neighbour across the street could build, but not Cotter (2017:215) and partner.

Cotter (2017:215) set up a blog about the abovementioned issues and called affected landowners to join. This strategy allowed for a unified voice for landowners in Victoria, with evidence-based data from landowners, collaboration with experts to develop alternative solutions, research of the political contexts, and media outlet support to garner support from the broader community –all were aiming to pressure the government to change regulations (Cotter, 2017). On 31st July 2014, the BMO planning legislation was amended and implemented. The changes to BMO 2011 to 2014 were not "private land, private risk" – but included the suggestions of civil society, allowing more options to reduce fire risk (private shelters) and more unilinear consistent nationally accepted BAL (Cotter, 2017:219).

Cotter (2017:227) notes various successes of the BMO 2014 in Victoria – communities of Wye River and Separation Creek were devastated by a bushfire on Christmas Day 2015. No lives were lost due to a full emergency evacuation, but 116 properties were destroyed. Properties constructed under both versions of the BMO were lost in the bushfire, highlighting inadequacies in planning policy and building standards. Planning policy exemptions have been established to allow rebuilding as the small lot sizes could not achieve defendable space requirements (C089, 2016) (Cotter, 2017:227). This emphasises that true resilience cannot be achieved without community support and public participation – *see figure 16*.

Policy	**WMO 1997**	**BMO 2011**	**BMO 2014**
Defensible space	Not specified	Outer and inner	Inner
Planning integration with other practices	Some	some	Some
Landscape type as a pre-condition of level bushfire defence necessary	Not specified	yes	Yes
Vegetation control	Yes	yes	Yes
Slope control	Not specified	yes	Not specified
Equity of application process	Not specified	yes	Residential areas have a simplified process
Water supply	Yes	yes	Yes
House specifications and design guidelines	Some	some	Strong policy base
Siting of a dwelling	Specified	specified	specified with exemption

The life span of policy and reasons for change	1997-2011	2011-2014	2014-till present
Consistency of application	No	yes	Yes
Building to flame zone	Not specified	no	Yes
Role of professionals	Not specified	Veto right and refusal of the application	No
A total ban on development	No	yes	No
Right to appeal	Not specified	limited	Increased
Alternatives (bunkers)	Not specified	No	Yes

Figure 16: a table showcasing the evolution of development restrictions imposed through the various fire management overlay from 1997 to 2014, in Victoria (Kornakova & March, 2017; Cotter, 2017).

3.3.4 United States of America, California

In October 2017, a series of wildfires started to burn across the wine country of Northern California, causing approximately $9.4 billion in insured damages and the death of 44 people – *see figure 17* (Jazebi & et al, 2020). Again, In November 2018, California experienced one of the most destructive and deadliest seasons in its wildfire history. Two major fires, Woolsey Fire near Los Angeles and Camp Fire in Northern California, killed at least 86 and three people, respectively – *see figure 18, 19 and 20*.

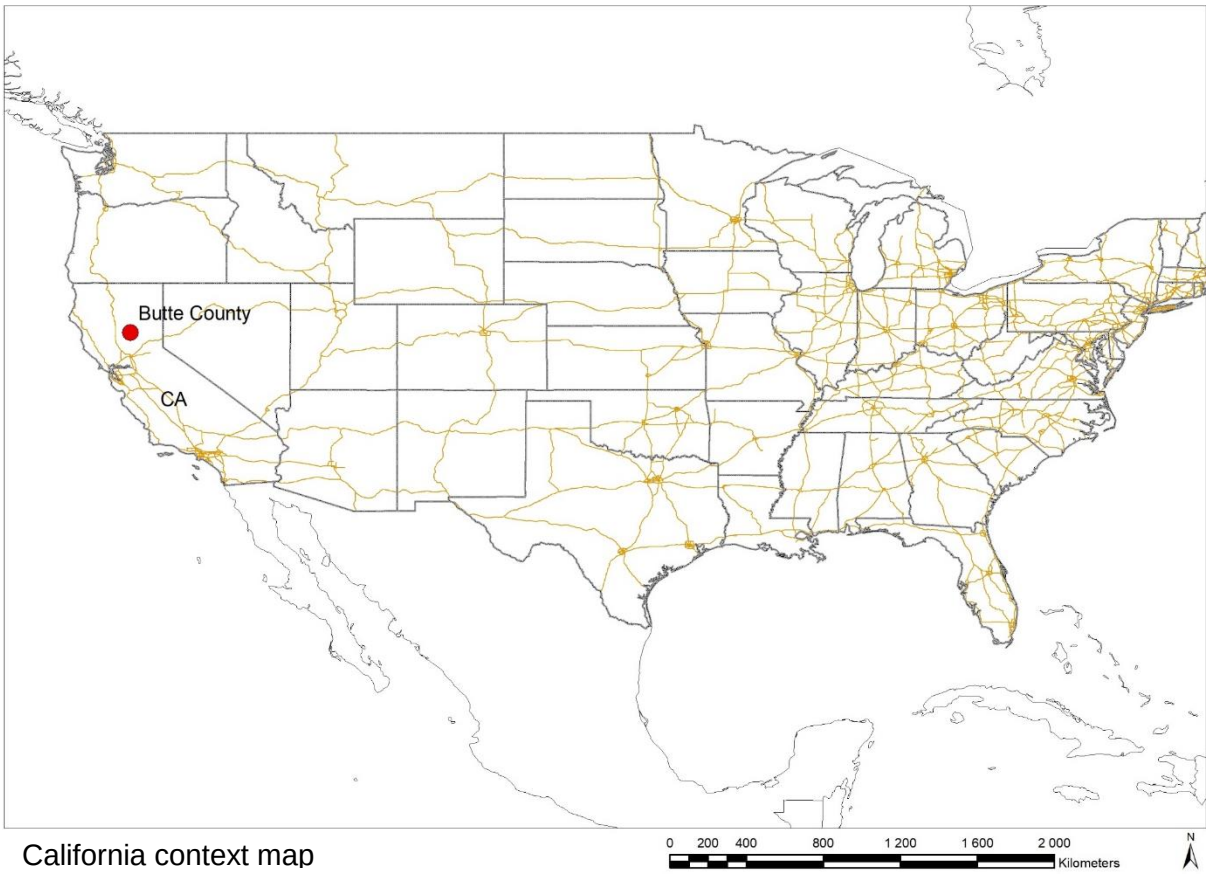


Figure 17: The United States of America, California context map (Author, 2022).

The Woolsey Fire cost about $4 billion, while the Camp Fire destroyed more than 18,800 structures and caused more than $11 billion in damages (Jazebi & et al, 2020). Rice and Davis (1991) foresaw that spatial planning and its subset on land use that was done in the past – usually falls short of providing adequate safety for communities from the reasonable risk of fires in the future. The present wildfire damage to property and loss of life in California's wild urban interface noted substantiates Rice and Davis (1991) claims–although the journal has aged, it is still relevant today.

Figure 18: Woolsey Fire Southern California, perspective (Osbourne & Winsor, 2018).

Figure 19: Paradise Camp Fire California before and after, the most expensive natural disaster of 2018 (Allen, 2018).

Figure 20: California Paradise Camp Fire 2018 wildfire destruction perspective (Allen, 2018).

3.3.5 California wildfire management and land-use planning

Rice and Davis (1991) emphasise the importance of land-use planning when protecting property and saving lives. Identified as three major wildfire events that occurred in the US. The relevant one to this study was the 1987 Morse Fire in Monterey County (California). The Fire hazard for this area was moderate (lowest possible rating), but in the first three hours, the Morse fire caused damage to approximately 37 million dollars, with 31 homes lost (Rice & Davis, 1991). Rice and Davis (1991:2) state that they cannot ensure from the case studies that good fire-safe planning will protect every home threatened by fire or that loss will be certain in the absence of good planning; however, the study does make two critical observations. Firstly, the investigator of the three sites was not able to find a single house lost where there had been comprehensive fire protection planning; Secondly, in every house lost in the three sites, the investigator found a complete lack of comprehensive wildfire protection planning (Rice & Davis, 1991:3). Rice and Davis (1991) showcase the existing tools of the time available for fire managers and planners to use in protecting from wildland fires.

Code and regulations are planning tool that requires understanding the authority and constraints placed on planning and regulating entities utilising general plans. General plans have substantial influence in that all zoning and development must be consistent with them (Rice & Davis, 1991). Several sections in the general plan, including the

Safety Element required by the California State Government Code, could easily incorporate the identification of wildfire hazards and the details of appropriate mitigation measures. Rice and Davis (1991) note that because a general plan is long-term (up to 20 years), it is legally binding on local jurisdictions, and new developments would have to keep up with the plans and policies of it (California Government Code 1989, Section 65359).

According to California government code 1989 section 65302(e), open space elements note that open spaces can be designated for areas that require special management or regulation because of hazardous conditions, such as high-fire risk regions. Rice & Davis (1991) notes that the California Government Code (1989) 65567 enforced the aforementioned open space element – as no building permits may be issued, no subdivision maps may be approved, and no open space zoning ordinance adopted unless the construction or ordinance is consistent with the Open Space Plan. California wildfire management thus can demarcate areas of wildfire risk and approve regulations and conditions for these areas, to decrease overall fire vulnerability.

The California Subdivision map act (California Government Code 66410-66499.58) is a law that dramatically influences the development pattern. A tentative map must be reviewed if a development creates over five parcels of land from one major subdivision. Spatial planning, through the Act, can coerce developers to develop built environment patterns, in a fire-safe manner (Rice & Davis, 1991:9). Less sporadic and more defensible. The 4290 regulations support the above Act and incorporate fire protection measures which address minimum turnarounds, length of roads, bridge strengths, water supply, building construction, emergency access and vegetation modification (Rice & Davis, 1991:10).

The uniform code addresses construction types, water flow rates and hydrant spacing and layers these requirements with land use (commercial or residential). Rice and Davis (1991) note that the Uniform Fire Code does not adequately address the fire problem in the urban intermix. However, this does not negate spatial plannings ability to evoke the code and increase fire mitigation techniques within the fire-prone wildland and urban interface.

Balaban and Fu (2014) provide newer and revised versions of the above codes in a more present day. The California building code provides stricter regulation in fire-prone

Wild and urban interfaces. Furthermore, the 701A.3.2 code which that deals with issues of landscaping and structure but requires the use of fire-resistant materials in all new projects. Local endeavours, "Code enforcement", are also managed by municipalities, homeowners associations, and private developers to zone for and design fire-safe homes and clear brush or flammable fuel/vegetation (Balaban and Fan, 2014:826). Lastly, the state of California has adopted evacuation techniques such as the "stay and defend or go early" policy, inspired by Australia. Despite the numerous positive shifts that spatial planning has produced in disaster risk management within the fire-prone wildland and urban interface – it is not without drawbacks.

3.3.6 California and the commodification of wildfire-safety

Balaban & Fu (2014) provide some insights as to how fire and fire management/prevention has inevitably become intertwined with local environmental and conservational efforts. What arises is a conflict between developers, landowners and governmental management of flammable lands; and what arises is a phenomenon called disaster capitalism whereby rapid encroachment without consideration for disaster management, is exacerbated by the disjuncture in planning and disaster management (Balaban & Fu, 2014:821).

Kolden (2019:7) states that prescribed fire and other fuel reduction activities have depleted over the past two decades as federal agencies expand allocated funds toward suppression/technology rather than prevention. Balaban & Fu (2014) note that builders and regulators' and regulators' drive toward suppression or passive fire-fighting is allowing business interests to celebrate safety, despite the lack of public funding for fire protection. A commodification of safety occurs – initiatives such as shelter in place become tools for continued development into flammable canyons and hillsides.

As sprawl into the wild and urban interface continues, investment in fire protection technologies solidifies the polarisation between communities of different classes – whereby property into good and bad investments, turn into safe and unsafe areas and overall prosperous and less successful neighbourhoods (Ellin, 1997; Low, 1997). Although wealthy communities are directly affected by fire, interestingly, poor communities suffer more significant declines in value than similarly or even more scorched affluent neighbourhoods following a firestorm: for example, the city of

Escondido suffered a more significant decline in property values following fires in 2007 than did the wealthier Rancho Bernardo. In extremely affluent communities, such as Rancho Santa Fe, property values continue to increase despite its history of high fire risk (Fu, 2013). This pattern is not limited to California. A similar pattern following bushfires has also been observed in Australia (Eves, 2003).

3.3.7 Conclusion

The previous section has showcased how "best practice" precedents in Victoria and California have revolutionised disaster risk management – within the wildfire-prone WUI – through utilising aspects and tools of spatial planning.

The extensive bushfire overlay use (BMO) in Victoria has led to dozens of communities becoming wildfire resilient and has saved many lives and properties within the fire-prone WUI. The review notes that politics rears its head in the Victorian case. The Victorian government passed and enforced the BMO 2011 without consultation of the residents – due to the 2009 "Black Saturday" wildfire disaster that resulted in significant loss of life and property. The Victorian government turned 360 degrees, amending and adopting the new “less stringent” BMO 2014 after lobbying pressure from disgruntled Victorian residents. BMO 2011 conditions were rendered as "nonsensical", and the Victorian government dropped it to gain the support of residents as 2014 was an election year. This review notes the reactionary nature of government. Similarly, noted in the review is that no matter what regulation can be enforced, if the community does not abide and buy in, then regulation will not be effective.

The use of spatial planning subset land use within California – to demarcate areas of high risk and impose restrictions and conditions on civil construction, buildings and landscape to increase wildfire resilience within the WUI and enforce these changes. Uncovered in the review was that the buy-in to prevention measures was limited, as government and private sectors still spend most of the annual funding on fire-fighting technology/suppression. This results in the commodification of safety, as the poorer areas are at higher fire risk than those affluent areas.

Spatial planning moved from the past master plan toward the mass inclusion of public participation and opinion – serving as a valuable pathway to assist disaster risk management in achieving overarching resilience. It is clear that without community involvement, overall and holistic resilience cannot be achieved. The review concludes

the above sentiments from the foreign "best practice" wildfire disaster risk management and associated planning procedure, regulations, guidelines and policies. The review in the upcoming section attempts to investigate local (South African) wildfire disaster management and planning legislation and policy – in an attempt to uncover pathways for fire mitigation in a fire-prone WUI.

3.4 Local planning procedure and wildfire disaster management

Victoria and California showcase that spatial planning tools can significantly positively affect long-term sustainability, decreasing wildfire risk and destruction within the fire-prone wildland-urban interface. In South Africa, the Western Cape City of Cape Town has countless vulnerable urban structures and communities within the fire-prone wildland and urban interface (WUI). Local spatial planners face significant developmental pressures as they attempt to uphold what makes the Table mountain region one of the seven wonders of nature, uphold the region's rich heritage and provide land for social/amenities, schools and hospitals for an ever-growing population – *see figure 21*. In the Helderberg region, there is dozens of kilometres of fire-prone wildland – *see figure 22*. With a steep population rise predicted in the future, this vast fire-prone wildland will remain under threat from planners. Thus, the need for spatial planning to develop sustainable fire-resilient communities in these much-wanted and highly developable fire wildland ecosystems – is needed now more than ever, and this need continues to grow as the years go by. This chapter investigates local wildfire disaster management and planning

Figure 21: South Africa, Cape Town, Table Mountain region one of the 7 natural wonders of the world (Mcfadyen, 2019).

Figure 22: Helderberg Mountain, part of the Hottentots mountain rage (Pilot, 2015).

legislation and policy – as a means to uncover pathways for fire mitigation in the fire-prone WUI.

3.4.1 Western Cape provincial overlay zones

The Victoria bush fire overlay was a planning tool that has had significant successes in the push to increase overall disaster management, increase community resilience, and abide by international framework mantras "build back better"; for communities and properties in the fire-prone WUI. In the context of the Western Cape, overlay zones provide an excellent platform for fire mitigation enforcement for WUI communities – note that this connection remains largely absent.

Chapter 16 of the Western Cape provincial zoning scheme provides an excellent opportunity to increase fire protection for property owners within the WUI (WCG, 2004). Chapter 16 (i) states that overlay zones can increase flexibility and provide an opportunity for special circumstances and local conditions; chapter16 (iii) reminds us that in applying overlay zones, the objectives of it needs to be accountable to the goals and ideals of the integrated development plan (IDP); lastly and most importantly chapter 16(iv) shows that council needs to follow a transparent process, so that council, community and property owners are included to the fullest extent (WCG, 2004).

The above sentiments show that overlay zones as a spatial planning tool can provide an excellent platform – to add restrictions and guidelines for fire safety within the WUI (just like in the Victoria precedent). Because the IDP needs to be in correlation with a potential local overlay zone and primary the emphasis placed on public participation and inclusion throughout the development of applying overlays – many of the Victorian bush fire overlay public involvement issues can be avoided.

There are significant grounds for adopting a fire-specific management overlay for the Western Cape – because there is a severe lack of restrictions or guidelines in the by-law regarding wildfire. Chapter 16 references overlays around the environment, airports, floods, heritage and many more. Chapter 16, subsection 16.2, the environmental protection overlay zone – is mainly geared around protecting "special" nature and environment, encouraging sensitive forms of development to promote sustainable development and tourism to benefit the local and general population.

Under this Chapter 16 subsection (16.2.5), there is a specific reference to fire through the "Fire management Area provisions". In total, it states: "the council may stipulate special fire management provisions for an area designated as a fire management area in terms of this overlay zone" (WGM, 2004). One sentence is not sufficient for guiding development within the fire-prone WUI. In fairness, the primary tool is there in terms of "designating" an area for intervention, but other than that, this version is severely limited compared to "best practice" international legislation. Victoria and California, within the by-law, designate an area and supply stringent planning guidelines for fire management within the fire-prone WUI– sprinklers, construction, landscaping and many more. These fire management planning guidelines exist locally for the City of Cape Town. However, there is a significant disconnect between the guidelines and the severely limited fire management overlay by-law in the zoning scheme.

3.4.2 City of Cape Town veld and forest fire interface planning guidelines

In January 2000, Cape Town wildfires ravaged the cape peninsula and areas in Blaauberg, with an estimated cost of damage of more than R30 million rand. Following these events, a planning toolkit was developed for Fire protection planning guidelines for at-risk properties on the urban edge/WUI (CoCT, 2004). The inspiration for this toolkit lends from many of the spatial planning principles and guidelines of Australia and California, USA. These guidelines acknowledge the global disaster management rhetoric that promotes the shift from suppression and fire-fighting services limitations toward fire prevention for properties and fuel management techniques within the WUI (CoCT, 2004). This is especially important during a Wildfire summer situation where fire-fighting services might be stretched thin, and living residents within the WUI needs unmet. Major, dangers from wildfires are spot fires from flying embers, radiated heat and direct radiation from flames and turbulent winds – *figure 23*. The policy recommends various fire mitigation techniques for the fire-prone WUI – *see figure 24*.

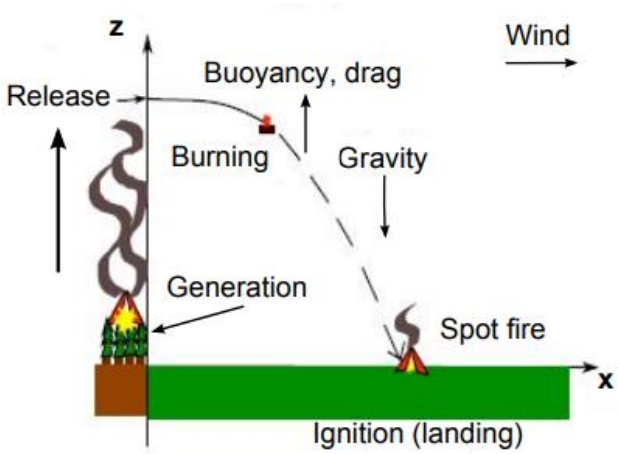


Figure 23: Flying embers and how a spot fire is caused (Martin & Hillen, 2016:2).

Managing fuel loads	Clearing alien vegetation and hazardous and flammable shrubs.
Designing garden for fire protection	Using local fire-resistant plants as a barrier for screening against radiant heat and burning embers. Utilising an interval canopy instead of a continuous canopy.
Slope control	Each 10% increase in slope doubles the speed of wildfire – new developments should be aware of building too far up in the WUI.
Poorly maintained firebreaks	Clearing a road or piece of land from flammable shrubs and vegetation (fuel), cutting the fuel from a wildfire, and slowing it down.
Building design and construction	Avoid plastic gutters, timber decking and thatch roofs – which are flammable and will burn readily once spotting occurs.
Unattended houses	If a house is unattended, the small fires started from spotting and burning embers brought by the wind can burn down the whole house – if there is no one to extinguish it.
Storage of highly flammable materials on premises	Storing minimum car fuels, wooden storage/Wendy houses sheds, and creosoted wood – these should be avoided as they are highly flammable.
Inflammable materials on roofs	Removing leaves and organic materials from the roof and gutters, as burning embers/spotting, can ignite these materials, and the flames can creep into the roof and wood structure and burn the whole property down.
Access roads	For new developments, access roads ought to be wide enough for emergency vehicles, as sometimes.

Water supplies	Water supplies through plastic pipes can easily be destroyed by a wildfire when it lies on the ground. Water pipes should be buried to a depth of at least 30 cm to maintain fire-fighting capability.
Lack of awareness	Lack of awareness around the above tools puts communities in the WUI at the most significant risk. This is identified greatest threat. Public awareness programmes should be implemented to reduce fire risk – radio, brochures, and television could be leveraged. The western cape fire plan should address these issues.

Figure 24: A table showcasing wildfire planning guidelines City of Cape Town Natural Interface Study (CoCT, 2004).

3.4.3 Western Cape Veldfire plan

The purpose of the fire plan is to provide the various responsible fire authorities and agencies with an overview of the current arrangements that are in place for the management of veld and forest fires in the province (WCG, 2019:3). The Plan contains an overview of veld and forest fire awareness, planning, prevention and response arrangements. The WCG (2019) veld fire management responsibility emphasises collaboration – through shared responsibility involving many organisations and people. Although some organisations have specialist roles, veld fire management is not done by one single organisation. All to realise the objective of guiding activities in the western cape to reduce the impact of wildfire on human life, essential Infrastructure, industry, economy and the environment – *see figure 24* (WCG, 2019).

Figure 24: A table showcasing the cardinal principles in achieving a veld fire resilient western cape (WCG, 2019).	
Protection of human life	Human life includes both community and emergency services personnel, taking priority above all other obligations in veldfire management.
Responsibility for building resilience	Veld fires are inevitable and cannot be prevented. All sectors of society share responsibility, within their sphere of influence, for building a more resilient community and

	environment that can prevent, respond to and recover from veldfire.
Community and landowner involvement	Community involvement is essential to ensure veld fire management approaches are inclusive, integrated and comprehensive across diverse societies and landscapes.
Seamless approach	All agencies will work together, using resources efficiently and effectively, to present the community with a seamless approach to all aspects of veld fire management.
Risk driven	Policy and program priorities for veld fire management should be based on the measurable reduction of risk from the impact of bushfires.
Learning and knowledge	Incorporating local knowledge, experience, and operational and scientific evidence is integral to the ongoing improvement of veld fire management policy and practice.

Figure 25: A table showcasing the cardinal principles in achieving a veld fire resilient Western Cape (WCG, 2019).

The veldfire 2019-2020 plan for the Western Cape, institutes carious integrated planning committees that operate within a legislative capacity. This occurs on a provincial level, regional level, municipal level and landowner level – all to develop tools and processes for consistent and continuous improvement in veldfire management planning. This promotes seamless multi-layered partnership and upholds the critical principles from above – spatial planning should play a more prominent role in this process.

Notably, this WCG veldfire plan 2019-2020 is insignificant in correspondence with the national and provincial acts and policies. Such as the Municipal systems act 32 of 2000; Disaster management act 57 of 2002; Veld and forest fire act 101 of 1998; Conservation of agricultural resources act 43 of 1983; Spatial planning and land use management act 16 of 2013 (SPLUMA); and Building Regulations and Building Standards act 103 of 1977 (WCG, 2019).

3.4.4 Spatial planning and land use management act 16 of 2013

The (CoCT) Cape Town Spatial development framework (2018) makes significant spatial directives on wildfire safety. The wildland-urban interface (WUI) is defined by the CoCT (2018) as the risk level to communities where urban development areas intermingle with flammable wildlands. The CoCT (2018) outlines the WUI with a fire risk line from Gordon's Bay to Melkbosstrand on the outer edges of the built-up area. The line should be considered as indicative of locations where field fires are difficult, operationally complex, and expensive to fight, considering the locational context of the natural environment and operational constraints of practical fire-fighting. It represents itself in different risk levels to residents and their assets regarding exposure to death, injury, and damage from wildland fires. The WUI was supplemented on the Peninsula by the Table Mountain National Park fire breaks, whilst no line exists for the Cape Flats coastal area (CoCT, 2018:96).

The CoCT (2018:68) states that during the allocation of development rights, careful consideration should be given to reducing the risk and the operational needs of the city's fire services. The exceptions are that in cases where development is permitted, conditions should ensure access for fire fighting vehicles and that building materials and landscaping do not exacerbate risk (CoCT, 2018:68). The CoCT (2018:110) acknowledges that directing development within the fire-prone WUI of the CoCT, falls in line with the "transform the apartheid city" policy guidelines – "prioritise public health and safety measures around areas situated within informal settlements by upgrading the public environment to mitigate natural hazards and manmade risks, by ensuring adequate access for emergency services and regular fire breaks." Lastly, the 2013 Densification policy guidelines are the CoCT plan to combat urban sprawl and create a compact city (promoting intensification). Thus, encroachment of development into the CoCT WUI (which increases fire risk): limiting encroachment substantiates densification policy.

The City of Cape Town (2014) design and urban management guidelines focus on how development can increase fire safety (small intimate scale). For example, a road and footpath are the preferred interfaces between open space and housing development, as it increases levels of visibility, facilitates access for management and maintenance, and sometimes doubles as a firebreak – *see figure 25* (CoCT, 2014:18).

As discussed above, the policy above, urban and spatial wildfire guidelines adhere to SPLUMA both from a safety and transformative perspective.

Figure 26: road or footpath, doubling as a fire break, after intervention (CoCT, 2014).

3.4.5 San 10400 fire protection codes

This code sets out prescriptive provisions in order to satisfy the technical aspects of the building regulations act 103 of 1977.

The chapter in focus and relevant to the study is Part T (fire protection). A building needs to be designed, constructed and equipped. In case of a fire – Part T1 subsection (1a-e) outlines various requirements for a fire-safe building structure. From safe evacuation passages, in the case of a multi-storey building, no major structural system

failure shall occur, smoke minimisation and control techniques, adequate means of access, fire extinguishing, detecting and fighting equipment.

Part T1 (2a-b) places the duties to detect any violation of T (1a-e) on a professional engineer or other approved competent person. This person in T1 (2b) needs to notify the owner of the building if it is the opinion of a local authority that a building does not comply with the requirements set out in T1 (1) (a)-(e).

T2 outlines the offences. T2 (1) (a) (b) Any owner of any building who fails to (provide sufficient fire extinguishers and appropriate equipment shall be guilty of an offence. T2 (2) states that any person who renders any escape route less effective or obstructed or emergency less effective shall be guilty of an offence.

Part T is extremely important on the specifics of fire protection for buildings. Such as the width of escape routes, hydrants, smoke control, number of stairways per building storeys, roof materials, and angles.

3.4.6 Veld and forest fire act 101 of 1998 and Conservation of Agricultural resources act 43 of 1983

The National veld and forest fire act 101 of 1998 institutes the "duty of care". This means that a landowner's duty of care is their legal obligation to serve the greater public good (stock fencing along roads) (Pence & et al, 2003). The Act (101 of 1998) requires all landowners to maintain and prepare firebreaks on their property (where a risk of spread exists, where the weeds and regulations under Conservation of Agricultural resources act 43 of 1983 requires landowners to clear their property of (listed) invasive alien plants (Pence & et al, 2003). Under the aforementioned acts, landowners are expected to bear any management or incremental costs incurred in the process of upholding these duties, and these costs are expected to be substantial (Pence & et al, 2003).

Pence and et al (2003:270) express the implications of not abiding by the acts such as not maintaining firebreaks – *see figure 27*. The national veld and forest act clearly states that landowners will be assumed negligent and can be held liable for fire damage on neighbouring properties if the fire spreads from their properties. These implications are substantial due to vital sectors of the regional economy depending on mature veld for livelihoods (thatch farmers, wildflower harvesters and bee-keepers);

without proper fire management and prevention measures, the local economy will be under continual threat (Pence & et al, 2003:270).

Pence and et al (2003:271) suggest that landowners join a fire protection association which will displace negligence assumptions and reduce the individual cost of maintaining firebreaks (National Veld and Forest Fire Act, no 101 of 1998).

Figure 27: Fire breaks vary in size; by cutting away vegetation it acts as a prevention technique to slow a future wildfire, starving it from fuel (Working on fire, 2020).

3.4.7 Disaster management act 57 of 2002

The frequency and intensity of wildfires are modelled to increase substantially due to lower rainfall (reducing the moisture content of fuels), lower relative humidity, more prolonged droughts, and higher wind speeds. High fire risk conditions are projected to almost triple in the west of the province (Mukheibir & Ziervogel, 2006). This will harm biodiversity, soil structure and the spread of fire-adapted alien invasive plants, further

altering and enhancing fuel loads and making wildfires more intense. Plantations and buildings will be subject to increased risk (Mukheibir & Ziervogel, 2006).

On the opposite spectrum, if fires are severely prevented, and frequency is reduced from once in fifteen years to once in five years, many plant species that are killed by fire and rely on re-seeding to survive would become extinct as they would not have enough time to mature and set seeds between fires (Mukheibir & Ziervogel, 2006). This showcases the formidable conundrum between disaster management of fires. Mukheibir and Ziervogel (2006) note that alien plants result in a future climate with more frequent and intense fires, raising the fire hazard. Whilst being less flammable than fynbos due to the higher moisture content in their foliage, they burn readily once ignited because they tend to have greater biomass than the indigenous fynbos.

Mukheibir and Ziervogel (2007) developed a climate change adaption strategy for the CoCT and made numerous valuable suggestions that aim to align themselves with the ideals of the Disaster management act 57 of 2002. Before the suggestions are listed, it is essential to note that encouraged is the teaming up/collaboration of key role players, government agencies, private sector and research entities. All in hopes to realise the upcoming suggestions, such as increased training in ecological fire management for control of burning fynbos vegetation; greater investment for fire-fighting capabilities aircraft and technologies; control of alien invading plants; appropriate breaks between vegetation and residential areas; and erosion protection needed to avoid topsoil loss after fire – *see figure 28* (Mukheibir & Ziervogel, 2007).

Figure 28: prescribed or controlled burn in Table mountain area, cutting over-accumulated fuel, eliminating alien invasive plants and reduce the likelihood of uncontrolled wildfires (Cape Point, 2022).

The CoCT (2017) environmental strategy for the city policy (46612) showcases the importance of the National Disaster management act 57 of 2002 to increase resilience for the region. This policy acknowledges rapid urbanisation in Cape Town and; the growth of both urban footprint and population – placing pressure on the land for development. In both California and Victoria – this pressure was a defining issue that led to the encroachment of sprawl into the wild and urban intermix/interface increasing property fire risk (March & et al, 2018; Balaban & Fu, 2014). Nonetheless, policy (46612) ensures that the city will focus on resilience to withstand and mitigate the negative impacts of environmental hazards, proactively reduce Cape Town's vulnerability, and protect the economy.

Hazards such as climate change, floods, fires, and resource shortages are what policy (46612) aims to make suggestions (directive) for. Most suited to wildfire risk is subsection (6.4.4), stating that the city will apply a consistent risk-conscious approach to city development that considers and aims to minimise the potential impact of environmental hazards on people and infrastructure – the city is liable for development according to this policy. The other directive is subsection (6.4.5), stating the city will avoid development in areas known to be unsuitable, including flood plains, coastal risk areas, nuclear exclusion zones, within inappropriate noise contours, and other zones which would unacceptably increase the risk to inhabitants or infrastructure. Lessons from Rice and Davis (1991) and March and et al (2018) or California and Victoria, respectably, could include wildfire to 46612 (6.4.5).

Furthermore, subsection (6.4.9) ensures that the city will control and eradicate invasive plant and animal species, as required by national legislation and minimise the impacts of fires on the city. Subsection (6.4.11) ensures that the appropriate urban-natural interface protects communities from natural hazards, and (6.4.12) ensures that climate change risk is taken into account in the management of natural resources and the approval and implementation of developments.

The CoCT (2019) resilience strategy from a disaster risk management/reduction begins to incorporate international frameworks such as the Sendai and Hyogo Frameworks 2015-2030. There are two fundamental disaster management ideals that CoCT (2019) strategy lends from Sendai and Hyogo frameworks; that is that disaster management should not be purely static and reactive only, but without compromising

the aforementioned, add emphasis on prevention and long-term/ongoing/monitored improvements (March & et al, 2018).

This can be seen via the CoCT(2019) strategy with terms of "build back better", all in the hopes that cities continuously evolve and not recreate disaster-prone conditions(March & et al, 2018). Secondly, the Sendai and Hyogo 2015-2030 frameworks emphasise that urban planning is key to facilitating this "build back better" –advocating for a link to disaster management and urban planning. The CoCT (2019) strategy evokes the four Es as a part of disaster risk management. These Es aligned with the national disaster management legislature (act 57 of 2002). First, education and public awareness interventions; Second, engineering and technological interventions; Third, enforcement interventions; Lastly, Emergency preparedness and response. Lastly, the CoCT (2019:121) commits itself to collaboration efforts, stating that recovery from shock events is a significant responsibility of disaster risk management. "All city departments, government spheres and societal partners can play a part in developing resilience-building initiatives to ensure that destroyed infrastructure and homes are rebuilt in a more robust and safer" (CoCT, 2019:122).

3.4.8 Municipal systems act 32 of 2000

Harte and et al (2009:142) analysed the Imizamo Yethu (informal settlement) fires in Cape Town, South Africa – *see figure 29 and 30*. Although this is not my research's focus, Harte et al (2009) suggest that geographical discourse on cities in developing economies has focussed on the need to bring together urban policy and planning with the challenges of economic development and rapid urban development population growth. These trends of "bringing together", "merging", and "integrating" are highly topical and relevant when it comes to disaster risk management and spatial planning. Victoria and California

Figure 29: Imi zamo yethu, Houtbay 2017 informal settlement fires (Kahanji & et al, 2019).

Figure 30: Imi zamo yethu 2017 fire perspective (Kahanji & et al, 2019).

have shown that utilising spatial planning as a disaster management tool effectively decreases fire risk for communities within the wildfire-prone WUI. The Victoria planning and environment act of 1987 promotes such mergers and partnerships of disciplines (March & et al, 2018). However, in South Africa's context, Harte et al (2009:143) note that the Municipal systems act 32 of 2000 – includes specific mechanisms to ensure that disaster risk reduction planning is integrated into development planning. Harte and et al (2009) advocate for a collaboration of discipline to increase safety for Imizamo Yethu residents but similarly for the collaboration of the community to create adaptive capacity for long-term resilience.

Currie and et al (2017) substantiate Harte and et al (2009) on the municipal systems act ideals of collaboration and integration. Currie and et al (2017:107) note that the City of Cape Town (CoCT) has reorganised many of its departments since August 2016, showcasing the need for integrated and coherent planning, connecting transport with urban development and creating a department of urban integration to facilitate interaction between departments. With the integration between Cape Town's municipal department of planning, electricity, transport, solid waste management, water and sanitation and others – the hopes are that it promotes and results in more effective urban development (Currie & et al, 2017). Note that this is substantiated by the law (municipal systems act 32 of 2000).

The City of Cape Town (2019) resilience strategy promotes a futureproof urban system. The CoCT (2019:96) notes that while many shocks that confront Cape Town are known, such as flooding, fire and power outages, there are many potential shocks on the horizon for which Capetonians have little experience in responding or recovering. Currie and et al (2017) acknowledge that increased temperatures could lead to fire intensity and frequency changes. Thus the municipal systems act 32 of 2000 and its associated ideals of integration and merging of disciplines; bode well in the fight against unpredictable adverse effects of climate change. Through merging pieces of knowledge, perhaps new pieces of knowledge can be formed that could potentially assist Capetonians in responding to unforeseen shocks and stresses (Currie & et al, 2017).

3.4.9 Conclusion

Overall, South Africa has some of the best-written legislation on wildfire disasters, compared to "best practice" precedents in Victoria and California. It comes as no surprise: In the Western Cape, policy on wildfire and planning was inspired by "best practice" precedents and is, therefore, on par with the policy and guidelines.

There is a significant limitation regarding the Western Cape provincial zoning scheme – much more deliberation is needed in developing a wildfire-specific trigger for development guidelines and regulation. The City of Cape Town could use a wildfire overlay zone to promote wildfire resilience for communities residing in the fire-prone WUI.

Much of the local disaster risk management policy is on par with international frameworks with numerous references to "build back better" – the shift from suppression/technology to prevention techniques. Local policy through the municipal systems act acknowledges the need for merging disciplines and collaboration to develop new ways of thinking to combat threats facing locals – that current knowledge systems are not prepared for.

The review concludes that spatial planning as a disaster management tool can significantly decrease fire vulnerability for communities in the WUI. Local policy and legislation significantly emphasise public participation and inclusion, which in some contexts are better than "best practice" precedents. Hence, it is great to see that community input is treasured and respected because, without community involvement, true overarching resilience can never be achieved. The essential ingredients for spatial planning to play a more prominent role in disaster management are present; the whole process does need to be carefully nurtured.

4. Research methodology

4.1 Introduction

The chapter begins by briefly outlining the process followed throughout this research, from initial ideas to data collection to the spatial intervention recommendations. The second section focuses on each specific method and technique used with an explanation of the process followed, the reason behind the choice of method and its advantages and disadvantages.

The brief made clear that research projects need to build on ideas of previous planning courses, with the outcome culminating in an interventitive-orientated response to a particular planning issue at a specific relevant scale. The decision to work with research around spatial planning, wildfire disaster management, sustainable development, defensible space and urban design – was prompted by the "ethical position" in the introductory chapter. Within this "ethical position", the two main case study or sites for intervention was formulated—the University of Cape Town post-2021 wildfire disaster and the Somerset West Spanish farm post-2022 wildfire disaster.

The title of the dissertation: is "How spatial planning can enable pathways toward wildfire mitigation within the fire-prone wildland and urban interface, City of Cape Town." due to the vast subject matter covered and scrutinised throughout the dissertation, moving from a general focus to narrowing the focus would be difficult if a straightforward research question and title were not carefully formulated. The main research question was narrowed to: “how spatial planning can be harnessed to mitigate wildfire risk and assist in disaster management within the context of climate change?” This question was formulated to capture the subject's layered complexity and multi-disciplinary nature. Thus, the sub-questions alluded to in the introductory chapters were formulated to break down critical parts of the question. If answered in specific parts – the whole picture that forms the central question becomes more apparent.

Before undertaking the research, approval was gained from the UCT ethics committee, as the research uses human subjects. The previous literature review provided a theoretical basis for the research project. It analyses, compares and contrasts various relevant documentation, reports, legislation and policy from various local and international “best practice” precedents (Victoria and California) as it pertains to

wildfire mitigation for properties within the fire-prone wildland and urban interface (WUI).

The review then investigated how climate change and its role in the exacerbation of wildfire promotes spatial planning as a critical tool in disaster risk management. Furthermore, the review uncovered the relationship between spatial planning and disaster risk management as disciplines and the potential each has to decrease wildfire vulnerability for urban structures in a fire-prone WUI. Secondly, the review analysed the institutional, procedural and legislature of wildfire management within international "best practice" precedents in Victoria and California and how elements of spatial planning in these contexts were leveraged to decrease fire vulnerability within their fire-prone WUI. Collaboratory pitfalls of these cases are similarly reviewed. Lastly, the review analysed local national, provincial and municipal regulations; in the process, it uncovered pathways by which spatial planning can contribute to disaster risk reduction within local fire-prone WUI.

In conjunction with the literature review; the primary emphasis of the research method was the several interviews conducted with academics, disaster management officials, spatial and land use planners; insurance brokers; fire engineers; veld and forest fire experts; lawyers and many other affected and interested role-players within the realm of wildfire disaster management within the context of climate change.

The findings from the literature are then compared and contrasted with the findings and themes developed from interviews – creating corroborated conclusions. The base maps for the University of Cape Town (UCT) and Somerset West Spanish farm (regions within the fire-prone wild and urban interface) were selected. The dissertation then shows how spatial planning tools can be used to manage wildfire disasters in these at-risk areas and various recommendations and interventions. Note that these recommendations and interventions for UCT and Spanish farm are based on the literature review and interview findings. This means it is corroborated, has a solid theoretical basis and "best practice" inspiration, and is vouched for by the various local wildfire and planning professionals who have over a century of experience together. Lastly, the dissertation uses mapping and imagery to bring about a spatial conceptualisation for the above sentiments – *see figure 31*.

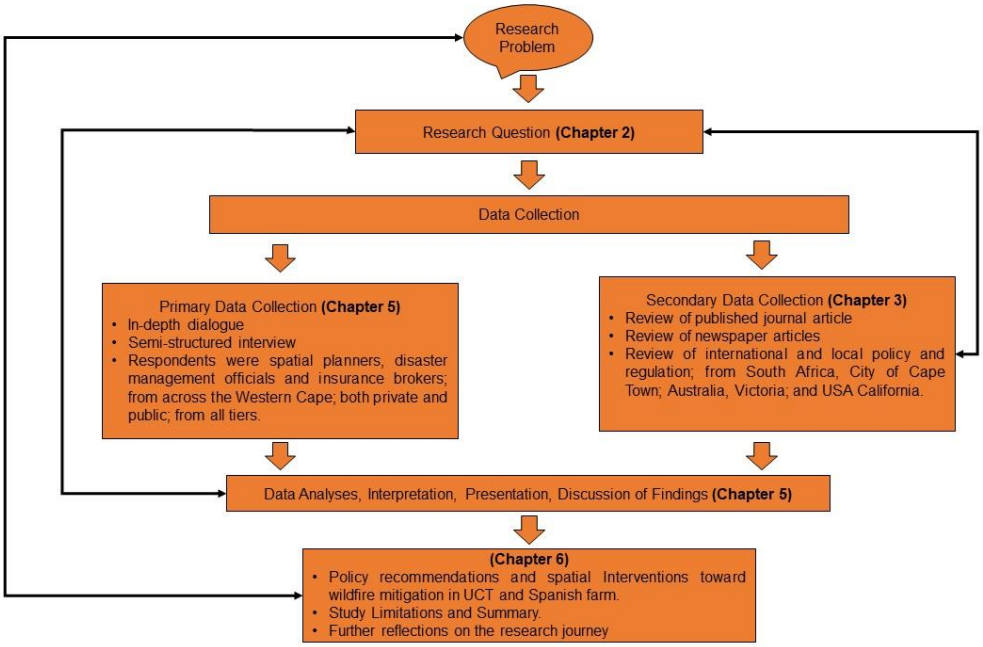


Figure 31: Methodology diagram for research project (Author, 2022).

4.2 Research methods and tools

4.2.1 Qualitative

The research project covers a vast number of disciplines. The result of the research project, as per the brief, is to generate an intervention-based conclusion. The scrutiny of international and local; ideas, regulations, opinions and wildfire mitigation techniques, the pitfalls and breakthroughs thereof – require a gathering of deep, insightful, rich descriptions (Roulston & et al, 2003). Thus non-numerical qualitative data was gathered to formulate the final spatial recommendations and interventions. Qualitative methods similarly provided the much-needed flexibility and open-mindedness required for the respondents to freely draw from their experience and thoughts when answering the interview questions.

The qualitative methods employed in this research project allowed respondents to explore various perceptions and themes of wildfire preparedness, climate change, wildfire and disaster management/planning, and defensible urban design within the wildland-urban interface. Types of respondents ranged from disaster management officials, insurance industry brokers, wildfire lawyers/experts, fire engineers, and spatial and land-use planners. The findings from the literature review, as well as those that were gathered from this rich and deep qualitative engagement, provided the basis from which recommendations and interventions were generated for the cases selected (Bihari & et al, 2012:4). Those cases being the high-fire risk regions within the City of Cape Towns, fire-prone wild and urban interface namely: UCT and Spanish farm. The interventions and recommendations were based on spatial planning tools to promote wildfire risk reduction strategies for UCT and Spanish farm.

4.2.2 Case study

The research makes use of the case study method. Two case studies utilised in the research are found within the City of Cape Town and are high fire risk located in the WUI. Both recently were affected by wildfire disaster – UCT in April 2021 and the very affluent neighbourhood of Spanish farm in Somerset West in June 2022. The research is a reaction to these wildfire events. It utilises spatial planning to offer recommendations and interventions for future sustainability and wildfire resilience for the regions and other similar contexts throughout the Western Cape. Precedents such as Victoria and California were used and analysed in the review to understand foreign contexts and how they leverage spatial planning to mitigate wildfire disasters

for their fire-prone WUI communities. They are seen as relevant comparatively to Cape Town, as all share the same Mediterranean climate, wildfire disaster issues and densely populated fire-prone WUIs.

Flyvbjerg (2011) notes this as a significant strength of using case study methods – it allows for in-depth focus on specific areas, which in turn, from those in-depth conclusions, allows for relevant comparisons, leading to in-depth "grounded in research and cases" style recommendations and interventions. Hence it is viewed as best applicable to the goals of the research.

The case study methodology assisted in the process of formulating recommendations for spatial and policy interventions. Flyvbjerg (2011:301) states that case studies provide the opportunity to comprise more detail, completeness, richness and variance. Thus, the researcher benefits from being situated within the location, creating a platform for a greater understating of the value and systems of power amongst spatial planning and disaster management officials (Rice & Davis, 1991; Flyvbjerg, 2011:301). This assists the researcher in recognising the complexity of the research.

The case study research data comes from various sources (Yin, 2006). Secondary data came from desktop studies of which two levels were recognised. Firstly, the literature review provided a theoretical basis for the research project via historical, legal and policy analysis from Victoria and California. Secondly, an in-depth analysis of Cape Town's spatial development framework, disaster and risk management plan, land development objectives, and local wildfire mitigation techniques took place. As mentioned before, the literature review found that these before-mentioned cases have very high comparability to Cape Town regarding wildfire regulation, mitigation and planning on the relevant fire-prone wildland-urban interfaces. This is an essential characteristic of case studies regarding the final spatial and policy recommendations, as the researcher could draw from relevant latest and grounded examples/cases.

Due to the (hierarchal) nature of the departments in question (planning, disaster management and forestry), the subject matter (wildfire and urban politics, regulation, pitfalls and breakthroughs) discussed during the interviews was highly layered and complex. Adding non-local precedents (Victoria and California) was a great challenge. However, the case study method assisted in dealing with many contextual analyses and sources under one set of criteria (Yin, 2006).

One of the significant limitations encountered using the multiple/variety source case study method – is that the data gathered would rely on the researchers' own biases when building toward the policy and spatial recommendations section in the final chapter (Yin, 2006). To combat this limitation, when the perspectives of planners, disaster management officials and any relevant party under the wildfire management umbrella were gathered – their own non-scripted opinions, ideas and thoughts were portrayed in the research to balance out any personal bias that might have come from the researcher. More extended quotes are utilised to exacerbate the "non-scripted" opinions. Furthermore, to the best of my ability, throughout the interview process and writing journey, I remained as non-partisan as I could, as not doing this could significantly affect the quality of my research.

4.3 Tools and Techniques

4.3.1 Dialogue Interview

To ensure detailed, deep and insightful descriptions of the fire-prone wildland-urban interface (WUI) problems were gathered from respondents – the dialogue was highly promoted before and during the interview process. This made respondents feel at ease when discussing the highly layered and politicised subject matter. Furthermore, the dialogue style of the interview allowed respondents the freedom to draw from their experiences and thoughts unbiasedly. The fact that the ethics consent form was used throughout the dialogue with various planners and wildfire disaster management professionals allowed for further freedom of speech, as respondents identities and personal information was omitted. The omitting of personal identities was very important due to the complex and politicised positions the various respondents hold in government and the private sector. Respondents were made up of spatial planners and disaster management officials.

Shared were opinions of current local legislation, the pitfalls, successes, and any stories from their wealth of experiences were shared around the capabilities of spatial planning to assist in wildfire mitigation within the fire-prone WUI. Local legislation and policy were scrutinised, and pitfalls and possibilities were uncovered. Ideas and seeds for the future were similarly deliberated. The veld and forest fire act, veldfire policy and planning principles, the provincial zoning scheme overlays and many more regulations were interrogated. Furthermore, the pitfalls and successes of collaboration were similarly discussed. Roulston and et al (2003) state: "All are allowed to use the dialogue style." A quantitative questionnaire numerical style would have fallen dreadfully short in gathering the aforementioned rich and insightful answers that the qualitative style dialogue allows.

4.3.2 Semi-structured interview

The semi-structured style of questioning during the interview provided a permeable guideline for respondents to remain within the relevant realms of spatial planning and wildfire disaster management within the fire-prone WUI. This style provided a degree of much-needed flexibility, as respondents could freely share their ideas, hopes and plans within the research subject matter (Roulston & et al, 2003). A significant limitation of the semi-structured style was that it was common for respondents to stray way past the research focus during the interviews. However, due to the semi-

structured layout provided, respondents could easily be guided back to the research focus – allowing me to listen attentively to the rich and deep insights shared throughout the various interviews.

The semi-structured format allowed for close contact between the respondent and interviewer, allowing for the questions around data to be detailed and extensive. I shared a screen showing the respondents various open-ended questions using the online zoom platform, then displaying a diagram to encourage the respondent to shape their narrative within the realms of the research focus. The questions were tailored to each relevant profession, and yes and no answers were avoided, as these are catered toward affirmation rather than the much-needed description required in this research.

Due to the multi-disciplinary nature of the research topic, some respondents needed to be probed and guided on the correct course, but this happened far and few in-between. However, once the probing was complete, the majority of respondents (probably due to their vast experience in their respective fields) had no problem linking various disciplines toward a common goal – which was to investigate spatial planning tools being leveraged to increase wildfire disaster management within the fire-prone WUI (March & et al, 2018; Rice and Davis, 1991).

Due to the layered, complex and interdisciplinary nature of the research topic and the desktop studies from local and international contexts, time was noted as a significant constraint during the research. Thus the questions used were peer-reviewed well before being implemented in the field – were crafted carefully and well-tested to avoid being leading (Yin, 2006).

Furthermore, it is noted that the nature of the research is contested. Thus during interviews, I made sure to be aware of respondents body language, words and attitudes – to ensure that they were happy and comfortable throughout the research process (Roulston & et al, 2003).

4.3.3 Data analysis

Data analysis involves seeing if there is a connection between what is being studied and the research findings. Findings were analysed based on the themes and categories established via an in-depth review of the related literature.

As mentioned before, due to the layered and politicised nature of the research and the various work environments the respondents find themselves in – time was noted as a significant constraint, as sometimes the interviews run over the suggested 20mins. This resulted in a significant limitation regarding noting taking and going over the many interviews. This took up a significant amount of time due to the respondents' multi-disciplinary nature and vast experience. The outcome of the interviews was sometimes tough to link due to the amount of time it took or the number of respondent information to compile. Nonetheless, clear patterns emerged within the data collected, allowing for a substantiated basis for the manufacturing of policy interventions and recommendations in the dissertation's final chapter. There were four patterns, categories and codes that arose from the analysis – and it was informed by both the findings/conclusions of the review and respondent data, namely:

1. Climate change and wildfire disaster
2. Wildfire regulatory and spatial planning procedure
3. Institutional collaboration
4. Insurance industry

Note that the above themes are corroboration and verified across the research project – these form the foundation of the research project and its interventitive conclusion about wildfire mitigation through spatial planning for UCT and Spanish farm.

4.3.4 Limitations

Throughout the research project, when the data was collected (2021), stringent national social distancing policies had to be abided by, which was a major limiting factor. However, most respondents had access to the internet and a laptop with camera and audio – as many were working remotely from their homes; zoom online meeting software provided a viable tool for data collection, given the national situation and pandemic guidelines. Secondly, time was another major limitation for the project, as secondary and primary data collection was necessary. Hence, the dissertation was extended by a year to allow adequate time to complete the research project to the highest quality possible.

4.4 Ethical considerations

Throughout the primary data collection portion of the research project, major ethical considerations were warranted. Due to the in-depth and politicised nature of the subject matter – respondents were provided with absolute transparency during the interview process; communicated through the initial email sent to them; they were made aware of the aims of the project; and who would have access to the data and reasons. The respondent was aware that they could stop the interview anytime. Furthermore, each respondent signed an ethical consent form before the interview and data collection took place – this was signed either electronically or in person. The ethical consent form bound me to omit the respondent's identity and sensitive information from inclusion in the research project. The ethical consent form obliged me to ensure respondents wishes were upheld. All interviews were conducted over zoom, meaning no face-to-face in-person interviews, to uphold the social distancing national standards during the time the data was collected – 2021.

4.5 Conclusion

Several interviews were conducted during the data collection phase of this research to gain information and insight from role-players connected to the spatial planning, wildfire and disaster management realm. These interviews were conducted over zoom (video call) and recorded. The names and personal information have been barred per the ethics form agreement. The following table of respondents was selected based on their occupational experience, prowess and expertise – *see figure 32*. These respondents were deemed invaluable, critical and indispensable to my research project:

Respondents Interviewed	**Interview form**	**Purpose for interview**	**Role and affiliation**
Respondent 1	Online semi-structured	Planning perspective on wild and urban (WUI) wildfire issue for the City of Cape Town (CoCT).	Senior planner Western Cape Government (WCG): Department of Environmental Affairs (DEA)
Respondent 2	Online semi-structured	Development planners perspective on WUI wildfire issue CoCT.	Spatial and development planner WCG in the DEA.
Respondent 3	Online semi-structured	Land-use planners perspective on the WUI issue CoCT.	Senior spatial planner CoCT municipality.
Respondent 4	Online semi-structured	Spatial planners perspective on WUI wildfire issue CoCT	Senior director spatial planning WCG in the DEA.
Respondent 5	Online semi-structured	Disaster risk management official perspective on wildfire and politics; and fire mitigation techniques for the WUI.	Senior fire brigade service member WCG in the department of disaster risk management.
Respondent 6	Online semi-structured	Fire engineers perspective on the fire industry and technology function and uses in fire mitigation.	Engineering Council of South Africa (ECSA), fire engineer apprentice.

Respondents Interviewed	Interview form	Purpose for interview	Role and affiliation
Respondent 7	Online semi-structured	Wildfire expert perspective on applying and enforcing the Veld and Forest Fire act 101 of 1998 (NVFFA). For CoCT, Knysna and George (Southern Cape).	A senior official from both; the department of forestry fisheries and the environmental (DFFE); and the Southern Cape Fire Association.
Respondent 8	Online semi-structured	Fire Protection Association (FPA) Manager, perspective on spatial planning role in the fire-prone WUI.	Senior advisor for private environmental practitioners, FPA manager, and enforces the NVFFA.
Respondent 9	Online semi-structured	Insurance brokers perspective on the insurance industries role in fire mitigation In the fire-prone WUI. Insurance etiquette around affected properties post-wildfire disaster.	Senior insurance broker, specialising in short-term insurance – domestic, commercial, aviation and marine.

Figure 32: A Table showcasing Respondent interviewed (Author, 2022).

5. Findings and analysis

5.1 Introduction

This chapter showcases the findings gathered from the several interviews conducted during the data collection phase of the research project. The data collected was coded, and pertinent themes were uncovered: climate change and wildfire disasters; wildfire regulatory and spatial planning procedure; institutional collaboration, partnership and public input; and the insurance industry. This chapter is organised as per the themes mentioned above. The data collected in this section provided insight into the research question: "how spatial planning can be harnessed to mitigate wildfire risk and disaster management within the context of climate change?" firstly, this section showcases the respondents, insights into spatial planning and the role it has in mitigating wildfire risk within the WUI. Secondly, this section – with the secondary data collected via the literature review and the primary data collected via the interviews – answers the sub-questions within the introduction chapter of the dissertation. This answer is the analysis portion of this section. The primary and secondary data findings will be contrasted, compared and corroborated to set a firm basis from which the final interventive and recommendation chapter can launch. Setting up this firm basis is essential in showcasing how spatial planning can enable pathways to mitigate wildfire risk within the UCT and Spanish farm, Somerset West WUI sites (dissertation case studies).

5.2 Climate change and wildfire disaster

The suppression or a focus on technology and emergency response have been at the core of disaster management. However, international and local regulations and policies have promoted a considerable shift, aiming to focus on prevention rather than. Prevention means mitigating the disaster and preparing for it before it happens. At the core of prevention is the disaster management frameworks mantra "build back better", meaning post-disaster, building to a specification that will deter the effects of future more significant disaster events. Spatial planning is seen as a critical discipline in achieving this goal. The upcoming section showcases the insights and opinions of respondents that deal with wildfire disaster management daily. They drew from their vast experiences to expand on the claim that "climate change" exacerbates wildfire disasters for vulnerable communities residing on the wild and urban interface (WUI). Many misconceptions, definitions and ugly truths about wildfire disasters and climate change were brought to light.

One of the sub-questions in the research project's introduction chapter is: "what effects do climate change and associated water scarcity have on city regions with a fire-prone wildland-urban interface?" This sub-question is vital in answering part of the leading research question for the research project. This section of the findings and analysis chapter is paramount to addressing the concerns of the sub-question mentioned above. Utilising the literature review and above respondent data, this section aims to answer the sub-question through sections labelled "analysis". This “analysis” takes place throughout the section

5.2.1 Wildfire anomalies

Respondent 5 states: "As far as the wild and urban interface is concerned, these fires need to be viewed as an extreme weather event rather than a normal wildfire. Certain conditions are needed to increase exponentially for the occurrence likelihood of a wildfire anomaly. Temperature exceeding 30 Degrees Celsius, wind speed exceeding 30 kilometres per hour and an adequate fuel load. The fire at UCT is an example of a wildfire anomaly extreme weather event. This type of fire is extremely difficult to control and extinguish." *see figure 33*.

Characteristics	Wildfire anomaly, extreme weather event	Normal wildfire
Temperature:	30 Degrees Celsius or more.	Less than 25 degrees Celsius.
Wind speed:	30 Kilometres per hour or more.	less than 20 kilometres per hour.
Humidity:	Low Humidity	High humidity.
Fuel Load:	Trees and vegetation with a large biomass such as alien invasive infestation.	Fynbos and plants and shrubs with a lower biomass.
Management Level:	Very difficult and nearly impossible to contain. Normal fire breaks are inadequate.	Easy to maintain depending on defensible space. Can be stopped or suppressed by a simple fire break.

Figure 33: A table showcasing the differences between a wildfire extreme weather event anomaly and a normal easy to maintain fire (Author, 2022).

Respondent 7 states: "looking at fire behaviour, certain issues can arise when a fire burns uphill, and structures are at the top. This is a problem. But mostly, you can easily control a fire if there is no extreme weather event." *See figure 34 and 35*.

Figure 34: a small veld fire, in fynbos with a low biomass and easy to manage

Figure 35: a wildfire anomaly extreme weather event of 2021 Rhodes memorial (Charles, 2021).

5.2.1.1 Wildfire ember storm

The wildfires occurring during an extreme weather event, or in short, wildfire anomalies – are extremely difficult to extinguish as these phenomena generate their own wind, leading to an ember storm. This is where burning embers rain down on urban structures and properties within the WUI. This random raining down of embers finds compromised houses and properties and starts small fires on roofs, gutters or any combustible matter. These burning embers can travel 8 kilometres from the fire crown. Emberstorm fires constitute the most destruction of properties and, in many cases, loss of lives within the WUI – *see figure 36 and 37*.

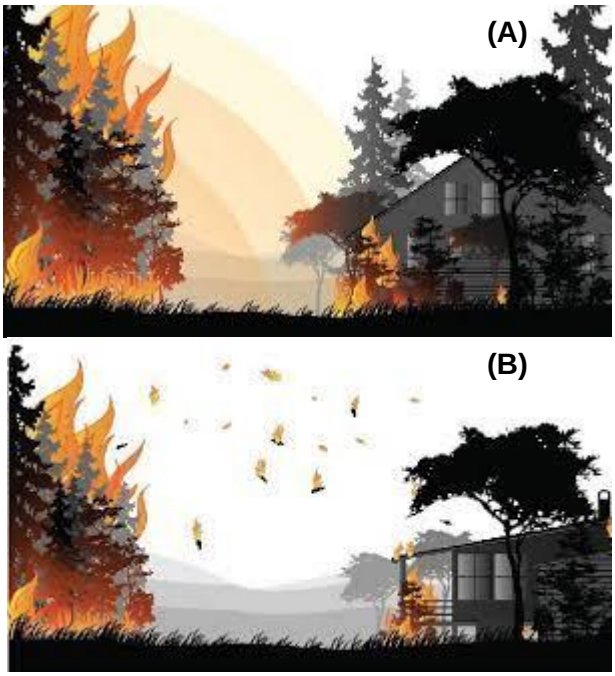


Figure 36: (A) is a home burning due to radiant heat of a nearby fire; (B) is a home catching a light due to spotting, or ember storm (Walls & et al, 2019).

Figure 37: California Camp Fire disaster 2018, burning embers blown by the strong wind created by the fire itself (Allen, 2018).

Respondent 5 states: "The wildfire anomalies can lead to pyro cumulonimbus cloud formation, which generates its own weather wind system. This happens when the fire intensity is high. Alien vegetation is the main cause of increased fire intensity. We all know heat rises, and if you have the extreme weather conditions needed, it fans the wildfire. Then it forms a thermal column, and once the hot air rises high enough, it starts to cool down and lose energy. This leads to the thermal column collapsing. Lots of embers, or burning pieces of timber, are sucked up and collapsing, causing the embers to rain on a nearby area. These embers land on flammable roof materials and dead matter. This is why buildings burn. These embers start new fires, which eventually burn the house down. Rarely does a house burn from a direct flame contact from the heat source." *See figure 38 and 39.*

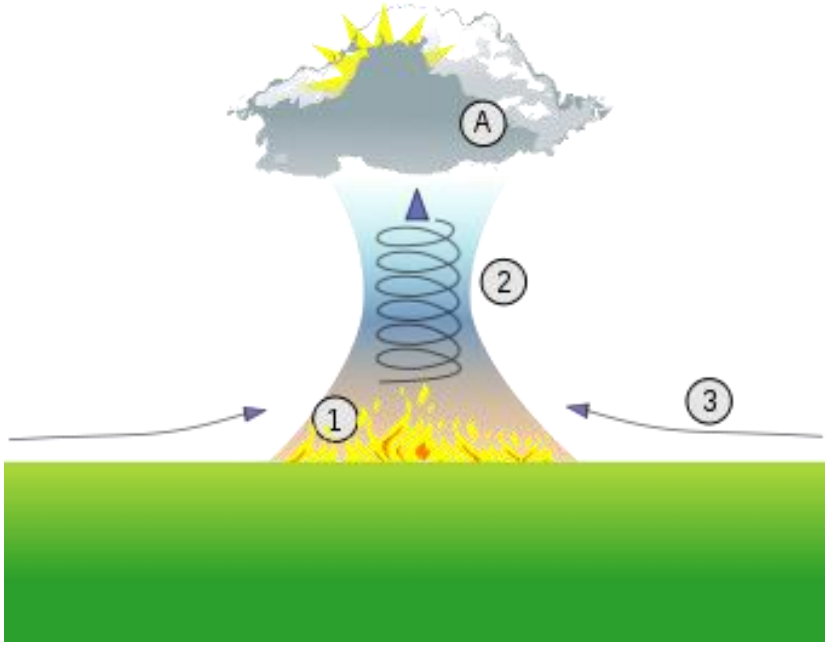


Figure 38: Showcases how fires change the weather. Fire (1). Makes air hot and intense (2). Hot intense air rises forming strong winds (3). That fans the fire, feeding itself resulting in a Pyrocumulonimbus cloud formation (A).

"What happened at UCT was a large ember attack. Not only did burning embers rain on the university, but also the properties across the road in Rondebosch randomly. This is why the buildings closest to the burning forested area at UCT sustained minimal damage. Further into campus, Library and the thatch Mostert mill across the street burnt down."

Figure 39: Showcases the Pyrocumulonimbus cloud formation during the Table mountain fire of 2021, which affected UCT (Pheto, 2021).

Respondent 6 states: "Embers fall onto a few dry leaves. They flew with the wind a few kilometres away. This small fire creeps into the building, finding more fuel and eventually burning the house if not attended to. In Gordon's bay, we had a massive fire. There were random houses that were burnt. The fire was not near the road, but the house was burnt. My friends dads house burnt that way. The fire was on the other side of the ravine. It is a large space; how would one regulate that?"

5.2.1.2 Wildfire extreme weather event analysis

Out of the four spatial planners interviewed, only one understood wildfire dynamics, the difference between a wildfire extreme weather event and a typical "easy to control" wildland fire (Respondent 1, 2, 3, 4). Spatial planners will need to become more familiar with dynamics such as "ember storms" and the means to mitigate such disasters—understanding why fires "skip" buildings and critical definitions. Spatial planners interviewed had significant knowledge of floods and floodplains, rivers and many areas of the natural environment – wildfire knowledge, especially in the City of Cape Town, ought to be just as imperative to acquire.

Spatial planners understanding of the distinction is paramount. Most spatial planners showcase ignorance of the dangers of an extreme event wildfire (as seen from UCT 2021 fire and the Spanish farm Somerset West 2022 fire) from spatial planners interviews. It is viewed as something that can be tamed or kept under control, offsetting responsibility solely to emergency services. Regular wildfires can be tamed. But wildfire extreme weather events, not so much. Contrastingly, the disaster management officials above (Respondents 5, 6 and 7) acknowledge the dangers and the difficulty of fighting under extreme weather conditions leading to ember storms.

It is good to see that local policy documents focus on wildfire anomalies and their traits and mitigation techniques (CoCT, 2004). This policy was primarily influenced by "best practice" precedents in Australia and California, USA. Respondent 3, a planner, assisted in the generation of that policy, and it is an example of planning starting to see its responsibility in taming these wildfire anomalies on the WUI.

In international contexts, California and Victoria, it is well documented how wildfires have become much more unpredictable and violent. They generate their own weather systems and their own winds and burn through old wildfire scars (Petryna, 2018:577; March & et al, 2018). Normal fires are pushed with the wind, whereas wildfires, coupled with extreme weather, push against the wind (Petryna, 2018). Respondents 5, 6 and 7 above clear up many misconceptions and define many of wildfires' "unknowns" and "violent" behaviours. It is "unknown" and "violent" because it is not an ordinary wildfire. It is a wildfire anomaly where weather and forest/wildland conditions have allowed it to supersede itself and exacerbate severity.

5.2.2 Wildfire and drought

Respondent 7 states: "water, per se, is not an issue in fire-fighting because not that much water is being used." *See figure 40*.

Figure 40: a fire fighter fighting the UCT blaze 2021 (Charles, 2021).

Respondent 8 states: "you can stretch your water capacity by adding retardant or foams, which can be used in the wildland fire-fighting operations. This can supplement the loss in water

capacity as it is used across various regions. Locally it is met with resistance due to the high-cost implications."

"Town planning tools can dramatically decrease the reliance on water for emergency services because it emphasises creating defensible space around structures and communities. In the long run, you reduce the risk and will not have to use so much water during wildland fire suppression or fire-fighting operations, as those structures are resistant to ignition."

Respondent 7 states: "With the Knysna 2017 fires, there was a drought that carried on for a couple of years. There was an extreme weather event that occurred. The ignition was caused by lightning, resulting in smouldering. Alien invasive plants took over the fynbos. This changes the fire regime, intensity and behaviour completely compared to the natural vegetation. Over the years, we have had these rich lifestyle farmers coming from Cape Town and elsewhere into the area. They do not manage the vegetation. Most fires in the region are caused like this."

5.2.2.1 Wildfire and drought analysis

Climate change is acknowledged across local policy documents to pressure the Western Cape in water availability issues, heat issues and ecosystem change under a future climate (Mukheibir & Ziervogel, 2007; CoCT, 2017; CoCT, 2019).

Respondents 7 and 8 largely agree that water scarcity is not as pertinent an issue as there are numerous ways to offset over-consumption. The use of foams and retardants. It was interesting to see that spatial planning is similarly a means to ease water consumption during wildland fire-fighting or suppression operations. The spatial planning's focus on urban structures as defensible spaces means fewer ignitions and less water is needed to be used for extinguishing purposes by firefighters. International Hyogo and Sendai frameworks on disaster management have called for massive shifts from suppression to prevention. These frameworks have noted spatial planning as key to this shift and named the discipline as a core aspect of disaster management for the future – the fact that it can ease water consumption for firefighters is just one of the reasons locally why this needs to take place.

Lastly, it was noted that climate change affects drought—this agrees with local policy. Variable droughts, coupled with alien vegetation overgrowth – can lead to changes in the ecosystem as the natural fynbos is overtaken by much larger aliens. This changes

the fire regime, meaning larger fuel to burn and more extreme fires. This is echoed throughout policy and disaster management officials interviewed above.

5.2.3 Climate change, wildfire severity and technology

Respondent 7 states: "extreme weather events have always been there. Obviously, we have a climate issue with drought or where the weather is behaving very funny. But if you go back and do the research. I am afraid I have to disagree with people saying there are more of these events. If you look at the Western Cape, the population has tripled over the last ten years, and more and more people are building onto the WUI or edges. These veld fires on the edge. Lots of it has got to do with management. You have to look at ecology. Fynbos will lose diversity if it burns too short a cycle. You want it to burn between 5 and every 25 years. How do you manage both? The cape floristic region is a world heritage site, so you have to compromise."

"There are many factors other than climate change contributing to the increase of wildfire anomalies. Climate change is not creating bigger and more dangerous wildfire events. It is not as simple as that. Looking back in history, in the 1800s, a Wildfire burnt from Swellendam to PE. They could not stop it."

Respondents 5, 6, 7 and 8 agree that: "climate change is not something we are changing immediately. Although we must do our part in combatting it. We should focus on what we can control. Such as town planning restrictions on properties in the wildland-urban interface; building code and guidelines enforcement; alien vegetation clearing; lack of personal private management; and prevention of ignitions."

5.2.3.1 Technology failures

Respondent 7 states: "the problem is that focus has been on suppression for too long. It needs to be shifted to prevention. You know, after a big fire, you always have the department standing on the news with a new fire truck and fire engine. You are not solving the problem. When the house starts to burn, they never save the house; it is too hot

Figure 41: Knysna Fire department posing with a new fire engine, post 2017 wildfire disaster (Wright, 2017).

and happens too quickly. Fire-fighting is an important part of disaster management, but the emphasis now needs to be placed on prevention, awareness, preparedness, and sprinklers on roofs or fireproof designing for houses in the wildland-urban edge." *See figure 41*.

"Aircraft could not be used at all in the Knysna wildfire extreme weather event. The winds were too strong. They could not take off. Fighting a fire like that with ground teams is a little too impossible. You need a combination of the two." See figure 42.

Figure 42: Working on fire showing off the new water bomber, in preparation for the 2014 City of Cape Town fire season (Isaacs, 2014).

Respondent 5 states: "You can have the best fire-fighting equipment and resources, but in extreme weather events, it is not going to help."

5.2.3.2 Climate change, wildfire severity and technology analysis

It is not as simple to say climate change means increased wildfire severity or more enormous wildfires. This does not help. Respondents note it is essential to focus on what one can control when fighting wildfires under extreme weather events. This is how you mitigate wildfire disasters to vulnerable communities in the fire-prone WUI.

Similarly, the overreliance; noted in policy and from respondents' experiences; on suppression and technology. The local policy calls on more significant investment in aircraft for fire-fighting capabilities and technologies (Mukheibir & Ziervogel, 2007). During extreme weather events, aircraft are not assured to fly and drop water bombs.

In international contexts, many firefighters lost their lives during extreme wildfire events, believing that technology would assist them. In 1994, in South Canyon, Colorado, USA, a wildfire rendered fire-fighting technology useless – 14 firefighters died fighting the blaze when their dependable fire retardant shelters melted due to unprecedented heat levels (Petryna, 2018:580).

“We do not stand in front of hurricanes and tornadoes with fans, trying to blow it in the other direction. We get the hell out the way or bunker and defend our property” (Petryna, 2018:577). It is time to have the same behaviour around wildfire anomalies.

Technology and suppression are still crucial in mitigating wildfire risk, but they should not be the only avenue toward that. Respondents (5, 6, 7 and 8) all call for equal responsibility to be on prevention measures, from spatial planning ushering fire-defensible urban properties; to alien vegetation clearing efforts or controlled burns to create buffer zones. Together lies the best pathway toward realising wildfire-resilient communities.

5.2.4 Conclusion

The sub-question of this research project is: "what effects do climate change and associated water scarcity have on city regions with a fire-prone wildland-urban interface?" Climate change does not necessarily have the only role in wildfire increased severity. As mentioned above, there is an issue when weather patterns become unpredictable and drought. Note that accuracy in judging weather patterns is paramount for wildfire anomalies preparedness, as the extremity of the disaster is so closely linked to weather conditions. However, the lack of management and not "focusing on what you can control" exacerbates the effect of a wildfire just the same. More responsibility must be placed on homeowners and their management; clearing dead vegetation closing up holes, installing fire-resistant construction materials and, on the extreme account, adding sprinklers on your roof to defend one's space in case of a wildfire anomaly – *see figure 43*. Spatial planning is dubbed, in both international disaster management policy and local disaster management officials, as the key discipline to assist in creating "fire-responsible homeowners" through development restriction. The upcoming section investigates this very spatial planning capability from a local perspective.

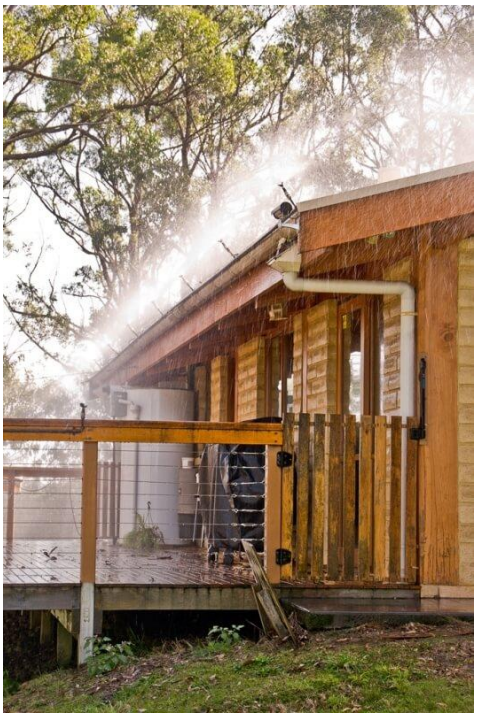


Figure 43: Installing burning ember protection system to a house, sprinklers on the roof (Terramatrix, 2020).

5.3 Wildfire regulatory and spatial planning procedure

One of the sub-questions in the research project's introductory chapter is: "what are the pathways and gaps within spatial planning and wildfire disaster management legislation and policies – capable of championing fire-safe urban structures and properties within the fire-prone wildland and urban interface?" This sub-question is essential in answering part of the main research question for the research project. This section of the findings and analysis chapter is paramount to addressing the concerns of the sub-question mentioned above. Utilising the literature review and above respondent data, this section aims to answer the sub-question through sections labelled "analysis". This "analysis" takes place throughout the section.

5.3.1 Western Cape provincial zoning scheme

Respondent 5 states: "planning does not take cognisance of the wildland-urban interface fire issue. You can still erect a thatch roof house in a wild and urban interface. When you build in that area, it must be defendable. The structure must be hardened to withstand an ember attack. Hardened through planting fire-resistant vegetation succulents; steel gutters; and managing and maintaining a property, clearing dead leaves and blocking holes." *see figure 44 and 45*.

Figure 44: Thatch roof Bezweni Lodge Somerset West a blaze during the 2017 wildfire extreme weather event (Coetzee, 2017).

Respondent 2 states: "If you look at Cape Town and its surrounds while I was in spatial planning. The strategic planning frameworks have due consideration for an area's disaster management frameworks and aspects. However, the regulatory limitations are more prescriptive

around environmental protection or being an environmentally sensitive area. So really, it is about those biodiversity areas and those sorts of things. This forms the backbone on limitations of developing in these wild and urban interfaces."

Figure 45: Bezweni Lodge Somerset West before and after 2017 wildfire extreme weather destruction (Coetzee, 2017).

Respondent 4 states: “what is regulatory as I understand it is limited to the zoning scheme and associated tools such as overlay zones. I do not think a wildfire risk mitigation overlay zone exists in the City of Cape Town, but it is worth checking if there have been discussions In this regard.”

5.3.1.1 Provincial zoning scheme analysis

Respondent 5 showcases the need for planning to interject itself into the wildland-urban interface (WUI) issues as disaster management officials recognise the need for spatial planning in wildland wildfire mitigation efforts.

Respondent 2, a planner, showcases why wildfire has taken a back foot, and the development around the WUI focuses on biodiversity. The review chapter of this research project recognised this focus. Chapter 16 subsection 16.2 has its own dedicated environmental protection overlay zone. This means it can be employed over an area requiring protection of its natural environment and environmental characteristics (WCG, 2004). Development can be restricted and directed according to this by-law – to ensure the upkeep of the natural environment to benefit the local population, and promote tourism and sustainable development (WCG, 2004).

Respondent 4, a planner, identifies the zoning scheme and overlay zones as the essential regulatory body in spatial planning, able to restrict development to ensure that the goals of the policy are realised. This is found in the integrated development plan, spatial development framework and other documents to ensure CoCT is developed sustainably (CoCT, 2022). The respondent is similar but unsure of an overlay zone dedicated to wildfire. This showcases what needs to change. Chapter 16 subsection 16.2.5, the "fire management area provisions", are the closest overlay that mirrors the Bush fire overlay from Victoria. To quote directly: "the council may stipulate

special fire management provisions for an area designated as a fire management area in terms of this overlay zone". This is it, one sentence. The review noted that in terms of any comparison between Victoria Australia fire overlay (BMO) and Western Cape fire management area provision, the local fire planning zoning regulation is severely lacking in depth. For example, the BMO included restrictions such as fire retardant walls, vegetation controls, water supply and house design specifications. Nonetheless, this provides an excellent opportunity for bolstering and buttressing the local and provincial zoning scheme for the interventitive conclusion of this research project. Local spatial planning's jurisdiction only extends to public land, as private land typically has existing developmental rights.

5.3.2 Zoning and development rights

Respondent 2 states: "In my work, we have not gotten to the point where we were brazen enough to say, let us start putting a disaster management overlay across our strategic plan. This would again impose further restrictions. It is around environmental protection, which forms the bulk of that regulatory limitation. That does not transfer into a more local scale planning. Because if we say you cannot develop in the wild urban interface. The WUI is agriculture, which it is in many cases. There are still developmental rights on that land. It is worth exploring whether there is scope to put in another layer of consideration for developmental rights."

Respondent 3 states: "When land use planning side is solidified and processed and land is approved and accepted, the national building act code side has to be adhered to, such as building materials, setbacks, kind of vegetation, hose pipes and water pipes. There is a whole lot of stuff that you can build into new developments. The problem is old developments, which have been there for 50 years. You cannot retrospectively expect them to change. If there is a thatched house in a WUI, you cannot say from tomorrow that all thatch houses on the edge, which have been there for 20 to 30 years, must be gone. It is not going to happen. But certainly, spatial planning has a lot of leverage over new developments. UCT has been there a long time, and the fire management plan/policy was not in place for the existing development of the institution."

“In terms of planning law, development occurs in terms of the zoning scheme for example, residential or industrial. In cases of the WUI. If there is a vacant piece of

land, up against the mountain you see the building line. If you look at a map with a cadastral, there are many blocks further up the mountain which are zoned residential, and some private individual owns them. This private individual probably bought the land whilst not even coming down to view the sight. The site is very steep, and it had got no road access. Although there is a road servitude, those roads will probably never be built. Despite all that, this person or private owner of the land has a legal right to build a house there."

Respondent 7 states: "Most of these developments were approved before we came along… If someone owns 500 hectares and they rezone to have 20 properties to sell to private people. Maybe a gated estate. We try to show fire preventative measures, what to be careful around, and what to look out for. You can intervene with old ones in that manner. But the structures have been built. That is as far as you can intervene with older developments. Those private owners should look to make their houses fire-safe, adding sprinklers and so on. However, people should stay realistic. Even legislation needs to be realistic. To tell people after development is passed and built, to spend 200, 300 or 400 thousand rands. It is not going to fly/happen. Even if you add it into legislation."

5.3.2.1 Zoning and development rights analysis

Although in both local and international contexts, Victoria and California, the central issue around spatial planning is that its sphere of immediate influence is reduced to public land, as well as input in new developments (WCG, 2004; March & et al, 2018; Rice & Davis, 1991). However, a significant limitation is that older developments that previously had approval – have existing rights to build according to a specific zoning scheme (residential or industrial). Across the respondent data collection from spatial planners to disaster management officials – this development rights stumbling block toward wildfire mitigation within the usually privately owned WUI is noted.

Spatial planning has significant leverage over new developments, in terms of applying veld/forest guidelines to decrease future fire risk for communities in those developments. However, on the ground, it is not as simple as this process is noted to become significantly politicised.

5.3.3 Corruption and development

Respondent 7 states: "Veldfire also gets politicised. Same with climate change. It is sad. It should not because it is a science. There is a reason why things happen. When people buy a piece of rural land, they want to develop it. When they do their environmental impact assessment, we input on those. Pezula Golf Estate in Knysna. It is a big golf estate designed in a way that encourages houses to burn down—terrible design. The houses are all over the show, in between the fynbos. Because of all the houses in the fynbos, you cannot do a fuel load reduction or prescribed burn to manage the fynbos. We gave inputs and said to the housing section that this estate should be clustered, creating a clear separation from the natural veld, to minimise people building in the bushes. We tried to intervene. But they had connections with politicians. They bypassed stuff that should not have gone through." *See figure 46, 47, 48 and 49*.

Respondent 8 states: "Fraudulent actions by some municipal officials are also a problem. They would like to get developments approved as fast as possible (with a handout or payout) and do not care about the safety of the residents/community."

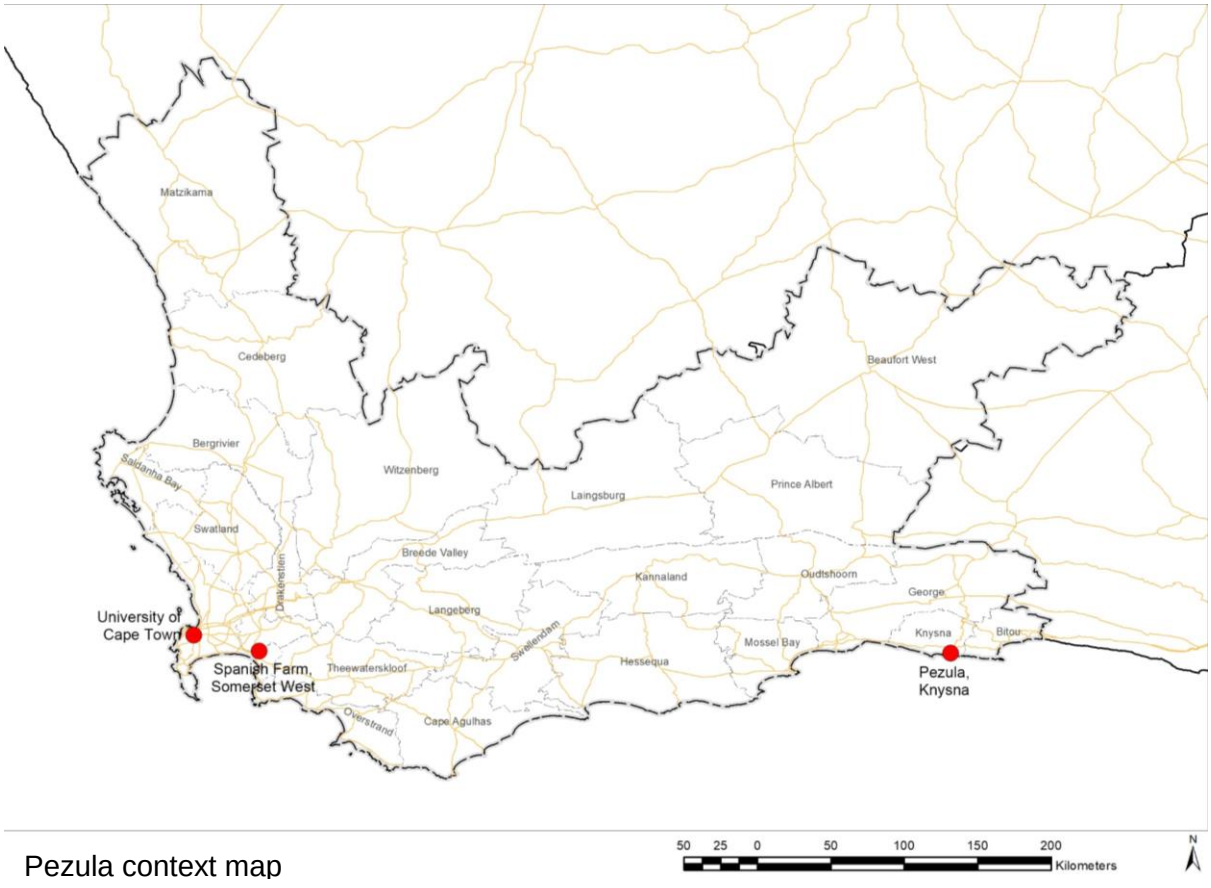


Figure 46: Context map showing Pezula Knysna, Western Cape (Author, 2022).

Figure 47: Ariel image of the high fire risk dispersed urban layout in-between the fynbos (Google earth, 2022)

Figure 48: Figure ground showing the Pezula high fire risk dispersed urban layout, note that there is no clustering or defensible space is present (Author, 2022).

Figure 49: Pezula Golf estate perspective (Kirsten, 2011).

5.3.3.1 Corruption and development analysis

From the local analysis above, respondents confirm that just as there are law-abiding people supporting the use and enforcement of positive restrictions for overall community well-being and goals of differing municipality IDPs, there are those more willing to bypass it through any means necessary. This is noted above with fraudulent municipal officials allowing developments to pass that should not be passed, as it is deemed a significant fire hazard. Within international contexts, spatial planning departments in Victoria and California governments have long been investigated around the claims of "disaster capitalism" (Balaban & Fu, 2014:821; Ellin, 1997; Low, 1997; Eves, 2003). A conflict arises between developers, landowners and governmental management of flammable lands (WUI) and a phenomenon called disaster capitalism whereby rapid encroachment, without consideration for disaster management, is exacerbated by the disjuncture in planning and disaster management. This is a significant limitation if spatial planning ought to effectively reduce wildfire disaster risk within fire-compromised communities residing within the WUI. Despite the aforementioned stumbling blocks, Cape Town officials commend the (City of Capetown municipality) CCT and past officials on an already fire-safe urban and town design compared to international contexts such as Victoria and California.

5.3.4 Cape Town's fire Safe design

Respondent 1 states: "California has extensive development of houses onto the primary dune. You can see that they build homes in cul-de-sacs in very high forested areas. Very different to what we have done in the Western Cape. We have had a century here of trying to build in a respectful way and anticipation of environmental impacts. Given the number of fires we have had. We have been remarkable in the way we have coped with wildfires."

Respondent 3 states: "there is an increased fire risk in the dryer and warmer summers. This is strongly linked to climate change. But in a sense, we planned and built very well from the get-go, in the valleys and plains and not on top of the mountain. California is the other way around. They face the brunt of fires. There are cases where the fuel load is hectic, arguably around UCT. But by the fynbos, it is not. There are laws in place to manage that. Whether we carry those laws out and how well is a different matter. But it must be noted that the UCT fire experience has been a wakeup call that these things can happen anytime and anyplace."

5.3.4.1 Cape Town's fire safe analysis

By in large, it is acknowledged that in terms of wildfire disaster and especially loss of life, Cape Town cannot be compared to Victoria and Californian contexts. Hughes and Mercer (2008) noted that at the time of their article, some 300 people lost their lives in the Victorian bushfires, far exceeding the total in other states in Australia. In October 2017, a series of wildfires started to burn across the wine country of Northern California, causing approximately $9.4 billion in insured damages and the death of 44 people (Jazebi & et al, 2020). There is no comparison. However, this does not negate the importance of spatial planning's role in wildfire mitigation from a local perspective.

Spatial planners deal with real future pressures, and what causes them is rapid urbanisation and population rise. The most available land in the City of Cape Town is situated on the urban edge or the WUI. As more and more people make their homes within the flammable land of the WUI, spatial planning would have needed to be at the core of wildfire disaster management sooner rather than later. With the issues of development rights mentioned in the previous section, spatial planners should not wait for developers to develop with free reign because that could be a wildfire risk. Spatial planners should focus on these issues now and guide development in a fire-safe manner to mitigate future wildfire disasters within these fire-prone regions. These are principles of the resilient city, sayings such as "preparing for the future shocks and pressure". These sentiments are cardinal pillars of many a CCT and WCG policy and regulation (WCG, 2004; CoCT, 2022; CoCT, 2019; CoCT, 2018; CoCT, 2017).

5.3.5 Support for a wildfire management overlay

Respondent 2 states: "The problem we run into and the issue prevalent across many areas is that our mandate only extends onto public land within our jurisdiction. Funds are not allowed to be used to clear private land. That is where we can perhaps be a little stringent. We look at UCT, for instance, regarding alien vegetation clearing. UCT is unique in the sense of its location. But there is a lot to be said, that it could be managed better before the April 2021 fires – it is something you only see in hindsight."

"On a more building level, we talked about those ember storms. Things could have been done differently. As beautiful as those vines are creeping up the side of the buildings if they are not managed correctly and cut back, that is certainly a fire risk—the applicability to implementing mitigation techniques on different levels. You can implement it on a higher policy level, around overlay zones, and that can cascade down into lower-level, more stringent requirements for developments in these areas. It can also influence existing developments in these areas. So you can start enforcing that if you reside within the wild and urban interface, measures should be put in place to mitigate fire risk." *See figure 50*.

Figure 50: UCT creeping vines fire hazard (Charles, 2021).

Respondent 3 states: “5 years ago, we introduced an urban edge. It was based on certain criteria, but the fire was not one of them. Slopes and geotechnability were certainly one of them. We identified a line and tried to identify management areas on either side of the line (around densities and so on). The urban edge was done for the peninsula and Helderberg and the northern areas around Durbanville. This process was easy around areas like Melkboss and even Helderberg, but was extremely difficult around the peninsula, simply because the context changes so radically so quickly and so many times. The variability, within 100 meters, on the one side, it was bare, and on the other side, it was bushy; wind direction changes so drastically. We tried for years and eventually gave up. We appointed consultants and did a lot of work; eventually, we could not do it. We have not tried that with fire; maybe it would be easier to put it in place because it would be one criterion. You speak of fire management zones that could be one thing that one could introduce."

Respondent 7 states: “In terms of environmental impact assessment (EIA), we can play a big role in the natural area, but not the urban. The urban fire brigades and disaster management officials should seriously engage town planners (the people that approve new buildings). There should be a merging of guidelines on that level.”

5.3.5.1 Support for local wildfire management overlay analysis

Despite the numerous pitfalls mentioned around spatial planning, corruption and development rights issues – spatial planning upholds a great capacity to assist in wildfire mitigation efforts within the wild and urban interface. From a local perspective, respondent 2, a land use planner for WCG, acknowledges how an overlay focusing solely on fire mitigation efforts could have helped UCT during the Wildfire disaster there in 2021.

Respondent 3 echoes the ease of employing such an overlay and general positivity around such a proposal. Furthermore, respondent 3 notes that in the development of the dominant CCT policy of the last 10 to 15 years (edge), wildfire was not considered a guiding tool (CoCT, 2022; CoCT, 2018). This is a significant finding.

Respondent 7 shares the above sentiments, and supports the role of spatial planning, in assisting wildfire disaster management in at-risk regions/WUI. The majority of the respondents (2, 3, 5, 6, 7 and 8), with a combined experience of more than 100 years in spatial planning and disaster management – supported the above sentiments. Further corroboration of the above is seen via international disaster management frameworks Sendai (2015) and Hyogo (2015) – urging this shift. The shift of disaster management to focus on preventative (defensible urban structures) measures rather than only suppression/fire-fighting.

The international precedents (Victoria and California) have shown spatial planning to be very effective in wildfire mitigation and many houses and lives being saved in the process (March & Kornakova, 2018; Rice & Davis, 1991). From the local perspective, officials from both disciplines have acknowledged the critical role spatial planning can play in wildfire mitigation. However, it is essential to note that because policy guidelines and regulations say something does not mean that all developments abide by it. Corruption usually leads to disobeying restrictions; however, even when corruption has no influence, other factors can impede policy effectiveness.

5.3.6 Regulation effectiveness and affordability

Respondent 3 states: "We spoke about those developments in the WUI where the gradient is so steep that fire engine access is impossible. Say 50% of this development has already been built. But say someone wants to build a guest house and the guidelines say you need to have reasonable fire access, which includes a turning circle at the end of the street. But the road gradient is so steep. You cannot put that in. This shows on the ground that you cannot be 100% when applying these guidelines. It is a best-of-your-ability scenario."

Respondent 1 states: "Regulations are only as good as they are deemed affordable; every municipality has an affordability envelope. So there is a certain amount of money in a municipal budget. The only way to increase that is to charge higher rates. Most people cry about rates because it is already too high. Adding and amending regulations is expensive. It costs money. A housing list could be collateral damage if you say to the municipality that you need to spend more on fire risk reduction. More fire regulation is good. However, 1000 people will not get houses. Now you have a trade-off. We can save on something else. Planners are always in a juggling act, and there are major implications. You need to ensure that it is financially viable."

5.3.6.1 Regulation affordability and effectiveness analysis

Respondent 3 unveils that regulation might be the best-written idea on paper. However, in practice, planners have to apply these development restrictions to the best of their ability. In many cases, if 50% of the development is built according to the goals of the CCT IDP and other local policies, then that is a win.

Figure 51: Reconstruction and Development Programme

Respondent 1 notes that planners not only juggle the stresses of development but, similarly, have to juggle the ideals and goals of the larger population. Just because spatial planning influenced wildfire overlay for disaster management is viable toward future sustainability and resilience of communities in the WUI – does not mean that this as an agenda is on demand from ratepayers and Capetonians in general. Housing provision for the previously disadvantaged has been on the main agenda for many municipalities across South

Africa since the dawn of democracy and free and fair elections in 1994. This pattern and popularity does not look like it is going anywhere soon (CoCT, 2022). *See figure 51 above*.

As the majority of respondents, countless policies and regulations, local and abroad, support the inclusion of spatial planning as a core aspect of disaster risk management. Budget and trade-offs do not negate the critical role spatial planning can play in wildfire mitigation and disaster management. For example, what does being a resilient and sustainable city (CoCT, 2022; CoCT, 2017)? One that "builds back better" after a disaster and actively attempts to adapt to future shocks and stressors – especially in the context of climate change. Spatial planning can assist in this aspect regarding the wildfire issue within the WUI and increasing community resilience in these areas – through inducing restrictions such as dead vegetation clearing, sprinkler systems and flame-resistant construction of houses.

5.3.7 Veld and Forest act 101 of 1998

Respondent 7 states: "the national veld and forest fire act 101 of 1998 (NVFFA) is one of the best-written legislations you can get when you speak to experts. The positive is that the Act does not prescribe how wide a fire break should be. This is important because every piece of land differs in density, vegetation height and fuel load. It is prescribed according to fire behaviour. To give specific width of a fire break would be ridiculous. A patch of grass compared to an invaded pine tree mess are two very different stories regarding each's wildfire risk. That is the rural side of things. For metropolitans or urban areas, a fire break can be a field. A fire can occur anywhere in the metro, so it needs to be mapped."

"You can have a 50-meter fire break. But when extreme wildfire weather conditions are present – low humidity, 30km/per hour wind speed and 30 degree Celsius temperature – fire breaks do not matter. The raining embers will get to a random unprepared urban structure that is not fire-safe, in the George fire 2018 fires. People had heaps of dry garden refuge. If a burning ember or spark lands there, it burns. It is the same with palm trees; they are usually dry at the top because they cannot prune anymore. Those dry leaves catch a light, and that causes sparks to travel further into the urban areas. It is a chain reaction."

Respondent 8 states: "The NVFFA is fairly effective because of the presumption of negligence clause – chapter 9. It "almost" forces landowners to become members of a Fire Protection Association (FPA). The land owner then gets exposed to all the rules, regulations and responsibilities of the FPA. These rules and regulations focus on reducing the risk wildfires pose to a specific region's social, economic and environmental assets."

Respondent 5 states: "It is not compulsory to belong to an FPA. In terms of the legislation, every landowner is responsible for their land. The vacant land at UCT. That is the property of San Park. They are legally responsible for managing the fire risk. The FPA can form a crucial role in managing these engagements and relationships. There are structures in the NVFFA that provide for an FPA. Although it is not compulsory to join FPAs, it comes down to looking at the incentive and benefits. FPAs are brilliant in supporting a legal battle that can be strenuous and expensive."

5.3.7.1 NVFFA analysis

Respondent 7 expresses the brilliance of the NVFFA in terms of fire breaks and how it appreciates that different landscapes are capable of different fire risks. NVFFA requires all landowners to maintain and prepare fire breaks on their property. The weeds regulations under the Conservation of agricultural resources act 43 of 1983 require landowners to clear their property of alien invasive plants (Pence & et al, 2003).

The effectiveness of fire breaks is noted and added as a critical tool to minimise the damaging effects of wildfires, slowing them down and saving lives and property. The local policy acknowledges this to the fullest extent (CoCT, 2022; CoCT, 2018; WCG, 2019). However, disaster management officials understand the overreliance on firebreaks very well. Fire breaks are redundant during a wildfire anomaly and extreme weather event, as burning embers can travel up to 8 kilometres and fall randomly on an unprepared house. Hence, it is acknowledged that spatial planning has a vital role in regulating defensible structures on the WUI to combat the ember storm issue. During regular wildfire events, firebreaks are nonetheless excellent tools for fire mitigation within the flammable wildlands on the CoCT urban edge. Spatial planning can substantiate this safety – *see figure 52*.

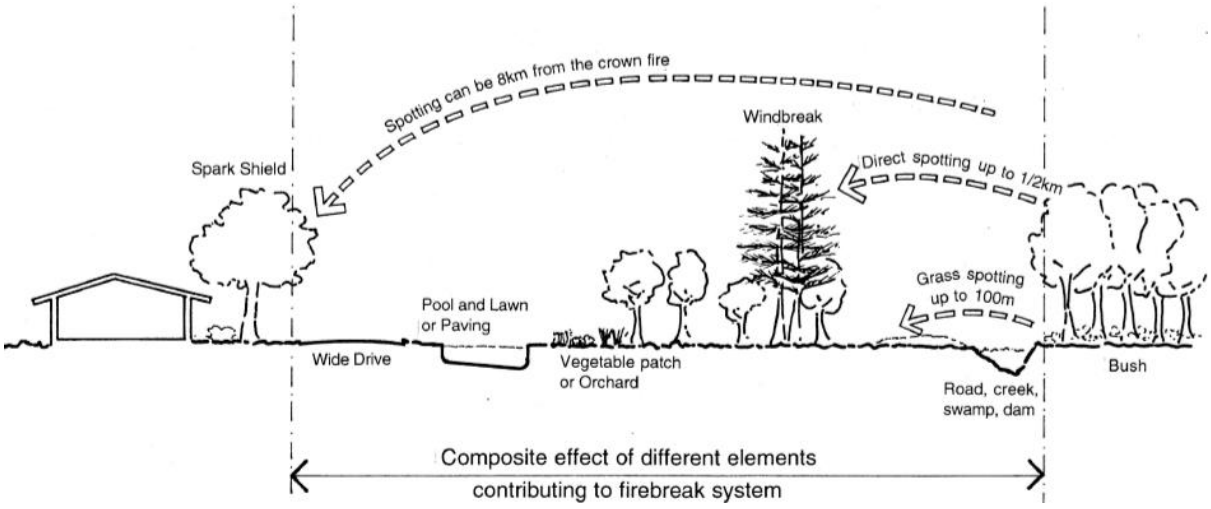


Figure 52: showing how far spotting/burning embers can be carried with wind over 8kms past a fire break, landing on a random property (CoCT, 2004:20).

Respondents 5 and 8 recognise that FPAs are not compulsory. However, many positives are noted in landowners in the rural and WUI joining FPAs, as it can assist in reducing costs of clearing fire breaks and assist in legal battles – as those are strenuous, if a landowner has no support and knowledge of their responsibility (Pence & et al, 2003:271). *See figure 53*.

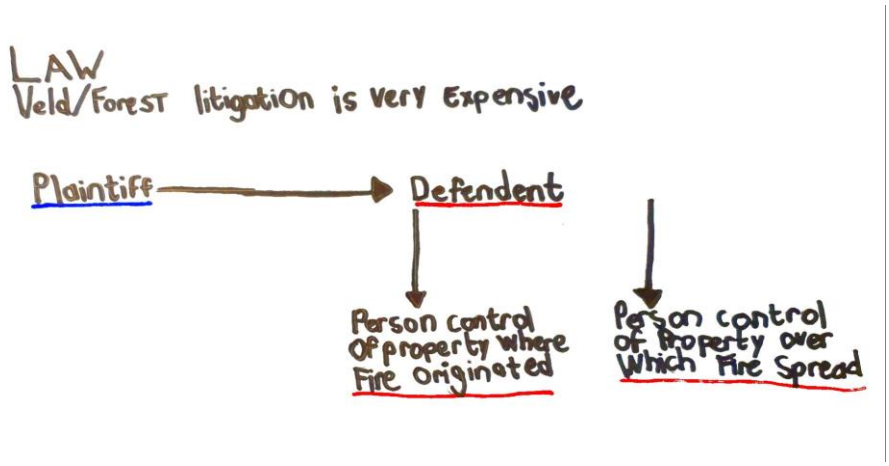


Figure 53: showcases the veldfire litigation process in a South African court of law (Author, 2022).

Emphasis is placed on legal battles, as the NVFFA expresses that the implication of not maintaining fire breaks are severe. The Act clearly states that landowners will be assumed negligent and can be held liable for fire damage on neighbouring properties if the fire spreads from their properties. Implications are substantial due to vital sectors of the regional economy depending on mature veld for livelihoods (thatch farmers,

wildflowers harvesters and bee-keepers); without proper fire management and prevention measures, the local economy will be under continual threat (Pence & et al, 2003:270). *See figure 54*.

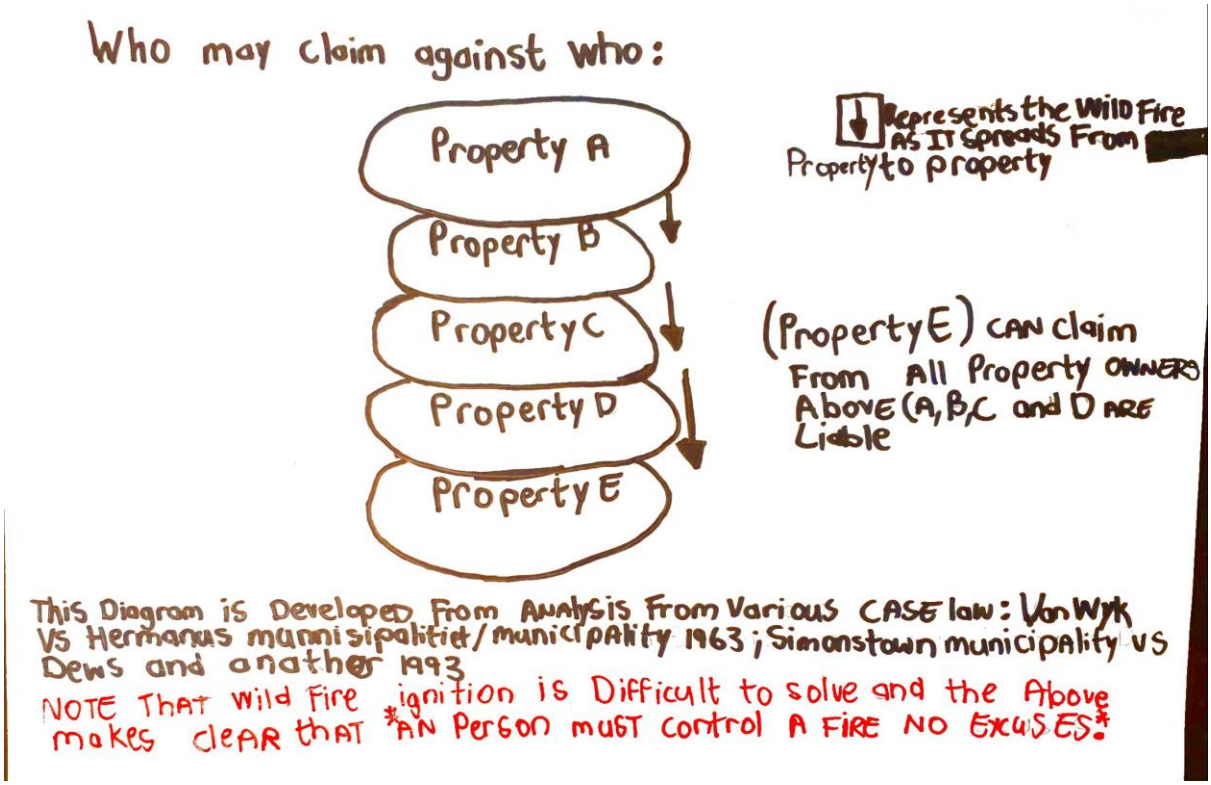


Figure 54: showcases who is responsible during a wildfire disaster and relevant case law, providing the perspective of the South African courts on the subject (Author, 2022).

5.3.8 Key local wildfire regulation

Respondent 5 states: "there are several pieces of important legislation. The Municipal structures act 117 of 1998; Disaster management act 57 of 2002 talks about the prevention of disasters; the Fire brigade act 99 of 1997 regulates fire services; NVFFA; and the National environmental management act 107 of 1998 (NEMA). Then there are municipal by-laws, which vary from municipality to municipality."

"Consistent law throughout the province or country is crucial if you want to enforce the law effectively. However, each law has opposite goals to the other. There is a lot of groundwork and coordination to make it work. For example, if you look at a prescribed burning. The NVFFA makes provisions for that. But if you go to NEMA and many local by-laws – it triggers smoke management violations. Then it is a whole issue. Then it becomes a participative process within the community. Whenever there are rejections

to prescribed burnings, you have to listen to them. Some of the issues I have seen is, not doing a prescribed burn because that is the day someone is doing their washing. These are the types of issues that arise. Some have more valid arguments like my mother is living with me, and she is asthmatic. But if an unwanted fire breaks out, this person will be more affected and they could lose their house. The ground solutions are not always as straightforward as they seem on paper."

Respondent 2 states: "Coordinating between the legislations is a great challenge. For example, the veld and forest act (NVFFA) look at fire risk from a rural perspective, and the Fire brigade act looks at fire in the urban setting. NEMA looks at fire as an environmental tool for prescribed burning and so on; and does not see fire as a risk. There is a struggle to match them and find synergy with one another."

"For example, disaster management plans, in my opinion, are too vague. They speak about disasters and that they manage very well. But as to the practicality of integrating into other aspects of the wildland and urban interface. It is a legislative requirement that local and district municipalities have disaster management plans in place. Whether or not all of those are filtering into the associated sector plans. This is perhaps something that I do not think is happening as well as it should."

Respondent 8 states: "the entity ensuring restrictions and overall responsibility to a plan according to the threat wildland fire pose to communities. The local fire services should be involved, but there is a lack of capacity or so-ordination between town planners and the fire services. Normally when local fire services are involved with the approval of developments, they focus on structural issues/rules and regulations but do not focus on the wildland threat around the development or communities."

5.3.8.1 Key local wildfire regulation analysis

International Sendai and Hyogo frameworks have noted spatial planning as the key discipline to further disaster management effectiveness from a preventative capacity. So helping communities prepare for disaster well before the disaster happens. Disaster management is no longer just waiting for disasters to happen and simply reacting like in the past – spatial planning can champion this focus. These frameworks note that the tools and pathways for this shift are largely absent.

The NEMA and NVFFA view wildfires differently as a management tool and the latter as a threat. The fire brigade act focuses on structural issues, whereas the NVFFA

focuses on rural forest fires – these are just a few examples of this misalignment of goals. In contrast, in theory, they are perceived to be synergistic. For example, respondent 2, 5 and 8 notes a pitfall of the local wildfire regulatory tree – and how many of these regulation goals are misaligned when applied to the ground.

From the above respondent sentiments, local and international policy analysis. At the same time, fire services do not turn around and look at the nature and the flammable risk of a wildfire during an inspection of a house – focusing on construction and structural issues. Furthermore, where EIA practitioners and NVFFA focus on the forest and are busy trying to manage fuel load, stopping by the urban structures. Spatial planning sits exact point of necessary intervention when it comes to wildfire mitigation. Spatial planning has applied overlay zones for sole environmental purposes, shifted gears, and focused on purely construction components such as river setbacks (WCG, 2004). Nature, community and urban areas are cardinal pillars of planning – therefore, these themes fall under the jurisdiction of the discipline. Spatial planning then provides an excellent opportunity to address respondent issues above and decrease wildfire risk for compromised communities on the wild and urban edge–from a construction and structural and forested point of view (March & et al, 2018).

5.3.9 SAN10400 building codes

Respondent 6 states: "The law (SAN10400) is minimal and limiting. There are many gaps in our law. Our whole regulation is around 90 to 110 pages. USA California has multiple laws, and all are above 400 pages – there are 3 or 4 main ones and a few smaller ones. The United Kingdom Building Structure regulations are around 900 pages. Australia is similar in depth and description of laws. We use quite abit of USA building structure laws to fill in the gaps of the local 10400. So a building might be declared safe according to the 10400; we then use USA laws to substantiate further and increase fire safety."

"Town planning must have a role. Laws are needed to enforce change. Buildings and houses under fire risk need to be demarcated. Currently, if you have a big warehouse, it is a J2. If it is a high-fire-risk warehouse, it is a J1. Every structure has a code; you must put stuff according to that code. Whether your structure needs to be built using a 2-hour rated fire-resistant wall or you have sprinklers installed. You would need to

have a type of fire rating like that. Town planners can then say, your roof assemblies must change so that your fire-risk house can have a better chance of surviving a veld fire." *See figure 55*.

Note that metals listed may only be considered to be non-combustible when in their solid form and not when in the form of a powder or shavings; percentages are given by mass.	
Aluminium.	Furnace slag.
Fibre-cement	Glass (solid).
Fibre cement products with less than 7.5% combustible additives.	Glass fibres (spun, woven or wool, with less than 5% resin content).
Brass.	Gypsum (with less than 7.5% paper or other combustibles.
Brick(burnt clay, lime/sand, cement/sand).	Lime.
Cement (Portland, blast furnace).	Metals (other than the alkaline metals).
Clay (burnt or unburnt).	Mineral wool (with less than 5% resin content).
Concrete.	Mortar (lime, cement, gypsum).
Perlite.	Pumice.
Sand.	Steel (cast or rolled).
Stone, natural.	Vermiculite.

Figure 55: A table showcasing the non-combustible housing materials to be used to increase fire safety, according to the South African building regulation (SAB, 2009:207).

"In some cases, buildings pass that should not be passed. If we count in an apartment block, after you build more than two storeys, or two levels to three – according to the 10400, you need two staircases or a staircase that is fire protected. We inspect many apartments where this is not the case. We try to give a rationale design, but all the regulations enforce for that second staircase. Who signs that off? The fire chief. Moreover, the fire engineer takes the risk and tries to elevate, according to budget and regulations. So if someone dies in that building, the fire chief must stand in a court of law for manslaughter."

Respondent 5 states: "if you look at the Western cape Helderberg region. That is Somerset West, Strand and Gordons Bay. We deal with an unoccupied wildland and urban interface (WUI) of 100s of kilometres. This is a big problem for disaster management. There are almost 100 kilometres of property bordering on natural vegetation. This is a landowner and land management issue. The landowner has to manage the risk. The by-law can be enforced. However, much of the WUI is an uncoded area. You cannot enforce codes in an uncoded area. Hence my previous

comments. You can put up a double-storey thatch house in the WUI. Town planning should be involved to deter such types of development."

5.3.9.1 San10400 building codes analysis

When it comes to building codes, they provide much information on what is considered a fire hazard and what steps to take to mitigate property from a structural capacity (South African Building regulations, 2009). Respondents (5 and 6) echoed the need for spatial planning to play a more prominent role. Helderberg is an area with a large fire-prone WUI; much of it is uncoded. As noted before, with population rise, flammable lands/WUI are bought up by developers and become developable. Spatial planning ought to evoke its capability of development guiding, in a wildfire-safe manner, to ensure the future sustainability for these communities – on wildfire risk reduction. Lastly, note that International building regulations on fire in Victoria and California include landscape laws, whereas local codes do not (Rice & Davis, 1991; March & Kornakova, 2017).

5.3.10 Conclusion

The sub-question of this research project is: “what are the pathways and gaps within spatial planning and wildfire disaster management legislation and policies – capable of championing fire-safe urban structures and properties within the fire-prone wildland and urban interface?”

Various pathways within the spatial planning legislation are capable of championing fire-safe urban structures within the fire-prone WUI. By far, the provincial zoning scheme and associated tools like overlays – are identified as the vital interjection regulation toward fire mitigation within the WUI. There is a significant problem of spatial planning jurisdiction being limited to public land and property – as private property have existing development rights. However, post-disaster, if planning by-laws become updated and private owners aim to rebuild – an overlay could potentially assist in adding a restriction to promote wildfire disaster. Other than development, rights unforeseen elements, evident in the local context, similarly derail spatial planning's ability to induce effective fire-safe development in the fire-prone WUI. That is corruption and fraudulent officials that partake in disaster capitalism. This is a significant limitation.

Even when corruption and fraud are not present, planners face real development issues that come with population increase – meaning the populace need to be catered for in terms of services and amenities, and planners are responsible for this. Housing has been at the forefront of the spatial planning agenda since 1994 in South Africa across various municipalities – as the population demands it. It is noted that an overlay or spatial planning regulation amendment and adoption is expensive and could derail a housing list, as all municipalities work with a budget. This is a significant limitation.

South Africa has some of the best-written legislation on wildfire management. However, most disaster management respondents (5, 6, 7 and 8) have called for spatial planning to play a more significant role in wildfire disaster reduction. They note that their jurisdictions are missing a discipline that can cater to nature, community and urban structures unanimously. Wildfire dwells in all these spheres, and spatial planning can similarly dwell in those spheres and evoke positive steps toward addressing the WUI fire problem.

International precedents analysed in the review (California and Victoria) have shown how spatial planning can make significant inroads in wildfire mitigation within the fire-prone WUI (March & Kornakova, 2017; Rice & Davis, 1991). Locally, the tools exist to emulate such trends, supported by various respondents (2, 3, 4, 5, 6, 7 and 8).

5.4 Institutional collaboration

One of the sub-questions of the research project is: “What is the state of institutional collaboration between spatial planning and disaster management within the City of Cape Town?” This sub-question is essential in answering part of the main research question for the research project. This section of the findings and analysis chapter is paramount to addressing the concerns of the sub-question mentioned above. Utilising the literature review and above respondent data, this section aims to answer the sub-question through sections labelled "analysis". This "analysis" takes place throughout the section.

5.4.1 Alleged institutional collaboratory united front

Respondent 1 states: "the department is a synergy and collaborative (the department of affairs and environmental planning). It seeks to be the custodian of our environmental future, catering to the need for a relationship between the natural and built environments. Inward growth. Need for social justice."

Respondent 2 states: "We work closely with development planning which encompasses knowledge management, spatial planning and a few provincial infrastructure initiatives. The other aspect of our department is focusing on law enforcement, climate change and waste management. Internally across all spheres of government, officials have great working relationships, so much collaboration is happening with those spheres." *See figure 56*.

5.4.1.1 Alleged institutional collaboratory united front analysis

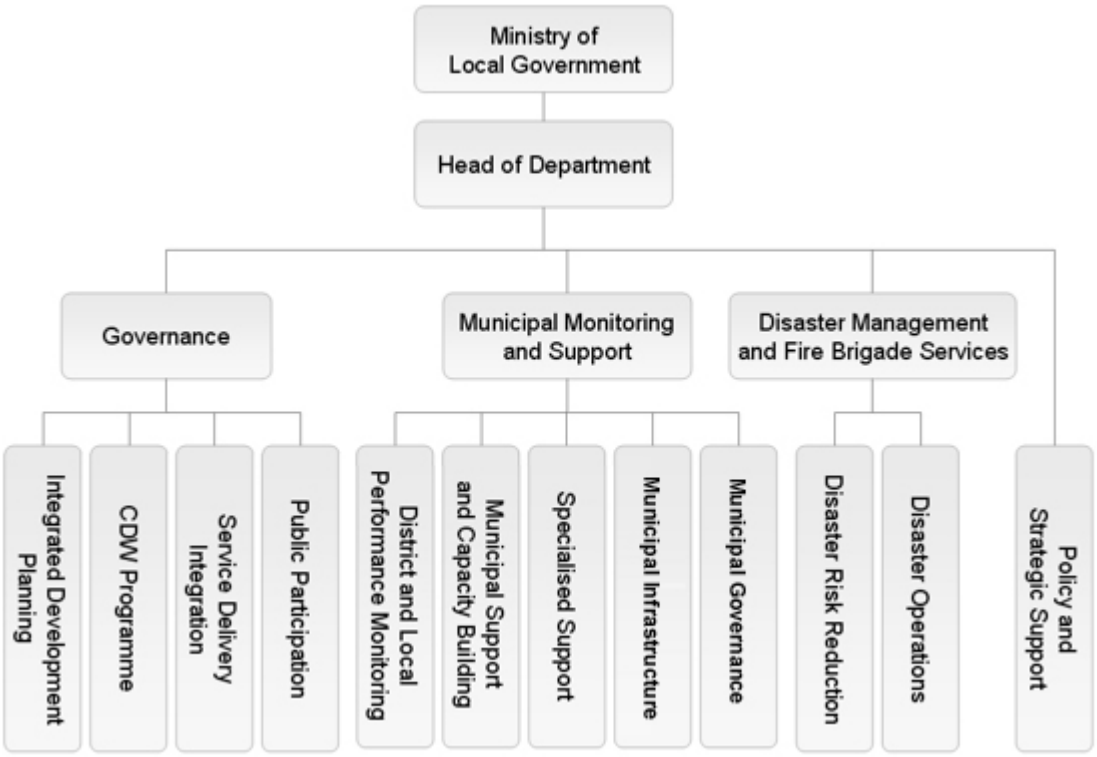


Figure 56: Western Cape Government structure diagram (WCG, 2019).

Respondents 1 and 2 refer to collaboration as the structure of the institution rather than the action of working on specific tasks together. The wording in both cases, is the type of style that is similarly found in numerous policy documents generated by the WCG and CCT – which is further substantiated by the municipal systems act 32 of 2000 (CoCT, 2017; CoCT, 2018; CoCT, 2019; Currie & et al, 2017; Mukheibir & Ziervogel, 2006).

Furthermore, the responses on collaboration were surface level, articulate – feeling knee-jerk or coached. This is a positive as different officials from different sides of the department understand collaboration and support it as the same thing. This is the aim of regulations such as the Municipal systems act, which promotes strong collaboration, meaning multi-input from all levels to deal with multi-faceted problems that South Africa has to deal with. Climate disasters and wildfires in this study focus, for example. However, upon further inquiry, the issues of collaboration were uncovered.

5.4.2 State of spatial planning and disaster management collaboration

Respondent 5 states: "several important pieces of legislation, municipal structures act 117 of 1998 and disaster management act 57 of 2002, focusses on prevention, which is a massive step and adopted from best practices."

Respondent 7 states: "There needs to be a much bigger responsibility on town planning and the way structures are constructed. The focus has been on suppression for far too long. It must be preventative, not just in policy and regulation, but also in practice."

Respondent 8 states: "the CSIR (Council for Scientific and Industrial Research) developed a software programme some time ago, determining where the priority wildfire risks are within the wild and urban interface area. This can greatly help town planners acknowledge the fire risk for a proposed development."

Respondent 1 states: "Near Ashton in the Western Cape, a large bridge was replaced. When the conclusion was reached to replace a 180-year-old bridge (inside my sphere of responsibility), it was replaced due to years of low alien vegetation clearing on the river sides, causing a build-up of debris leading to flooding. They built the bridge for future specification due to climate change, which increases the risk of future episodic flooding. We determine setbacks on estuaries and river water courses all to increase the future sustainability for the Ashton community so that the population can continue to utilise the bridge for many years." *See figure 57.*

Figure 57: the Ashton Bridge "build back better"

Respondent 2 states: "Planning around floods and flood lines is more prevalent because it is listed in NEMA activity. Wildfire does not get the same attention perhaps because it is seasonal."

5.4.2.1 Spatial planning and disaster management collaboration analysis

Spatial planning becoming a core aspect of disaster management is paramount. From a theoretical aspect, this is acknowledged by the intergovernmental panel on climate change (IPCC 2012:460). It is being further reinforced by the current Hyogo and Sendai 2015 frameworks. On the ground "best practice" wildfire mitigation precedents, Victoria and California has made significant strides in fire risk reduction in the WUI, leveraging spatial planning and associated tools. This has resulted in countless properties and lives being saved. Locally respondents (5 and 7) vehemently acknowledge the need for spatial planning to be included in wildfire risk reduction strategy.

Respondent 8 notes that between professional spatial planning and disaster management officials, the points and commonalities between the disciplines are largely non-existent – more to do with professionals being unaware of the tools, which are rare and few. Spatial planning focuses on socio-economic and geophysical characteristics and trends for future development, whereas disaster management uses indications such as hazards, susceptibility and vulnerability characteristics (March & Leon, 2013). Furthermore, there is extreme difficulty in identifying high-risk fire zones due to the many climatic circumstances that dictate how the fire will spread and its intensity (Lall & Mathibela, 2016; Mukheibir & Ziervogel, 2006; Kornakova & March, 2017). Thus, CSIR software developments on demarcating high fire risk areas within WUIs across South Africa – this tool can be utilised by both spatial planners and disaster management, bridging the gap between the disciplines.

Spatial planning concerns itself with the future physical, social, economic and ecological outcomes in cities and regions. At the same time, disaster management has shifted from cold-war era relief measures toward future-oriented prevention proactive measures (March & Leon, 2013). Phrases such as "build back better" are commonly used throughout the significant disaster management frameworks, calling for a merging of urban planning and disaster management. Respondent 1 showcases an example of "build back better" in South Africa's context through the Ashton Bridge construction. International disaster management frameworks note that the global south, post-disaster, rarely "builds back better" and instead rebuilds back to the pre-disaster state – which is highly problematic and unsustainable. The UCT vice-chancellor echoed the unsustainable sentiments of "rebuild" post-2021 wildfire

disaster. Like in Ashton, calls should be to "build back better" so that UCT can cater to the populace for many years.

Wildfire does not get the same respect as flooding. Respondent 2 notes that NEMA and planning generally do not pay much attention to wildfires. Wildfire and urban fires have their own sets of legislation, veld and forest fire Act and fire brigade act, respectively – so South African legislation does place significant emphasis on wildfire. This is not filtering through to the spatial planning spheres of influence, as fire mitigation is limited to fire breaks when international precedents have shown that the discipline has so much more to offer for overall wildfire resilience for the WUI. Wildfires and, more so, Wildfire anomalies should get the same respect from local planners as floods.

5.4.3 Objectives misaligned

Respondent 2 states: "Although we are encouraged to work collaboratively and try and integrate each other's work, findings and policies. Everyone has their targets, ideals and goals. It is not easy to integrate something separate from your focus. For example, the main goal of a spatial development framework is to ideally set out a long-term strategic plan for that area to both protect the natural environment and boost the economy. We (planners) need to enhance and allocate certain areas to upgrade for future development and new developments. This might be in direct contrast to a disaster management plan (because this area is, for instance, a 1:100-year flood zone, or it is a seasonal fire risk in this case). It is about balancing the need for what you are trying to put in place."

Respondent 3 states: "one of the main challenges is the amount of time collaboration takes. You have all your core functions; you only want to collaborate where collaboration is to be had. Collaboration can certainly enhance your core work, but you do not want to hear stuff from people where it has got nothing to do with you." *See figure 58.*

Respondent 5 states: "in this disaster management space, you have the fire-fighting fraternity and the environmental fraternity on the other side, and they are always at

odds. The differing expectations of both fraternities need to be balanced. These conflictions occur mostly in local municipal planning."

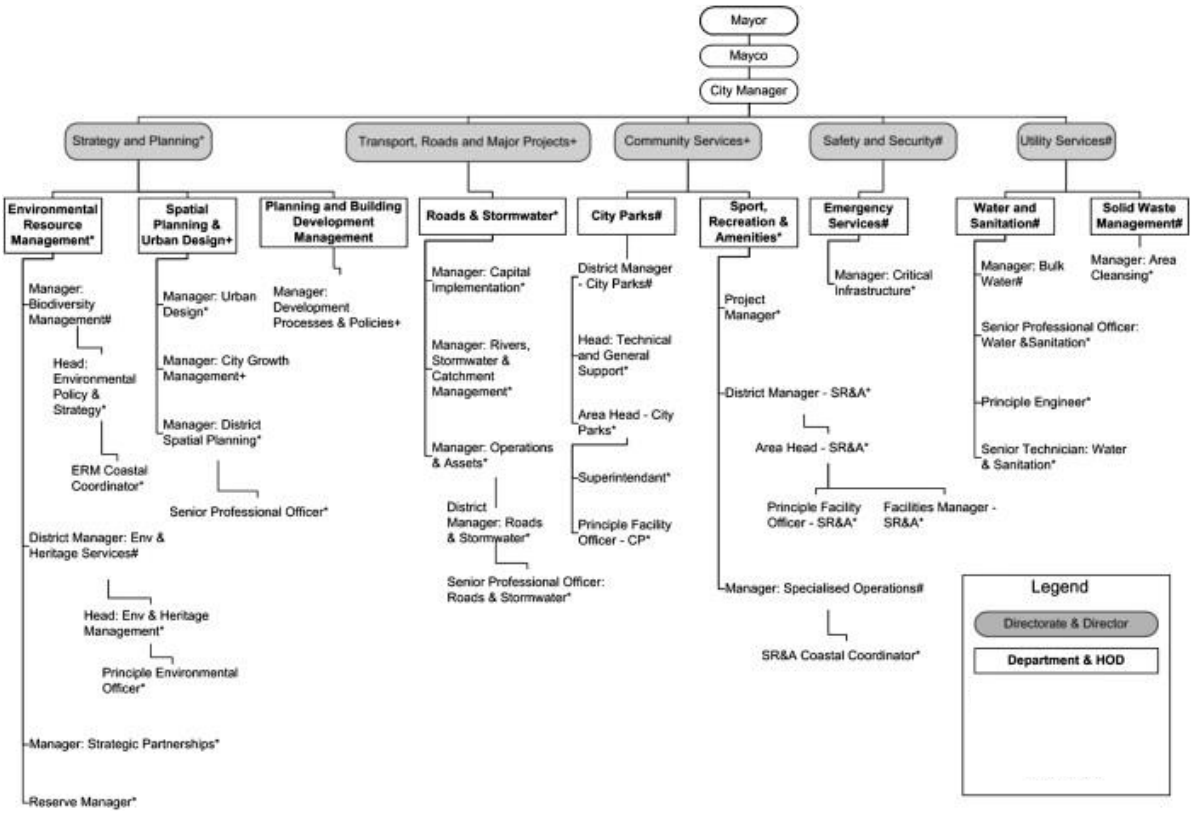


Figure 58: showing the vast structure of the CoCT municipality, and how difficult cross collaborating is between emergency services and development and spatial planning (CoCT, 2019).

Respondent 6 states: "No one likes the fire engineer, because the client does not want to spend more money on sprinklers, a firewall, or a fire-resistant roof. The architect does not want it to look ugly, and they do not want a firewall because they cannot put a hole through it. The fire chief wants more than the fire engineer and architect are willing to give. It is a fine balance between the three. There are also big site meetings to go through every aspect of the building. Pretty useless, people talk for 3 hours, and our (fire engineer) part is only 10 minutes."

5.4.3.1 Objectives misaligned analysis

Multiple Respondents (2, 3, 5 and 6) all note the difficulty around collaboration and working together, despite it being mandated under the Municipal systems act. Between spatial planning and disaster risk management, there are incredibly different goals. Spatial planning is ultra-focussed on housing provision and urban services such as transport, whereas disaster risk reduction puts resources toward suppression, emergencies, and pressing visible matters (March & Leon, 2013). Furthermore,

planners have more extended time frames (10, 20 or more years) or more immediate development control; planners develop plans that do not consider the sudden onset of events. Disaster risk reduction efforts focus on a specific crisis point, establishing preparedness, response and recovery actions, and mitigation efforts that aim to eliminate crisis points and reduce their impact (March & Leon, 2013).

The sentiments mentioned above constitute a significant limitation – however, improvements around differing objectives can be made using CSIR tools that can bridge the focus of the disciplines. Utilising similar "intelligence bases", such as CSIR, has excellent potential to merge the disciplines, which have the great potential to improve wild resilience overall for WUI communities. Working together is difficult due to the different focuses of disciplines involved in fire and wildfire mitigation and disaster suppression and prevention. A strict hierarchy that moves down a ladder where everyone is waiting for their turn to contribute toward this singular final plan, creating "collaboration" and allowing it to not be time-consuming and frustrating for already pressured officials. This is explained in the next section.

5.4.4 collaboration, not cross-collaboration

Respondent 3 states: "we try to collaborate as much as possible, but at a certain point, you have to silo; that is your mandate and responsibility. Cape Town has 21 000 employees; the bigger the department, the more need to work collaboratively."

"With development applications, you have a pre-application; you call a meeting right at the beginning. All departments come together and talk about it. This is what we think the issue is; we got a problem with this, and we need to talk about this. There is strong collaboration at that point. Although I do not know anyone in the fire department. There is very little cross-collaboration with the fire department." *See figure 59.*

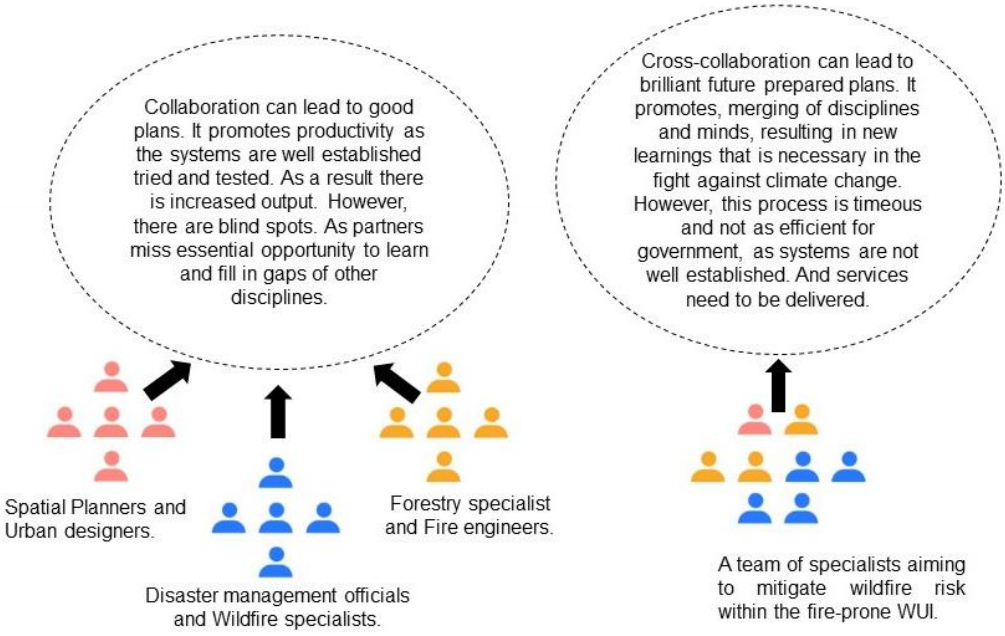


Figure 59: Collaboration and cross-collaboration (Author, 2022)

Respondent 6 states: "developers and town planners submit council plans – this is an SDP (site development plan). We (the fire engineer) and the architect work together to make sure the building is passing all the council requirements because these plans are submitted to get approved by the fire chief. After that, fire engineers and architects come in for a detailed plan, and we have to contact whichever discipline is required. An example of this is when a structural engineer needs to be consulted about a 2-hour fire-resistant wall installation, or if a heavy sprinkler system needs to be installed into a roof structure – this system is heavy on the roof structure."

Respondent 7 states: "a veld fire is not like a building that is burning, which is static. It is moving like a flood. It is challenging to manage in terms of disaster management services. If a big building is burning, the fire engineer is in charge. When you have a veld fire, you have a conservation agency like san parks or cape nature; a forest company; 20 to 30 private farmers; land owners, for example, Eskom, Transnet or sandrail; there are traffic issues around evacuations. It is tough to coordinate these agencies. It is all abit impossible, and everyone has their priority and agenda."

5.4.4.1 Collaboration, not cross-collaboration analysis

This is an important key finding. There is a big difference between collaboration and cross-collaboration. Collaboration from officials is strictly hierarchical. Everyone waits

down the line to input/contribute to the plan or development. Whereas cross-collaboration deals with "talking directly with" departments to make a more significant attempt to reach a goal.

Collaboration remains important between different disciplines to develop a multi-faceted point of view or recommendation to attempt to cure a multi-faceted issue such as a wildfire disaster or climate change (Bhengu, 2021; March & et al, 2018; Petryna, 2018). In the past, planners would have never thought to merge with disaster risk management because it would have been viewed as having "nothing to do with me". Presently, in light of the wildfire disaster exacerbated by climate change, these disciplines are looked toward as having the great potential to mitigate risk for communities and properties in the fire-prone wildland and urban interface.

Collaboration is a huge task. The research project review does not argue for less focus on the effective response to an emergency. However, rather an incorporation of planning to assist in realising the goal of disaster and risk management regulation and policy, which is to "build back better" and shift the focus from suppression to prevention. If realised, this will inadvertently put less strain on disaster risk management services, as the issue of wildfire risk would be combatted mainly at the root.

5.4.5 Conclusion

The sub-question of this research project is: "what is the state of institutional collaboration between spatial planning and disaster management within the City of Cape Town?"

Collaboration between the City of Cape Town (CCT) and the Western Cape Government (WCG) is great among more traditional relationships. So spatial planning, the environment, zoning around environmental protected areas and so on. Then spatial planning works well with the disaster management department around flooding and, by the looks, the new most prominent threat to Cape Town, sea level rise (CoCT, 2022). Local spatial planning has implemented the latest disaster management rhetoric of "build back better". It is a core aspect of disaster management, with the R32 Ashton Bridge construction and flooding.

When it comes to wildfires, however, there are mainly little to no collaboration efforts between spatial planning and the fire department. Disaster management respondents supported the need for spatial planning and its potential role in enforcing defensible space in fire-prone WUI regions. However, to spatial planners, there is just too much difference in goals and ideals. International perspective shows that spatial planning can be utilised in wildfire disaster mitigation –California and Victoria. Locally, it ought to be the same as the population grows; developers will target vacant flammable land within the wild and urban interface to cater to the density and their associated facilities, needs and amenities. Wildfire needs to be respected, on the same level as flooding – as more and more population fills the fire-prone WUI within the Western Cape.

The CSIR and its information on fire risk areas within South Africa's WUI is a great tool that can be leveraged to bridge the gap between spatial planning and disaster management. Both disciplines can utilise such information to guide development in a fire-safe manner.

5.5 Insurance industry

One of the shortcomings stopping spatial planning from positively contributing to wildfire disaster management by decreasing fire risk within the WUI; is development rights. Spatial planning jurisdiction and intervening capability are restricted to new developments and government-owned land. As for private land and older developments that have a legal right to develop or build, for instance, a house if the zoning is residential – spatial planning cannot impose or demand changes in such circumstances. The insurance industry could potentially intervene in these private no-gos and older development when urban structures were previously granted building rights. This section investigates the insurance industry's capability of enforcing defensible space within the fire-prone WUI.

5.5.1 Insurance and disaster management

Respondent 3 states: "there are large developed areas – such as Hout Bay, Noordhoek, Kommetjie and even the Muizenberg fish hoek area – where if they tried to develop today, we would have said flat-out absolutely no. You are too close to the sea. We now see that the insurance industry has become quite interested in such situations. There have been discussions with the insurance industry around building in risk areas."

"To apply this to fire, for areas far from the fire-prone wildland-urban interface. I live in Kenilworth, and the chances of fire are low. Whereas UCT, located near a fire-prone region, is at a much higher risk. Insurance has a greater chance of Paying out in these areas; they could be charged more."

Respondent 9 states: "if your house is destroyed and you want to rebuild on the same ground. Rebuilding all depends on the local municipal by-laws. Ten years ago, the building lines could have been one meter from the boundary line. Building lines could have changed with new by-laws, and today must be 2 meters from the boundary line. Suppose you take that big fire that happened in Knysna. It started on a farm. Some people built too deep into the Knysna Forest; they will not say now, you must cut all of the trees. This is not what insurers will do."

"The only time insurers will consult the natural environment is if the roof of the house is thatch or grass. They would say you need to ensure there are no trees or bushes close to 50 meters from it. You will need a fire extinguisher in each room, fire blankets

in the kitchen, and spark erectors in a fire or braai place chimney. You would also need to treat the thatch with chemical fire-resistant liquid. They would not be too hard on that if you have an all-structured roof."

5.5.1.1 Insurance and disaster management analysis

The local insurance industry is very much interested in sea level rise. This is an example of Insurance intervening in private property due to disaster risk. Respondent 3 urges the idea that the Insurance could be leveraged similarly to intervene in areas with high fire risk, such as WUI. Smith and et al (2018) state: "it is a common practice of using insurance and external subsidies (disaster relief) to rebuild back to the pre-disaster state continually; treating the symptoms, without addressing underlying fire sensitive causes."

This is an essential point, as respondent 9, an insurance broker, notes that the insurance industry analyses local by-laws well. In the case of rebuilding on disaster-compromised land – the rebuilding needs to take place per by-laws. Spatial planners have the power to create non-flammable barriers between structures and wildlands and design landscapes that incorporate parks, water features, golf courses and gardens as community fire breaks (Smith & et al, 2018). This is a crucial finding for the research project interventitive chapter.

Respondent 9 notes that insurers rarely consult the surrounding environment unless the roof of an urban structure is thatch. This is a significant limitation if insurers intervene and bypass development rights on private property to mitigate fire risk, where spatial planning cannot.

5.5.2 Local wildfire risk and Insurance premiums

Respondent 6 states: "the main challenges of urbanisation leading to encroachment on the edges, like at UCT. The fire industry does not care. They do not care that there is high risk because it is close to the wildland-urban interface. Fire engineers are pressured by the client and architect for the value of money. Ultimately, we design fire mitigation in houses, buildings and businesses to the minimum requirement required by the municipality. The insurance industry can come in and ask for more fire mitigation installations. But in my experience, they are usually happy because they do not see

the Western Cape as a big fire hazard. They might see it as one in-30-year event, and the risk is worth it for them."

Respondent 9 states: "If the Western Cape had more frequent fires, or at least once a year – then insurers can say no, we are not insuring or covering anything near a veld or wildland. In 2004, a big tsunami hit Thailand, India and Sir Lanka. At the time, I was at a broking firm. We had a building facility that AIG underwrote. AIG is one of the big insurers worldwide. After the Tsunami hit. NEW York AIG sent emails to all their offices worldwide. Over 100 branches, with immediate effect, if you are insuring any buildings on the coast, within 30 days, all got notices. This meant no cover for any buildings within 1km of coasts because this is a high-risk tsunami zone."

"If you live close to the game farms and nature, like in Table Mountain. In an ideal world, insurers would like higher premium structures for those wildfire risks. However, nowadays, the insurance industry is so competitive that everyone looks at the bottom dollar. The insurance industry sits at the cusp of intervening between existing properties and higher premiums because you could lose clients. Clients should be warned if risks unfold. The insurance industry blows hot and cold when it comes to premiums. Outsurance, have a big drive in this. When they started, they cut premiums by 50% to 60%. It is cut-throat to get a foot in the market."

5.5.2.1 Local wildfire risk and Insurance premiums analysis

Respondents 6 and 9 note that in the local context, wildfire disaster is not nearly as common for the insurance industry to react. Respondent 9 notes that Insurance will give notice in severe circumstances, like tsunamis disasters. As for wildfire, the risk is deemed worth it within the Western Cape.

The other thoughts on higher premiums for at-risk regions have a significant shortcoming, as the market in South Africa is too competitive. The insurance industry is balancing premiums with other insurance companies. They must be competitive in price and coverage for fire at-risk homes. By doing that, insurers are trying to keep as many clients as possible and will deem at risk properties worth the risk.

5.5.3 Conclusion

The insurance industry as a tool for fire mitigation promotion in at-risk regions, where spatial planning has no right to go – is not as viable an option within the local context of the Western Cape. Too many shortcomings present themselves as the insurance

industry deals with aggressive competition. It deems the Western Cape worth fire risk and rarely consults the outside environment on inspection (alien vegetation and fuel load). There is a significant finding that the research project ought to focus on by-law change, as although spatial planning only has leverage in intervening in new developments; also, post-disaster, when private homeowners aim to rebuild, if the by-law is updated, they would have to build to a specification of the new by-law. *See figure 60.*

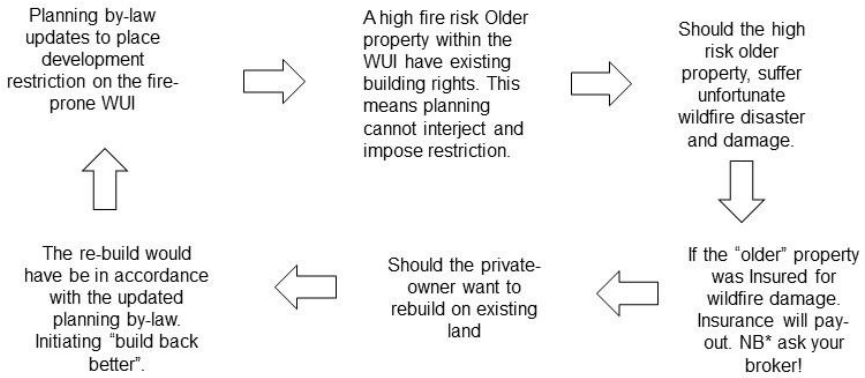


Figure 60: The process showing why focusing on by-law is paramount in the fight for a sustainable fire resilient WUI (Author, 2022).

6. Recommendations and Interventions

6.1 Introduction

The research was conducted to provide recommendations and spatial interventions for the City of Cape Town (CoCT) population residing within the wildland and urban interface (WUI) – that could mitigate wildfire risk, saving lives and properties from associated destruction. The research project started with a literature review of the current debates and critical revolutionary viewpoints within spatial planning, wildfire disaster management and climate change. Furthermore, the review findings (which inform this recommendation and intervention chapter) were inspired by theory and grounded in analysis from: "best practice" precedents in Victoria and California and local contexts on spatial planning enabling wildfire mitigation for at-risk regions. The research project used both primary and secondary data sources as a basis for this current interventitive chapter.

The secondary data through the literature review investigated wildfire mitigation techniques within the fire-prone WUI from a local perspective – local regulation and policy analysis. Further, policy and regulation from "best practice" regions Victoria and California were investigated – specifically on how they leveraged spatial planning to increase wildfire resilience within their fire-prone WUI regions. Climate change and its role in wildfire disaster exacerbation, locally and internationally, was investigated. Lastly, investigated was the extent to which spatial planning could become a core aspect of disaster management – to increase overall wildfire resilience for at-risk communities residing in the fire-prone WUI. This process was qualitative at heart. The findings from this process above form part of the basis for this current interventitive chapter.

The primary data was obtained through several semi-structured interviews with relevant role-players and professionals (respondents) within the wildfire, insurance and spatial planning sphere. These respondents worked across various institutions across the Western Cape, public and private. The previous findings and analysis chapter reflected these respondents' thoughts and viewpoints. The chapter represented the respondents thoughts on climate change and wildfire exacerbation, as well as misconceptions about the two concepts. Secondly, the respondents views on local wildfire and spatial planning regulation and policy; procedural shortcomings

and pathways for fire mitigation within the fire-prone WUI. Thirdly, the state of institutional collaboration between spatial planning and disaster management within the Western Cape. Lastly, the insurance industry's role in increasing wildfire mitigation on private land within the WUI. All the above respondents thoughts and views on the subject matter were compared and contrasted to the findings from the literature review as a means to analyse. These corroborated and analysed findings from the previous chapter is used as a basis for this interventitive chapter.

The primary and secondary data analyses revealed several findings of paramount importance to the current interventitive chapter – *see figure 61*. The findings serve to inform the upcoming proposed interventions and recommendations:

Key Finding	Theme	Data source	Issues to be addressed
In the context of climate change, spatial planning has to become a core aspect of wildfire disaster management – more focus needs to be placed on how urban structures are constructed within the fire-prone wildland-urban interface.	Wildfire regulatory and planning procedure	Primary and secondary	How spatial planning can be interjected into the wildfire disaster management situation within the fire-prone WUI to increase overall wildfire resilience for those at-risk communities.
Wildfire disaster management has an overreliance on suppression. Hence, wildfire disaster management must rely similarly on prevention techniques to increase overall wildfire resilience for fire-prone communities within the WUI.	Climate change and wildfire disaster	Primary and secondary	More firefighters and more fire-suppressive technology are not the solutions; emphasis must be placed on prevention, alien clearing, and personal property management, such as removing dead shrubs and planting local fire-resistant plants.
There is a significant difference between normal wildfire and extreme wildfire weather events. The latter is exponentially difficult to deal with due to ember storms or firebrands, which render many firefighting efforts and traditional fire	Climate change and wildfire disaster	Primary and secondary	Spatial planners need to understand the difference between normal wildfire and wildfire anomalies and how urban structures and properties within the fire-prone WUI can be hardened and defended from ember storms.

mitigation, such as fire breaks, redundant.			
The biggest impediment between wildfire disaster management and spatial planning collaboration; is the differing goals, ideals and objectives.	Institutional collaboration	Primary and secondary	How can utilising "intelligence" like the Council for Scientific Industrial Research (CSIR) bridge the gap between perceived polar disciplines.
Insurance is not as adequate as perceived in increasing wildfire resilience within private residences within the fire-prone WUI; due to the competitive market and local insurance not deeming wildfire within the City of Cape Town high enough risk. However, post-disaster, if private land owner aims to rebuild – they are to abide by the by-law.	Insurance industry	Primary and Secondary	How CCT can realise a resilient city through updating and amending by-laws – to do away with rebuilding and promote "build back better" post-wildfire disaster.
Overall, wildfire disaster resilience cannot be achieved without the unwavering support of affected communities.	Wildfire regulatory and planning procedure	Secondary	Public input and involvement are paramount to realising overall wildfire resilience for the CCT.

Figure 61: A table showcasing the corroborated key findings from the review and respondent data collection (Author, 2022).

This section starts with the proposal of a local veld and forest fire management overlay zone explicitly dedicated to wildfires within the WUI or edges. This means demarcating the extremity of the wildland wildfire issue spatially. The areas under the proposed veld and forest fire management overlay zone are deemed a high fire risk for nearby communities and properties; development guidelines and restrictions will be accompanied and employed accordingly.

Amending the current provincial zoning scheme overlay zones was unanimously supported by most of the respondents (1, 2, 3, 4, 5, 6, 7 and 8). A planner respondent 2 states: "certainly, this is something that can be explored. An additional overlay, which then also has additional development considerations. That would cascade down into your development with an identified disaster management zone; you need to ensure that the following additional requirements are adhered to from a development perspective. Here is where we start to get into the practicality of things, where you start talking about appropriate fire breaks, personal vegetation and alien clearing on personal property."

The Western Cape provincial zoning scheme chapter 16(i) notes that overlay zones can increase flexibility and provide an opportunity for special circumstances and local conditions. Furthermore, chapter 16(ii) notes that overlay zones can result in more restrictive parameters applicable to a property. This current research project chapter will evoke this section of the provincial zoning scheme and recommend an amendment toward a veld and forest fire management overlay.

Spatial planning and associated tools can materialise the cross-contextual paradigm shift within disaster management, moving the focus from suppression to prevention and building back better post-disaster. Rebuilding to pre-disaster specifications is an unsustainable practice. This amendment toward a veld fire overlay is an example of how spatial planning and disaster management can collaborate to find "new knowledges" to cater to the unprecedented disasters that occur in the wake of climate change. This collaboratory effort between disciplines significantly can reduce wildfire risk for communities within the fire-prone WUI – Victoria and California are testaments to the previously mentioned sentiments. Since the dawn of democracy, South Africa has allocated considerable resources toward developing stringent large-scale public participation requirements. The provincial zoning scheme is a testament to this, as the opinion of land and property owners on proposed regulatory amendments is a paramount and necessary requirement. Without the property owners' support and approval, the veld and forest fire management overlay is less likely to mitigate wildfires effectively within the fire-prone WUI. Finally, this section will reflect on the research process, state limitations and discuss ways in which research could be taken further in the hopes of further developing the ideas in different provinces and contexts.

6.2 Intervention table for University of Cape Town and Spanish Farm, Somerset West – *see figure 62, 63, 64, 65, 66, 67 and 68.*

Map #	Title	Intervention type	Aim		Description	Location/Scale	Timeframe	Responsible Role-players
	A Western Cape Veld/forest fire management overlay zone	Regulatory	Intervene in new developments. Intervene in post-disaster properties, encouraging "build back better" toward a fire-safe means. Save community lives and protect property within the fire-prone WUI.		The Western Cape veld/forest fire management overlay zone is a planning tool demarcating high fire risk and fire-prone regions/WUI. Development restrictions and guidelines will be imposed upon set property and land if a property or land falls under the Western Cape veld/forest fire overlay zone.	Potentially regional scale. For this research project, two sites were selected (Spanish Farm, Somerset West and UCT)	Medium-term 1-5 years	City of Cape Town municipality (CCT), Western Cape Government (WCG) Spatial Planners, disaster management officials, Working on Fire, community leaders/members.
1	Managing urban and property design and storage of flammable materials	Enforcement and Engineering (CoCT, 2019)	Decrease structural fire risk, hardening properties to limit fire spread. The upper-scale urban layout needs to be clustered, meaning defensible, not scattered, increasing the fire risk during construction, using fire-resistant materials – rebuilding or newly developing.		On the upper scale, a clustered physical layout of the urban landscape. Managing personal property in design (firewalls, fire doors, fireproof roof, steel gutters, covering holes, sealing garage doors and windows). Then, use less-flammable materials during construction: no thatch roofs, flammable paint, asbestos roofs, gas storage, and firewood storage.	Each property that falls under the veld and forest fire management overlay zone	Long term >5 years or more for existing developments (as they have older development rights). Medium-term 1-5 years for new developments	Landowners for private property. CCT and WCG for public space and property.
2	Managing fuel loads and gardens	Enforcement and Engineering (CoCT, 2019)	Limiting the spread of wildfire to the property to increase safety.		Removing alien vegetation. Garden designing by planting fire-resistant shrubs and utilising an interval canopy.	All land and property that fall under the veld and forest fire management overlay zone	Medium-term 1-5 years	Private land and property owners. CCT and WCG for public property, space and land.
3	Fire breaks	Enforcement (CoCT, 2019)	Limit the spread of wildfire.		A barrier of cleared or ploughed land that checks or slows a forest or grass wildfire.	All roads cleared land, dams and paths that fall under the veld and forest fire management overlay zone	Short term 1-3	Private land and property owners. CCT and WCG for public property, space and land.
4	Fire safety signage, awareness and evacuation	Education (CoCT, 2019).	Passive education on fire safety and ember storms, fire types, weather indicators on what to look out for and awareness as emergency numbers to contact in case of wildfire.		Knowledge of how the correct phone numbers to use, ways that one could defend property against an ember storm (mop and water techniques), explain the "stay and defend or go" policy and knowledge on different types of wildfire and the weather warnings or indicators to look out for.	Identified areas that fall under the veld and forest fire management overlay zone	Short term 1-3 years	CCT and WCG. Radio, Television and social media.
5	Slope	Engineering and education (CoCT, 2019).	Slope control is essential in decreasing wildfire ferocity.		Awareness: new developments to be aware of the effects of increased slope on wildfire ferocity and speed. The higher/steeper one develops into the WUI, and the more vulnerable the properties are to wildfire disasters.	Identified areas that fall under the veld and forest fire management overlay zone	For new developments, 1-5 years.	Both private developers, CCT and WCG.

Map #	Title	Intervention type	Aim		Description	Location/Scale	Timeframe	Responsible Role-players
6	Access roads	Engineering (CoCT, 2019).	Increase access to emergency vehicles.		With increased slope, many emergency vehicles cannot turn around on the small roads without getting stuck and becoming vulnerable to fast-approaching wildfire, risking firefighter and community lives and equipment. Ensure that roads are wide enough for these emergency vehicles to access fire-compromised properties.	The areas that fall under the veld and forest fire management overlay zone	1-5 years for new developments. >5 years or more for existing developments	Private developers and CCT and WCG.
7	Water supplies and fire hydrants	Engineering (CoCT, 2019).	Increase access to water to increase defensible capability.		Increased access to fire hydrants and consistent water pressure is critical in fighting wildfire in the currently steep and difficult-to-access WUI. More hydrants in "difficult-to-access regions" can go a long way in assisting in wildfire risk reduction.	The areas that fall under the veld and forest fire management overlay zone (on every dead-end and cul-de-sac)	>5 years or more	CCT and WCG, civil engineering issue.
8	Unattended houses	Education (CoCT, 2019)	Awareness of active defending of property		Small fires that embers start/ignite can easily be put out with water and a mop. Whereas if homes are unattended, these smaller fires eventually can be reasonable for the destruction of a property.	Awareness community-wide	Short-term <1 year	Private community members and public officials have more than one property in the wild and urban interface.
N/A	Monitor weather cycles and the Council for Scientific and Industrial Research fire severity maps	Education (CoCT, 2019)	Emergency preparedness and collaborative avenues		Assist in bridging the gap between community, disaster risk management officials and urban planners, utilising tools and platforms from which all entities within the realms of disaster management, planning and community within the wildland-urban interface can benefit.	Nationwide	Short term one year	Universities, communities, CCT and WCG Firefighters and disaster management officials.
N/A	Insurance industry	Emergency preparedness and education (CoCT, 2019)	Education on the insurance procedure, so the community is prepared for the long strenuous road ahead if an emergency strikes.		Ensuring that property owners residing within the fire-prone wild and urban interface see their insurance broker to make sure they have obtained wildfire coverage, as this is a real issue and stalled "pay-outs" are common – leaving communities members feeling helpless and adding trauma after homes and memories were lost in the blaze.	Communities within the wildland-urban interface (whether developed or non-developed).	1-year short-term to see your broker and ensure you are covered for wildfire risk.	Community members and the insurance industry.

Figure 62: Areas of intervention table for University of Cape Town and Spanish farm.

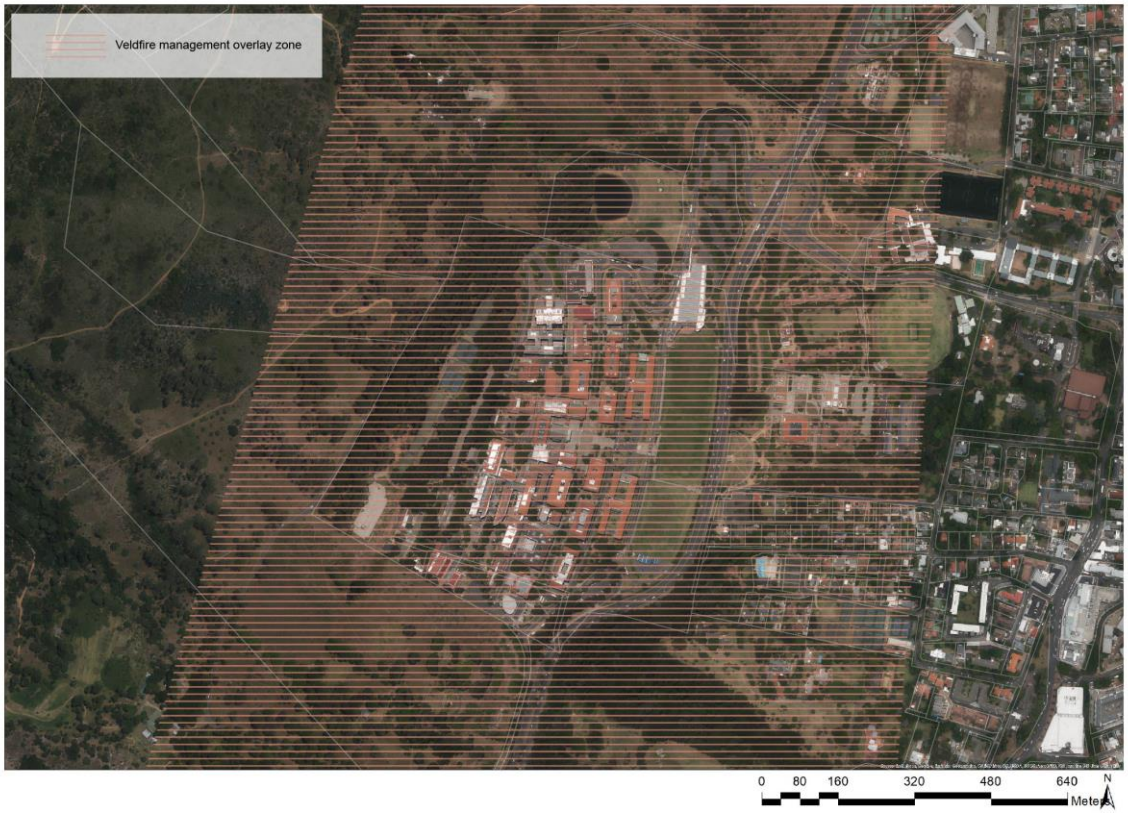


Figure 63: Proposed Veld and forest fire overlay zone UCT (Author, 2022).

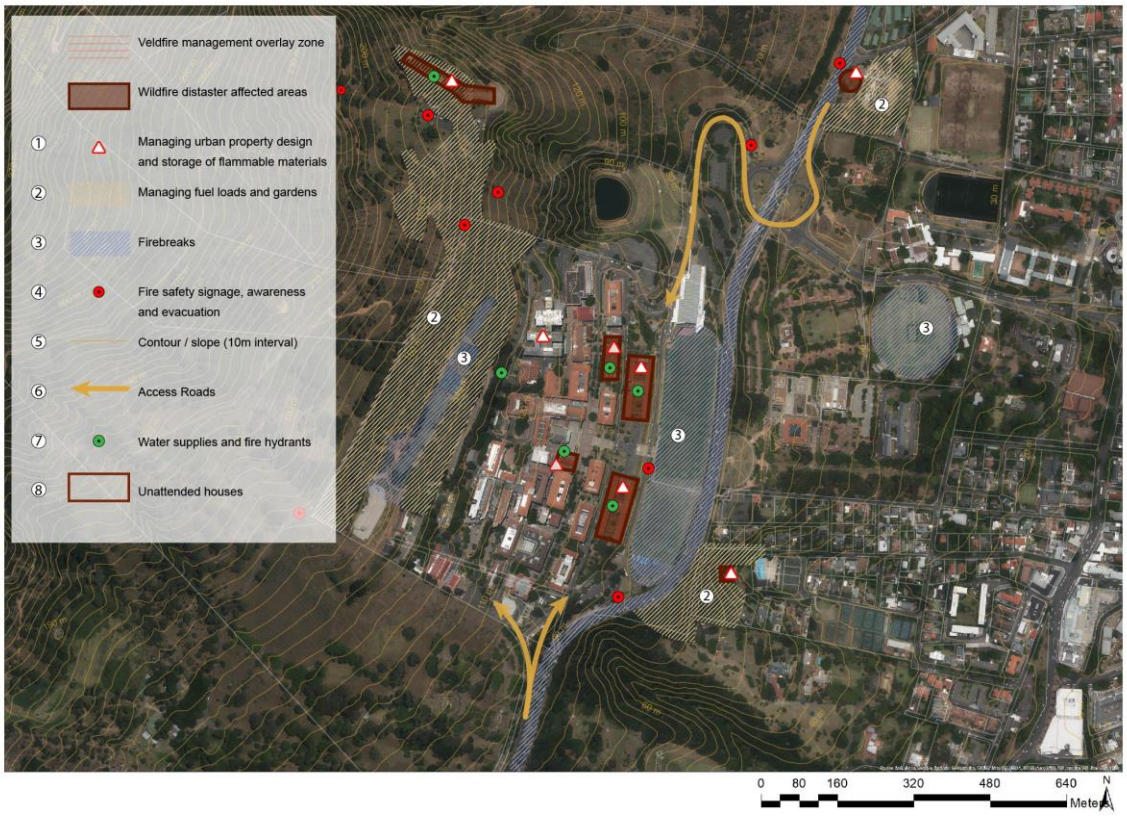


Figure 64: Proposed Interventions UCT (Author, 2022).

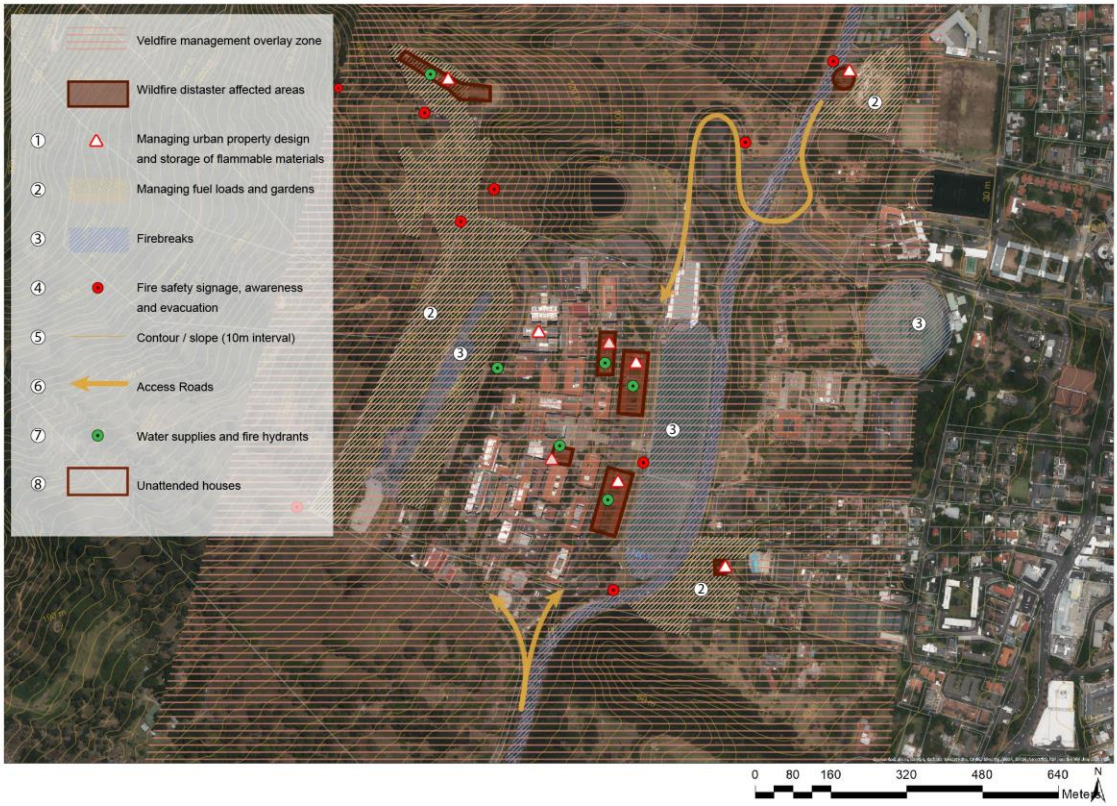


Figure 65: Combined overlay zone and interventions UCT (Author, 2022).

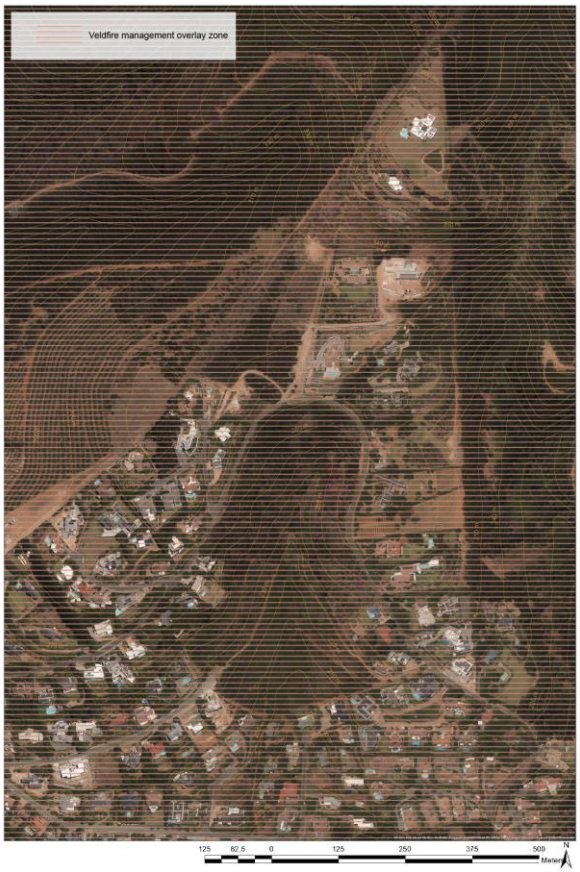


Figure 66: Proposed Veld and forest fire overlay zone Spanish Farm (Author, 2022).

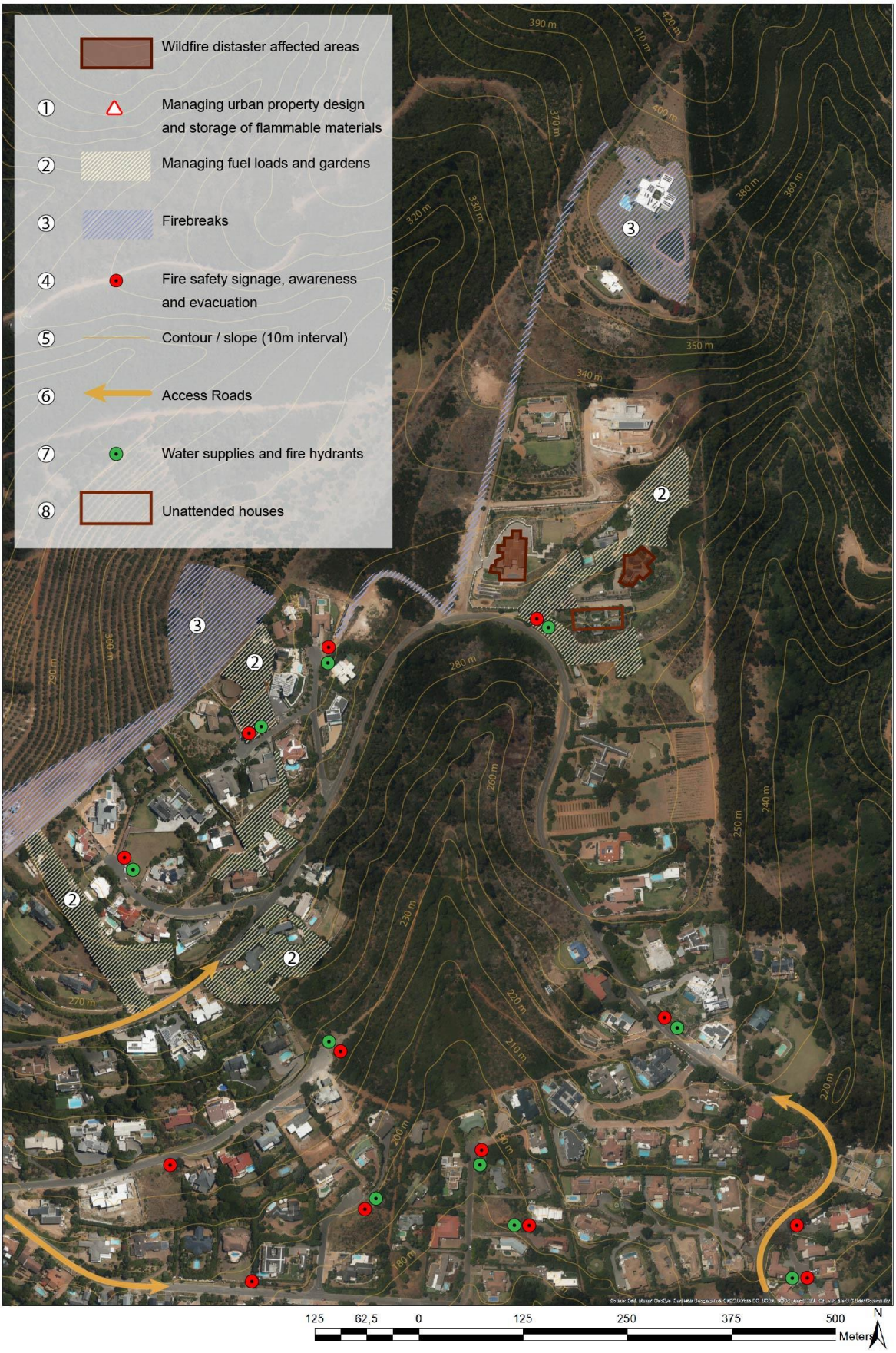


Figure 67: Proposed interventions Spanish farm (Author, 2022).

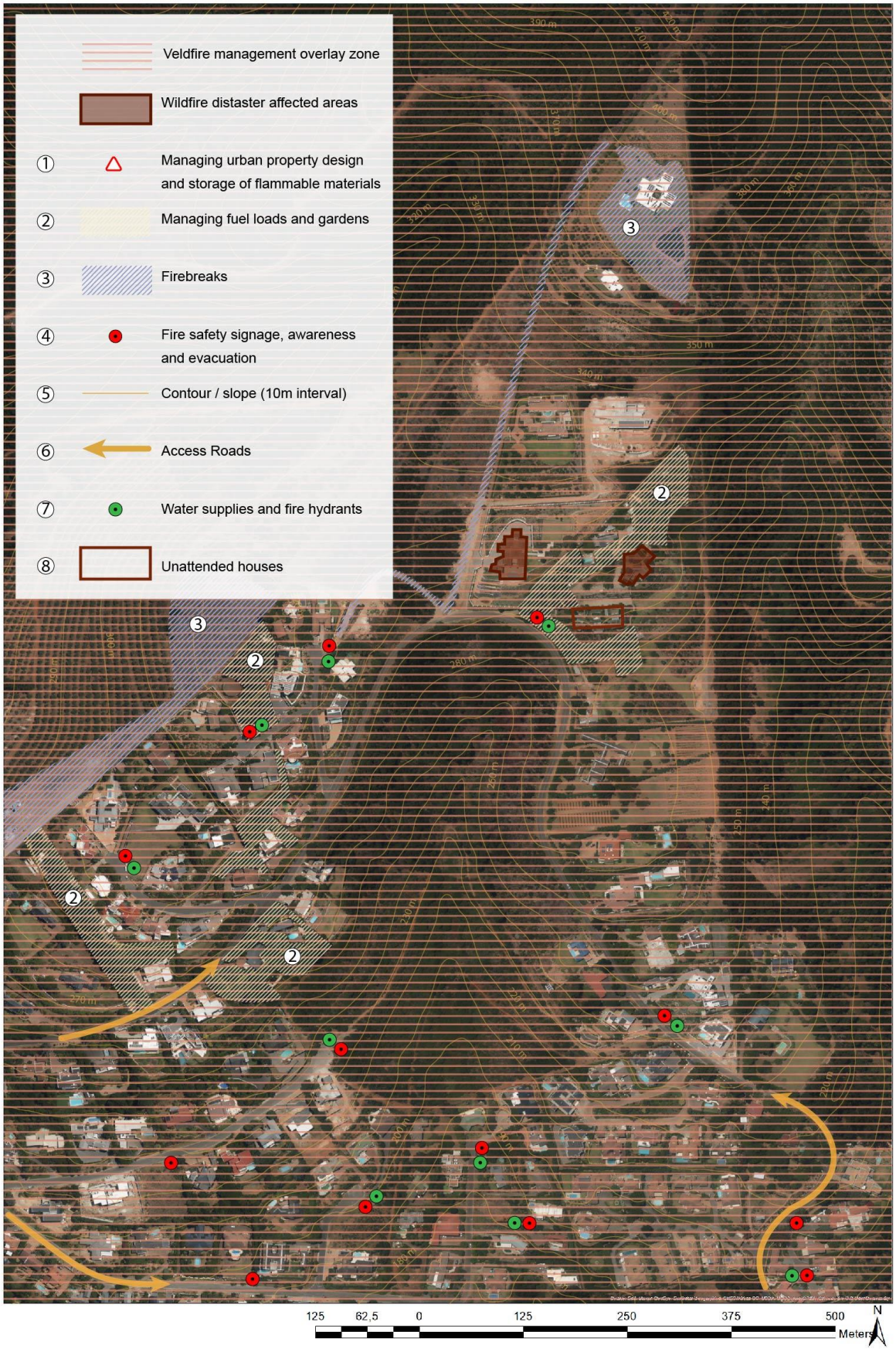


Figure 68: Combined overlay zone and interventions Spanish Farm (Author, 2022).

6.2.1 Veld and forest fire management overlay zone

The process of adopting or amending an overlay zone according to the Western Cape zoning scheme:

Municipal managers must according to chapter 3 subsection (3.9.1(a)) of the provincial zoning scheme, the proposed overlay zone needs to be advertised per the public consultation policy, allowing interested parties to submit written comments or objections to the municipal manager within not less than thirty days of the date of such an advertisement (WCG, 2004).

The provincial zoning schemes Chapter 3 subsection (3.9.1(b)) is the opinion of any public institution in which their opinion has an interest in the overlay zone concerned. In this case, the veld and forest fire management overlay zone (WCG, 2004).

The provincial zoning schemes Chapter 3 subsection (3.9.1(c)), the proposed overlay zone or amendment, and all relevant documentation should be submitted to the council for consideration and a decision. Subsection (3.9.1(d)(e)) must notify all persons who submitted comments relating to the adoption or amendment of the overlay zone within the prescribed period of the council's decision and make known the adoption or amendment of an overlay zone by the publication of a notice in the press, confirming at which municipal office the overlay zone may be inspected by interested parties (WCG, 2004). According to chapter 2 subsection (2.6.2), the prescribed period is 120 days (WCG, 2004).

Chapter 3 subsection 3.9.2 states that: "the council must review an overlay zone at least every five years from the date of adoption of that overlay zone." This is essential so that a potential veld/forest management overlay validity can regularly be investigated and potentially be improved upon is necessary. Public opinion thus justifies the overlay because without the support of the community validity of regulation such as this is not reached.

The inspiration for the Western Cape veld and forest fire management overlay zone comes from the revolutionary planning regulation in Victoria, Australia (bush fire management overlay zone) launched in 2011. The Western Cape veld and forest fire management overlay zone is to be used as a tool to demarcate areas of fire risk on the WUI. If property or land falls under the Western Cape veld and forest fire overlay zone, development restrictions and guidelines will be imposed upon set property and

land. It is important to note that these guidelines and restrictions cannot interfere with private property due to development rights that have been imposed. However, post-disaster – if property or land owners aim to redevelop, the site will be deemed undevelopable. Thus to deem the site developable again, the proposed updated by-laws that promote fire mitigation below would have to be adhered to by the property and land owners:

6.2.1.1 Manage urban/property design and storage of flammable materials

Of paramount importance is to decrease building vulnerability under the veld and forest fire management overlay zone. Respondent 7 states: "what cannot burn will not burn down." A more significant theme throughout the research project is the emphasis on moving away from suppression (the over-reliance on firefighting equipment/technology) towards prevention (focus on house design and construction and vegetation clearing/management). These above calls are agreed upon by various respondents (2, 3, 4, 5, 6, 7 and 8). Respondent 8 states: "more responsibility needs to be placed on planning and the way structures are constructed."

The veld and forest fire overlay zone promotes a clustered urban/built environment layout that enables defensible space between the house and flammable vegetation. This is likely to occur in a new development where spatial planning has jurisdiction and significant influence. Houses in cul-de-sacs within the fire-prone WUI should provide sufficient turnaround areas so that fire engines and teams can turn around, and roads should have sufficient gradient and width to allow easy access and decrease the risk of entrapment.

The veld and forest fire overlay zone prohibits the use of plastic gutters, combustible external walls, timber decking and thatch roofs. Thatch roofs should have sprinklers or a fire-resistant spray covering. Similarly, storing highly inflammable materials on premises is strongly advised against. Storage sheds (Wendy houses) or wood stored near property boundaries. The storage of paints, fuels and cleaning liquids in large quantities is strongly advised against. Lastly, inflammable materials on roof leaves and organic materials caught in gutters can create definite risks. Burning embers rain down all over unpredictably and will find any compromised or flammable material. Wooden

fencing treated with creosote burns profusely once ignited within the fire-prone WUI; no such fencing should be permitted (CoCT, 2004). *See figure 69, 70 and 71.*

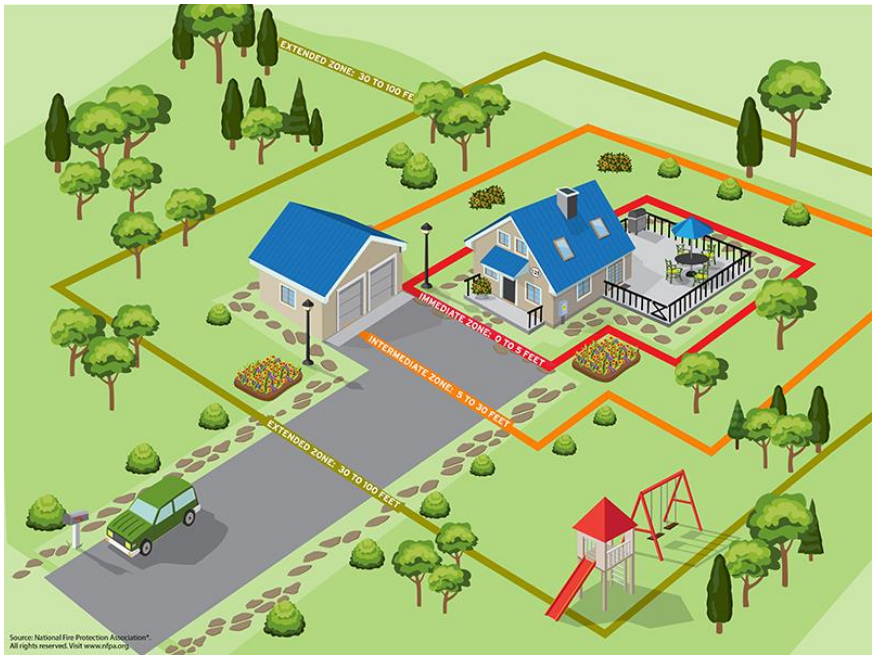


Figure 69: the concept of the figure is that wildfire risk reduction should be carried out in the immediate zone (the property and 2-3 meters around it). 2 to 10 meters additionally requirements in this "intermediate zone" should be carried out. The "extended zone" (10 to 20meters) is ensures excellent chances of wildfire disaster survival (Walls & et al, 2019; NFPA, 2018). However, note that home fire safety is paramount roofs, gutters, chimneys, eaves, vents, windows, doors, decks, walls and location. Garden and access safety is paramount, which will be discussed later (Walls & et al, 2019; NFPA, 2018).

Figure 70: A home that is wildfire resistant, due to non-combustible materials used, steel gutters, sealed doors and windows, doors decks chimneys (Howell, 2020).

Figure 71: A home with a sprinkler system to stop burning embers (Terramatrix, 2020).

Promoted under the fire management overlay will be sealing of doors or garage doors, shuttering windows and closing windows. Furthermore, depending on the budget, sprinklers on roofs, firewalls and doors, fireproof roofs, and steel gutters can decrease fire risk significantly (CoCT, 2004).

6.2.1.2 Manage fuel loads and design fire-safe gardens

Respondent 7 states: "you should focus on what you can control; this is the best way to deal with wildfire disasters and anomalies." A veld and forest fire management overlay prioritises the management of fuel loads as it is one of the most effective

manners to reduce wildfire risk for fire-prone WUI and its residents. Alien vegetation clearing on public land as these plants carry greater biomass than natural fynbos, changing the fire regime toward the severe and of the spectrum (Mukheibir & Ziervogel, 2007; Lall & Mathibela, 2016). *Figure 72 and 73.*

Figure 72: Alien vegetation burning at UCT (Keeton, 2021).

Figure 73: Alien vegetation removal (WWF, 2021).

Furthermore, private residents can design their gardens for fire protection, upholding defensible space principles. Avoid and remove flammable shrubs and dead leaves. Additionally, plants can be a barrier to screen radiant heat and intercept burning embers. Lastly, trees can be spaced in intervals to avoid a continuous canopy which can increase wildfire risk and spread (CoCT, 2004). see *Figure 74 and 75.*

Figure 74: Local Fire resistant plant types that can save a home, from a wildfire ember attack: (1) Gazania; (2) Cliffortia Ferruginea; (3) Vygies; (4) Arctotis; and (5) Aloe brevifolia (Cape Point, 2022; WCG, 2019; Author, 2022).

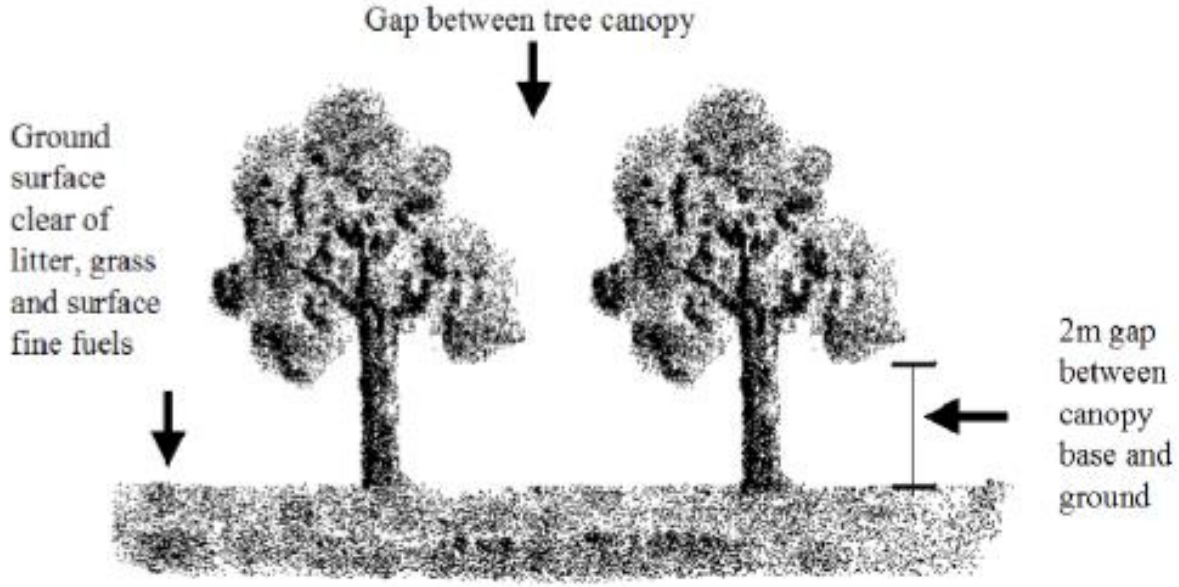


Figure 75: an interval canopy to impede an oncoming wildfire and increase fire safety (CoCT, 2004:7).

6.2.1.3 Clearing fire breaks

Respondents 5, 6, 7 and 8 agree that policymakers, officials and spatial planners over-rely on fire breaks. The National Veld and Forest fire act 101 of 1998 stipulated the consequences of not maintaining a fire break on private property or land in a rural area. If you fail to maintain a wildfire due to not maintaining a fire break, and it spreads onto a neighbour's land, then you and everyone else allowing the spread are liable in a court of law. Firebreaks are effective in slowing down normal wildfires. However, they have become redundant for wildfire anomalies/extreme weather events as a fire mitigation mechanism. *See figure 76.*

Figure 76: Maintaining a fire break, by clearing the vegetation growth, through a prescribed burn (Husqvarna SA, 2022).

Respondent 7 states: "you could have a 50meter fire break, but when conditions are ripe: low humidity, adequate fuel load or alien infestation, wind speed over 30km/h and temperature over 30 Degrees Celsius – it will not matter much." Wildfire anomalies generate their own weather system and wind, producing an ember storm: where burning embers and pieces of timber randomly rain down hundreds of meters, even kilometres away, on a nearby community, within a WUI. Urban structures rarely burn down from direct contact with the heat source/fire crown. They burn from spot fires caused by these embers, which start small fires in compromised property, eventually burning the house down. Hence the calls for more focus on defensible urban structures and properties.

Nonetheless, when properly maintained, firebreaks remain very useful in preventing (oblique) slower-moving fire events within the WUI. The veld and forest fire management overlay zone prohibits poorly maintained fire breaks because this allows a wildfire to be carried across into adjacent areas easily.

6.2.1.4 Fire safety signage, awareness and evacuation

Respondents 5, 6 and 7 acknowledge that WUI communities lack knowledge about what to do during a wildfire emergency, fuel load management techniques, relevant emergency numbers to contact and how to harden your house to stop burning embers from destroying your home. This is noted as a rampant issue for disaster management officials. The veld and forest fire management overlay zone promotes permanent fire safety information signage to be installed in the urban and wildland areas deemed high risk for wildfire. *See Figure 77.*

Figure 77: Cape Peninsula Fire Protection Association Fire signage outside Rhodes memorial (CPFPA, 2022).

Due to South Africa's multicultural landscape, different languages should be provided. This should be placed in communal areas and walkways (for example, popular walkways in the forest and veld). Where possible, public awareness can be implemented using social media, radio, print media and brochures

.

Preservation of life is of utmost importance; once a fire is within (200m to 300m), generally, it is too late to leave. In evacuation issues, as seen in Victoria, Australia and California, stay and defend or go confusion can lead to loss of life. Thus, in such circumstances, the properties and homes should have the necessary measures and means in place, mentioned throughout this section, to give themselves and their property the best chance to resist wildfire disasters.

6.2.1.5 Slope control

The veld and forest fire management overlay zone acknowledges slope and its effects on wildfire severity – each 10% increase in slope doubles the speed of a wildfire. So as the sites and properties on the hillside might have scenic views, owners should not

assume they are vulnerable to wildfire, especially when high fuel loads are present (CoCT, 2004). *See figure 78, 79 and 80.*

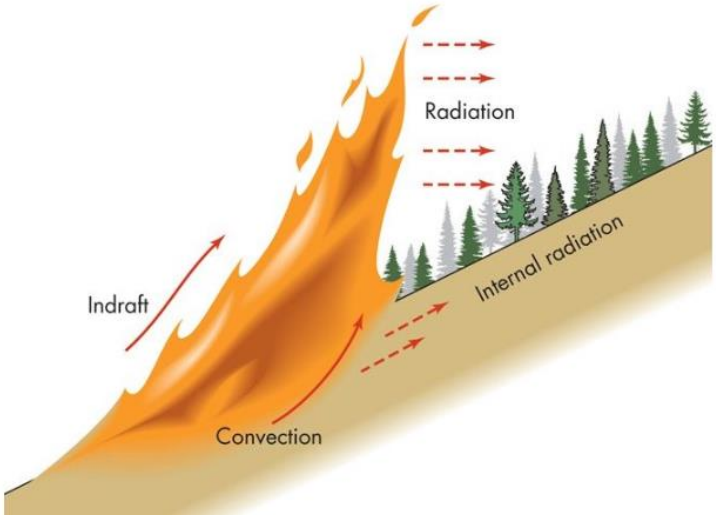


Figure 78: Diagram showcasing of fire slope exacerbates wildfire (Portugal Wildfires, 2018; CoCT, 2004).

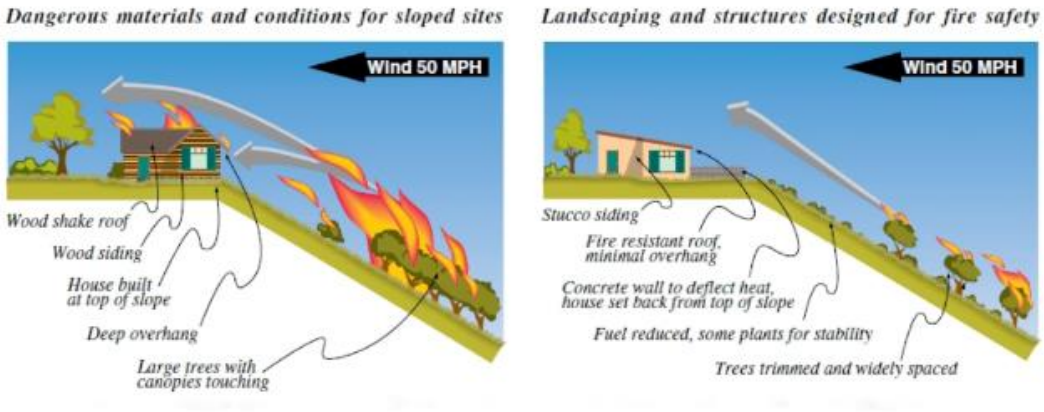


Figure 79: Diagrams showing how landscaping and preparation can mitigate wildfire (Portugal wildfires, 2018).

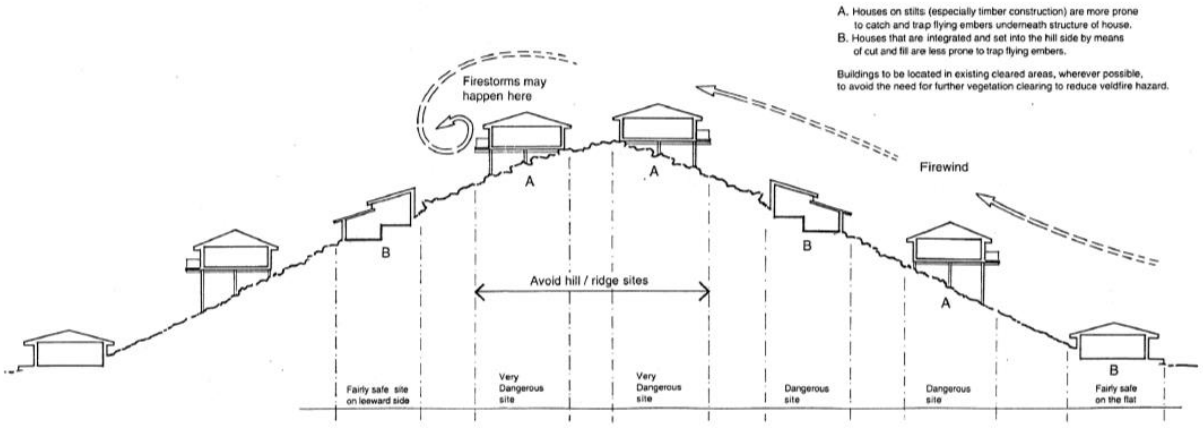


Figure 80: A diagram showing suitable safe places to develop and where properties are the most vulnerable (CoCT, 2004).

6.2.1.6 Access roads

The veld and forest fire management overlay zone acknowledges that high wildfire risk areas within the WUI are typically associated with steeper slopes and access roads that approach properties from below (CoCT, 2004). These properties are difficult to get to, and the roads are narrow and surrounded by thick and highly flammable vegetation. Furthermore, fire crews with fire engines cannot attend to fires in these conditions if they cannot turn the fire engine around, risking equipment and lives, as they could be trapped. A fire truck is 3.5 meters wide entrances should be wide enough to enter and exit; 4 meters tall, should be clear of branches and objects that would prevent access and 8 meters long (Walls & et al, 2019). *See figure 81 and 82.*

Figure 81: Showing fire truck that is designed for urban use, not suitable and too wide for the roads in the steep wild and urban interface (WUI) (Rice & Davis, 1991).

Figure 82: Fire engines and equipment is frequently lost due to wildfire, after getting stuck in narrow roads with no turnaround (Rice & Davis, 1991).

6.2.1.7 Water supplies and fire hydrants

The veld and forest fire management overlay zone identifies properties and future developments at risk of wildfire – promoting the use of a ring main for properties in these areas. This allows for suitable and reliable water pressure under conditions of heavy use. This is for new developments and is a civil engineering problem (CoCT, 2004).

Figure 83: Fire hydrant should be maintained for reliable pressure during wildfire disaster

Every day, water supplies become useless when critically needed for firefighting purposes. Water supplied with plastic water pipes is easily destroyed by wildfires when they come exposed to radiant heat and flame contact. It is strongly advised that these pipes be buried at least 30cm below ground to increase the reliability of critically needed water during a wildfire (CoCT, 2004). Fire hydrants should be provided at the end of all cul-de-sacs. *Figure 83.*

6.2.1.8 Unattended houses

As burning embers start small fires, residents can actively extinguish them. If the houses are unattended, those small fires can destroy the house. Taking lessons from international contexts Australia and California – it has been shown that unattended houses were more likely to be destroyed by fire than those actively defended (Fu, 2013; Hughes & Mercer, 2008; CoCT, 2004).

6.2.1.9 Monitoring weather cycles

Early weather cycle warnings can increase the chances for communities to mitigate wildfire risk – low humidity, 30 degrees Celsius, 30km per hour winds and fuel load. Council of Scientific Industrial Research (CSIR) fire severity can assist veld and forest fire management overlay zone in demarcating high-fire risk areas.

6.2.1.10 Insurance industry

Once the veld and forest fire management overlay zone is placed over an area deemed a high fire risk, further development restrictions and guidelines will be imposed on that specific location. It is important to note that existing properties, homes and land under private ownership have development rights by law. These older development rights and laws deem spatial planning overlay powers to interject through no good. For example, a private property owner can build a thatch roof house with current laws on the fire-prone wildland-urban interface. If the veld and forest fire management overlay is employed over new developments, that would not be permitted, as it increases vulnerability to wildfire. This is where the insurance industry is promoted to intervene, where planning cannot – increasing fire safety overall in those "hard to go" private at-risk places.

6.3 Study limitations

6.3.1 A fire management overlay alignment with current policy goals

The Western Cape provincial zoning scheme chapter 16(iii) states that in applying the zoning scheme, the council must keep the objectives of the by-law and any integrated development plan (IDP). Henceforth, an effective veld and forest fire management overlay zone should support the principles and ideals in the spatial development framework (SDF), by-laws, and IDP.

The CCT (2022) IDP calls still place a significant influence on suppression firefighting initiatives – volunteers, equipment and more firefighters. In contrast, the research project has shown that international best practice precedents and policy, local respondents, urge to place more emphasis on prevention, such as alien clearing and defensible urban structures. Respondent 5 states: "You can have the best firefighting equipment. In that extreme weather, it will not help."

The veld and forest fire management overlay supports the current goals and principles of the current City of Cape Town SDF (2018). Due to the further restriction it imposes on the urban edge, it inadvertently assists in stopping urban sprawl, and due to the associated fire mitigation measures it imposes on unsustainable houses and properties – it promotes "build back better"; therefore, sustainability is upheld. The SDF places significance on fire breaks and clear open spaces for fire management. The proposed veld and forest fire management overlay takes that a step further, bringing local policy on par with best practice scenarios. This will become ever-important as the population rise in the Western Cape threatens more profound developments into flammable Wildlands.

6.3.2 A fire management overlay zone and public participation

According to the Western Cape provincial scheme chapter 16(iv), before applying an overlay zone, the council must follow a transparent process through planning initiatives, rezoning procedures or resolutions in terms of this by-law (WCG, 2004). Thus, the launch of a veld and forest fire management overlay zone needs to be interrogated and approved via a collaborative process between the council, the community and the property.

In this study, respondents consisted of planners and disaster management officials. Community interviews would have been a great addition to seeing the viability of the

proposals herein. The most crucial opinion comes from the community because, without their approval, the interventions would likely not be possible. There are lessons to be learned in the Australian Victoria Bush fire management overlay, where private property owners took significant concern with an additional restriction on their privately owned homes (March & Kornakova, 2017). However transparent the bush fire management overlay has been in saving lives and properties, in this case, the people's voice is of utmost importance.

6.3.3 Veld and forest management overlay zone, feasibility and trade-offs

Amending and adding toward a regulation can be an expensive process. Regulation is only as good as what could be deemed affordable, as every municipality has an affordability budget. Higher rates have to be charged to increase the affordability budget, which can be an issue for rate-payers – no one wants to pay higher rates. Respondent 2 states: "spending more on fire risk mitigation regulation, a housing list can be implicated. Due to this regulatory amendment or adoption, 1000 people will not get houses. Now you have a trade-off. Planners are always in a juggling act with significant implications. The veld and forest fire management overlay zone needs to be financially viable if it is effective. Extensive public participation requires cost, running meetings. A finance viability study on the proposed overlay zone would have significantly benefited the possibility of adoption and amendment.

6.3.4 Cape Town, Victoria and California wildfire comparability

Although the CoCT shares a similar environmental context (Mediterranean climate and a prominent fire-prone WUI) to Victoria and California. The wildfires of the latter are substantially more deadly than those that commonly occur in the Western Cape. Loss of life from wildfire is not as common in Cape Town as in Victoria and California. This is mentioned by respondents 1 and 3 "cape town being more fire-safe and better off, than Australia and California contexts". However, this does not negate the responsibility planners have to look toward future sustainability.

Respondents 1 and 3 mentions in great detail the natural pressures they face when looking for new parcels of land to develop for public amenities, needs, schools, services, and hospitals. Respondent 2 states: "the wild urban interface will never stop being under threat of development as the needs and services of the people are ever-growing". Hence, for example, looking at the Helderberg region, respondent 5 states:

“there is nearly or more than 100km of wild urban land that is uncoded, meaning you cannot enforce fire design if the land has development rights and by-laws that ignore fire safety.” This means that, if densities permit and grow over time, Cape Town could be seeing wildfires at the same, or even greater magnitude, than those of California and Victoria. Hence the development of a veld and forest fire management overlay zone remains an essential addition to the long-term sustainability of the City of Cape Town.

6.3.5 Regulatory enforcement and corruption

Respondent 3 states: "guidelines are used as a best-case-scenario measure if you get 50% of the policy in a development is a win." Regulation should not be expected to solve 100% of the problems. This is not the expectation of the proposed veld and forest fire management overlay – as the reality on the ground is that even if the overlay could be represented in 20% of development, then positive steps have been taken to wildfire resilience. One step in the right direction is still in the right direction.

Respondents 6, 7 and 8 note that corruption and fraudulent officials are a real problem when effectively enforcing policy and regulation. Respondent 6 states: "buildings pass that should not; they go up before plans are finalised, developments, this despite laws and regulations." Respondent 7 states: "the police department is swamped with violent crimes, and they are not going to investigate someone for not upholding or clearing a firebreak." This is a significant limitation.

6.3.6 Development rights, private land and the insurance industry

Planning jurisdiction is severely limited when it comes to private property. This means that the veld and forest fire management overlay zone can freely take effect on public land and new developments but will not be as effective on private land.

The insurance industry was looked at as a potential measure to avert this issue, as the insurance jurisdiction can run into private land. Ideally, insurers could utilise the veld and forest fire management overly zone as a measure to enforce higher premiums or enforce fire mitigation techniques on private property in high-fire-risk areas. However, respondent 9 states: "the insurance market nowadays is so competitive. Everybody has got to look at the bottom dollar. Due to the competitive market and aggressive marketing (such as outsurance), they cut premiums by 50% to 60%. It is a cutthroat market to get a foot in the door." Thus if an insurer would have to abide by a potential veld and forest fire management overlay zone and set higher premiums or add fire mitigation restrictions because private clients are, for example, not abiding by fire safety regulations – private clients could quickly go to another insurer and be covered for cheaper. *See figure 84.*

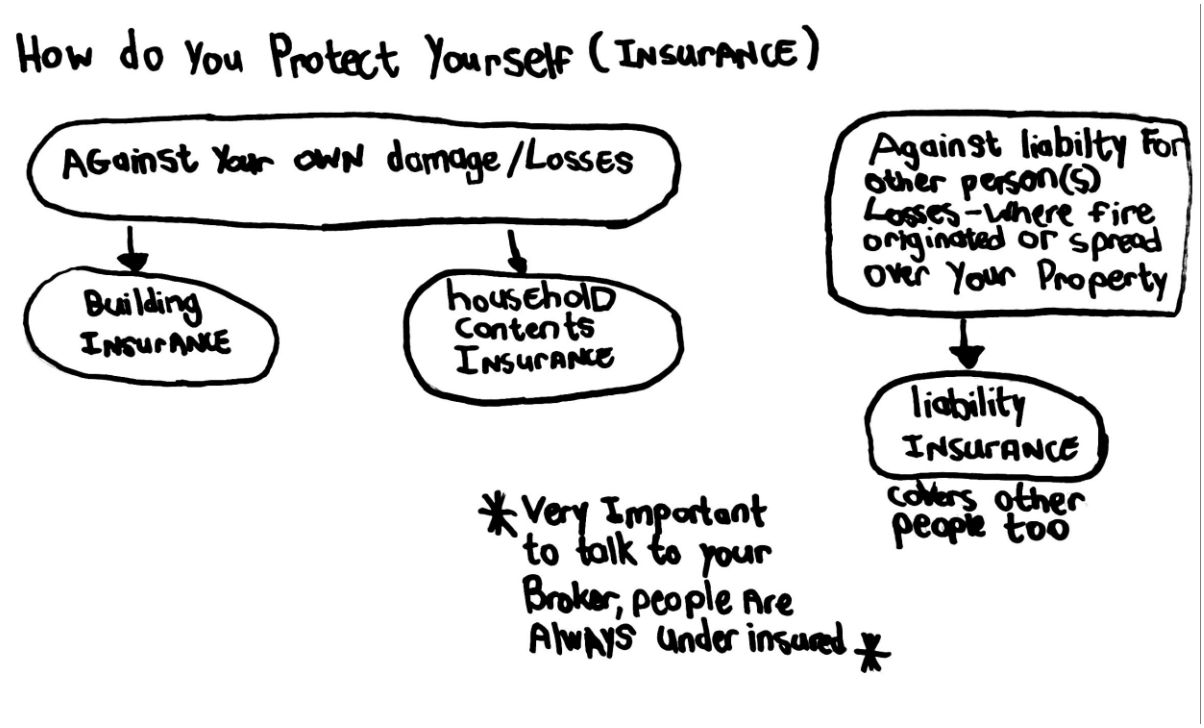


Figure 84: Private home owners within the fire-prone wild and urban interface should make sure that they are covered against wildfire damage because people are under insured. Speak to your broker.

Insurers are similarly not consulting the natural environment, usually the construction and inside. The veld and forest fire management overlay zone focuses on all the above (outside vegetation, construction, roads and more).

Furthermore, respondent 6 and 9 states: "the need needs to be great enough for intervention from the insurance industry." Currently, the City of Cape Town's wildfire severity is considered a situation under control amongst most respondents. However, it is essential to note that in the future, as development pressures and population needs become significant enough and more buildings and properties go into the fire-prone wildland and urban interface – the veld and forest fire management overlay could become of utmost importance.

Lastly, an update of the by-law is an addition to the western cape provincial zoning scheme (adding veld and forest fire management overlay zone). If a wildfire disaster were to strike property or home whilst the by-law is operative – the rebuilding process of set property or home or building would have to be built according to the above fire-safe precautions to avert future disaster, achieving "build back better".

6.4 Reflections and further work needed

6.4.1 Covid-19 and the lack of public participation

One of the biggest challenges I faced during 2021 was the extensive lockdowns and policy of social distancing and masks. Many of the respondents I interviewed were officials and professionals who worked in and around planning, disaster risk management, wild and urban fire specialists and the insurance industry. Most of them were used to conducting there day to day activities at home, hence were equipped to do an online meeting/interview. Even signing the ethics forms was not an issue, as many participants had access to the tools to ensure electronic signatures.

One of the most significant drawbacks is that due to the Covid-19 regulations of the time, many WUI community members either did not have the time, were unwilling or were not equipped as officials to do an online meeting. Due to the veld and forest fire management overlay zone suggestion, being so dependent on the community and community involvement, and due to the principles of public participation being central by law, in the adoption or formulation of an overlay zone – gathering the communities thoughts and opinions on such an intervention, would have added absolute clarity on the capability of the suggestions in this section, materialising sometime in the future. This is an avenue worth taking if the study is to be improved upon.

6.4.2 The Legacy of apartheid in South Africa and modern-day justice

This study focused on Somerset West and the University of Cape Town, areas with populations strongly linked to affluence. The legacy of apartheid is seen when comparing these areas to an area such as (Imizamo Yethu in the Houtbay, Cape Town, which is similarly situated in the wild and urban interface prone to wildfire/fire disaster). The sites the study focussed on were wildfire anomalies and extreme weather events which happened during the two years of this study. The Somerset West fires in 2022, and the University of Cape Town fires in 2021. The City of Cape Town is known as having one of the largest Gini coefficients in the world (the difference between the rich and poor in terms of income distribution), primarily due to South Africa's tragic past – apartheid (Harte & et al, 2009). The remanences of apartheid

inequality are not only in income but similar in the urban landscape and quality of life (Chance, 2015). *see figure 85.*

Figure 85: Fire disaster at Imizamo Yethu Informal Settlement, Hout Bay, Cape Town (Kahanji & et al, 2019).

In terms of justice, this study could include neighbourhoods and communities from all the vast income ranges and landscapes in South Africa. This could be beneficial in terms of upholding the goals and ideals of the City of Cape Town's IDP, SDF and general policy, which all is enshrined in the constitution. A positive is that many fire mitigating measures, triggered along with the veld and forest fire management overlay zone, can be replicated across different wildland-urban interface contexts. Just as there are expensive measures such as sprinkler and fire-resistant roofs, there are similarly cost-effective measures, as simple as a mop and water technique to put out small fires ignited by ember storms.

Throughout the Western Cape and the whole of South Africa, the fire-prone Wildland urban interface remains a massive issue for property owners' vulnerability and future sustainability. There is nearly 100km of the wildland-urban interface just in the Helderberg region, which, judging by development pressures mentioned by respondents, will soon be under threat. Hence, it could be beneficial that future studies consider the above limitations and suggestions for improvement and replicate this process across the country so that ultimately we could become more sustainable as a people, decrease wildfire vulnerability, saving properties and saving lives.

Albert Einstein states: "the definition of insanity is doing the same thing repeatedly and expecting a different result." We cannot simply rebuild to pre-wildfire disaster specification that is unsustainable. If we abide by Cape Town's numerous regulatory and policy ideals and goals of sustainability, resilience and justice, we must "build back better". The proposed Western Cape veld and forest fire management overlay zone provides an excellent avenue to realising this theory on the ground.

Word count [36 812].

7. Appendences

The following appendices provide additional information as background to the research.

They are:

- References
- Ethics Approval
- Initial email sent out to respondents and interview questions
- Ethics Consent forms

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Ethics Approval

Application for Approval of Ethics in Research (EiR) Projects Faculty of Engineering and the Built Environment, University of Cape Town

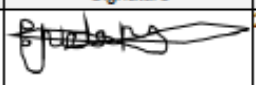
ETHICS APPLICATION FORM

Please Note:
Any person planning to undertake research in the Faculty of Engineering and the Built Environment (EBE) at the University of Cape Town is required to complete this form **before** collecting or analysing data. The objective of submitting this application *prior* to embarking on research is to ensure that the highest ethical standards in research, conducted under the auspices of the EBE Faculty, are met. Please ensure that you have read, and understood the **EBE Ethics in Research Handbook** (available from the UCT EBE, Research Ethics website) prior to completing this application form: http://www.ebe.uct.ac.za/ebe/research/ethics1

APPLICANT'S DETAILS		
Name of principal researcher, student or external applicant		Ewan Pieters
Department		School of Architecture, Planning and Geomatics
Preferred email address of applicant:		ewan.deano@gmail.com
If Student	Your Degree: e.g., MSc, PhD, etc.	Masters of City and Regional Planning
	Credit Value of Research: e.g., 60/120/180/360 etc.	120 Credits
	Name of Supervisor (if supervised):	Associate Professor Nancy Odendaal
If this is a research contract, indicate the source of funding/sponsorship		Guardian
Project Title		How spatial planning can enable pathways toward wildfire mitigation within the wild and urban interface, City of Cape Town.

I hereby undertake to carry out my research in such a way that:

- there is no apparent legal objection to the nature or the method of research; and
- the research will not compromise staff or students or the other responsibilities of the University;
- the stated objective will be achieved, and the findings will have a high degree of validity;
- limitations and alternative interpretations will be considered;
- the findings could be subject to peer review and publicly available; and
- I will comply with the conventions of copyright and avoid any practice that would constitute plagiarism.

APPLICATION BY	Full name	Signature	Date
Principal Researcher/ Student/External applicant	Ewan Pieters		2021/07/08
SUPPORTED BY	Full name	Signature	Date
Supervisor (where applicable)	Nancy Odendaal		2021/07/09

APPROVED BY	Full name	Signature	Date
HOD (or delegated nominee) Final authority for all applicants who have answered NO to all questions in Section 1; and for all Undergraduate research (Including Honours).			
Chair: Faculty EIR Committee For applicants other than undergraduate students who have answered YES to any of the questions in Section 1.			

Page 1 of 1

Initial email sent out to various respondents

Good morning to whom this may concern

Extremely sorry to bother you, as I am aware of your busy schedule; furthermore I hope this email finds you well during this trying time (pandemic). After thorough correspondence on my research topic with Julien Rumbelow (Western Cape Government) and supervisor Professor Nancy Odendaal; your name has been strongly recommended. Your occupational experience, prowess and expertise are invaluable, critical and indispensable to my research topic.

My name is Ewan Pieters I am 23 years old and I am a master's student currently studying city and regional planning at the University of Cape Town. My research topic is "how spatial planning can enable pathways to wildfire mitigation within the urban-wildland interface City of Cape Town".

I was hoping that you could grant me an interview opportunity (have casual/unstructured conversation) on my research topic (potential interview questions will be listed below). This is an opportunity for me to listen and learn from your invaluable experiences and expertise. The aim is not to impose/interrogate, but to learn. This process is for research purposes only and cannot benefit you or your community directly.

Due to covid regulations, I am more than happy to conduct this potential interview over Zoom as well as in-person, upholding appropriate national social distancing requirements. The recorded in-depth unstructured interview will not be longer than 45 minutes.

All that I would require from you is that the ethics form is to be signed before the potential interview is conducted. This is more to hold me accountable to an agreement, such as not using any personal/compromising information (such as your address or name) in the final write-up of the dissertation.

I am aware of your busy schedule, and I thank you in advance for the time you take to go through this email. I do hope that you could consider accepting this interview request as it is key to my research and it would mean so much to me. However, I do understand if your schedule is too demanding.

If you are interested, please feel free to email me (so that we can set a convenient time) or you can contact me at XXXXXXXXXX. I hope to hear from you soon.

Lastly, please find a brief synopsis of my research and a list of potential questions that you would be asked during a potential interview (pending your acceptance of this request) below.

Synopsis:

On the 18th of April 2021, a wildfire raged through parts of the University of Cape Town upper campus (Bhengu, 2021). After damage assessment post-wildfire disaster, senior management assessed the loss at approximately R500 million (Enca, 2021). The vice-chancellor responded that UCT "will rebuild facilities" (Bhengu, 2021; Enca, 2021). February 7 2009, Victoria Melbourne Australia experienced a wildfire that destroyed 2100 homes, killed 173 people and resulted in damage totalling $4 billion (Blakely, 2017). The then premier John Brumby said "they (the dead) unite us all in the task of rebuilding. Because we will rebuild" (Blakely, 2017:63; Jazebi & et al, 2020). November 2018, United States of America, California experienced one of the most destructive fire seasons – the Woolsey fire costing $4 billion and a campfire destroying 18,800 structures, causing 11 billion dollars in damage (Jazebi & et al, 2020). Again the response in California was to rebuild. The disaster management rhetoric of "rebuild" is problematic, as we should never rebuild what was because the old settlement geographic, economic, and social position is no longer sustainable (Blakely, 2017:63).

"Due to climate change, the exacerbation of wildfire anomalies and their associated destructiveness oblige humankind to revise pieces of knowledge that are calibrated to conditions that no longer exist" (Petryna, 2018:589). Current disaster risk management literature and frameworks are strongly advocating for more emphasis on the prevention of disasters; without compromising the much-needed reactive qualities of the discipline. It emphasizes that spatial planning (land uses, building regulations, tenure boundaries, and spatial layout and road patterns) is the key discipline in achieving long term disaster risk reduction. It calls for a different way of thinking– the

merging of disciplines to create new pieces of knowledge that can tend to exacerbate earthly disasters; brought about by climate change.

My research attempts to respond to this call and by partaking in this research, you too can contribute to this urgent call.

Questions were posed to the various respondents via the email, and these questions were used during the interview sessions that took place on zoom:

Planners:

What are the regulatory limitations of developing in the Wild and Urban Interface?

Which policies are effective? Which are not? And Why?

Collaborative efforts across departments and organisations (Disaster Risk Department)? Do you have any experience or examples of partaking in these? What are the main challenges of these efforts?

Do consider risk and disaster management in your planning activities? In your day to day life as a planner? Do you have examples?

Based on your experience and expertise as a planner, do you have any suggestions on how to increase the long term sustainability of the Wild Urban Interface?

Do you have any other comments or input?

Disaster Risk Officials

Do you work with planners? How?

Looking back at the veld fire (UCT FIRE) when you reflect back on this? What was some of the challenges? What could have been done differently?

Given water scarcity in the region, how can firefighting be supported by other strategies? Such as the use of technology?

What is the regulatory framework that guides your work? How effective is it?

In the wake of build back better, given the regulatory framework, who do you collaborate with? What are the challenges of working with other actors?

How effective are restrictions of development in the wild urban interface? How can spatial planning assist? Do you have any examples?

What suggestions would you make in relation to fire risk reduction in the WUI?

Do you have any other additional comments?

Fire Engineer

Would you kindly explain to me your role, in relation to fire risk management?

Do you ever work directly urban structures close to the wild urban interface?

Could you expand on the regulatory environment that you work in?

What are the other professionals that you work with? Does it include urban planners?

Any experience working in urban areas that are fire prone? What are the challenges?

What are some of the technological and infrastructural mechanism that you work with?

What would be some of your suggestions with regard to the regulation of the WUI in Cape Town?

Any further comments?

Veld Fire Act Specialist

Do you work with urban planners? How?

Given water scarcity in the region, how can firefighting be supported by other strategies? Such as the use of technology?

What is the regulatory framework that guides your work? How effective is it?

In the wake of build back better, given the regulatory framework, who do you collaborate with? What are the challenges of working with other actors?

How effective are restrictions of development in the wild urban interface? How can urban planning assist? Do you have any examples?

What suggestions would you make in relation to fire risk reduction in the WUI?

Do you have any other additional comments?

Kind Regards

Ewan Pieters (UCT Masters City and Regional Planning Student)

End of email

……

SCHOOL OF ARCHITECTURE, PLANNING AND GEOMATICS
University of Cape Town
Private Bag x3, Rondebosch 7701
Centlivres Building
Email: Janine.Meyer@uct.ac.za Tel: 27 21 6502359

UNIVERSITY OF CAPE TOWN

29 September 2021

STATEMENT TO BE READ OUT TO AN INTERVIEWEE BY A STUDENT ABOUT TO UNDERTAKE AN INTERVIEW FOR THE PURPOSES OF A MASTERS DISSERTATION

My name is Ewan Pieters and I am studying city and regional planning at the University of Cape Town.

I am doing research on Wild Fire Mitigation through Spatial Planning as part of my masters' dissertation and i would like to ask you some questions to help me with my research.

I can promise that i will not record your name or address, and your personal details will not in any way be revealed in my dissertation or any publication I produce.

The questions i ask are only for research and they cannot directly benefit you or your community.

If you want to end the interview at any point you are free to do so.

My supervisor is a/Prof Nancy Odendaal and her contact details are:
nancy.odendaal@uct.ac.za and phone number: 082 537 8699.

Garron Campbell

Digitally signed by Garron Campbell
Date: 2021.09.29 18:02:41 +02'00'

Signature and designation (interviewee) Signature of student

SCHOOL OF ARCHITECTURE, PLANNING AND GEOMATICS
University of Cape Town
Private Bag x3, Rondebosch 7701
Centlvres Building
Email: Janine.Meyer@uct.ac.za Tel: 27 21 6502359

UNIVERSITY OF CAPE TOWN

28 September 2021

STATEMENT TO BE READ OUT TO AN INTERVIEWEE BY A STUDENT ABOUT TO UNDERTAKE AN INTERVIEW FOR THE PURPOSES OF A MASTERS DISSERTATION

My name is Ewan Pieters and I am studying city and regional planning at the University of Cape Town.

I am doing research on Wild Fire Mitigation through Spatial Planning as part of my masters' dissertation and i would like to ask you some questions to help me with my research.

I can promise that i will not record your name or address, and your personal details will not in any way be revealed in my dissertation or any publication I produce.

The questions i ask are only for research and they cannot directly benefit you or your community.

If you want to end the interview at any point you are free to do so.

My supervisor is a/Prof Nancy Odendaal and her contact details are: nancy.odendaal@uct.ac.za and phone number: 082 537 8699.

Signature and designation (interviewee)

Signature of student

SCHOOL OF ARCHITECTURE, PLANNING AND GEOMATICS
University of Cape Town
Private Bag x3, Rondebosch 7701
Centlivres Building
Email: Janine.Meyer@uct.ac.za Tel: 27 21 6502359

UNIVERSITY OF CAPE TOWN

30 September 2021

STATEMENT TO BE READ OUT TO AN INTERVIEWEE BY A STUDENT ABOUT TO UNDERTAKE AN INTERVIEW FOR THE PURPOSES OF A MASTERS DISSERTATION

My name is Ewan Pieters and I am studying city and regional planning at the University of Cape Town.

I am doing research on Wild Fire Mitigation through Spatial Planning as part of my masters' disseration and i would like to ask you some questions to help me with my research.

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nancy.odendaal@uct.ac.za and phone number: 082 537 8699.

Kier Hennessy Digitally signed by Kier Hennessy Date: 2021.10.01 08:51:04 +02'00'

Signature and designation (interviewee) Signature of student

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University of Cape Town
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UNIVERSITY OF CAPE TOWN

22 September 2021

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Signature and designation (interviewee) Signature of student

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UNIVERSITY OF CAPE TOWN

21 September 2021

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My supervisor is a/Prof Nancy Odendaal and her contact details are:
nancy.odendaal@uct.ac.za and phone number. 082 537 8699.

Marek Mentz Kedzieja Digitally signed by Marek Mentz Kedzieja Date: 2021.09.21 14:26:15 +02'00'

Signature and designation (interviewee) Signature of student

SCHOOL OF ARCHITECTURE, PLANNING AND GEOMATICS
University of Cape Town
Private Bag x3, Rondebosch 7701
Centlivres Building
Email: Janine.Meyer@uct.acza Tel: 27 21 6502359

UNIVERSITY OF CAPE TOWN

19 October 2021

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Ian Meldrum (ID no; 6809195076086)

Signature and designation (interviewee)

Signature of student

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University of Cape Town
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UNIVERSITY OF CAPE TOWN

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My supervisor is a/Prof Nancy Odendaal and her contact details are: nancy.odendaal@uct.ac.za and phone number: 082 537 8609.

E. Du Toit (Fire Brigade Senior Manager)

Signature and designation (interviewee) Signature of student

SCHOOL OF ARCHITECTURE, PLANNING AND GEOMATICS
University of Cape Town
Private Bag x3, Rondebosch 7701
Centlivres Building
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UNIVERSITY OF CAPE TOWN

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Bryan Henning

Signature and designation (interviewee)

Signature of student

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University of Cape Town
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Centlivres Building
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UNIVERSITY OF CAPE TOWN

19 October 2021

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D. Smith (FPA)

Signature and designation (interviewee) Signature of student