Final Report[1]
African Urban Risk Analysis Network (AURAN)

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Executive Summary

In 2004, the University of Cape Town's Disaster Mitigation for Sustainable Livelihoods Programme signed an implementing agreement with the International Institute for Environment and Development to execute activities planned as part of the newly established African Urban Risk Analysis Network (AURAN). Specifically, these activities focused on :

- Further strengthening understanding of urban risk processes in the Cape Town Metro – with a specific focus on informal settlement vulnerability.
- Building capacity among local partners to more effectively use and apply quantitative and spatial information on risk patterns in informal and low-income areas.
- Developing the AURAN extranet website
- Facilitating and undertaking one exchange visit to another AURAN-affiliated partner.

In addition, the report outlines interim steps taken and financed by UCT/DiMP to enable the development of a Phase II AURAN support programme. It also describes UCT/DiMP's continuing efforts in urban risk reduction advocacy and capacity development foreseen until March 2007

The AURAN project placed an explicit emphasis on informal settlement fires, as these are an increasing priority risk in the City of Cape Town. The project specifically aimed at strengthening understanding of the drivers of risk in informal settlements as well as low-income formal housing areas. It resulted in the updating of the MANDISA disaster events database[2] from 1999 to 2004 – providing fifteen years of consolidated disaster incidents for the City of Cape Town. This provided an invaluable opportunity to obtain greater insight into the city's risk profile, and has resulted in consolidation and geo-referencing of more than 19 000 incidents from 1990-2004.

This initiative was implemented with an explicit emphasis on informing and strengthening prospective disaster risk management efforts in fire-prone informal households, communities and areas – as is required both by South Africa's disaster management legislation and the Hyogo Framework for Action.

Focus on policy and institutional arrangements

The value-adding support from AURAN co-financed the updating of both the MANDISA data-base to 2004, along with funding from the Office of the Mayor in the City of Cape Town and SASRIA.[3] Within three governmental spheres (local, provincial and national), the information has actively informed risk reduction policy.

[2] The Disaster Mitigation for Sustainable Livelihoods Programme (DiMP) at the University of Cape Town has developed the MANDISA database (Monitoring, Mapping and Analysis of Disaster Incidents in Southern Africa) that can be used as a strategic planning tool by disaster risk management and development practitioners/decision-makers.

[3] South African short-term insurer with history of government catastrophic loss cover and with explicit interests in exploring potential insurance products to cover local government informal settlement losses.

- Locally, the information has influenced priority-setting in the TEAM capacity-building initiative by assisting in the objective identification of high fire-risk settlements requiring urgent risk reduction action.

- Provincially, the accessible provision of objective temporal and spatial fire loss information has resulted in the profiling of disaster risk as a critical consideration in the Provincial Strategic Infrastructure Plan, practically resulting in:
  - the inclusion of an explicit 'Risk Reduction and Emergency Management' Sector in the provincial plan,
  - the drafting of a potential provincial project to develop policy and processes to incorporate risk management as a transversal consideration in future construction and infrastructure development within the Western Cape.

- Reference to and inclusion of fire loss information in the Province of the Western Cape's strategic study on the impact of climate change, commissioned by the Provincial Department of Environmental Affairs and Tourism.

- Nationally, economic loss information generated by MANDISA was presented in accessible graphs that were presented by the Provincial Department of Local Government and Housing and Provincial Treasury to National Treasury to motivate allocation of National Treasury funds for the implementation of the Disaster Management Act. This information effectively and robustly substantiated disaster risk management funding requirements for municipalities and provinces.

Focus on risk identification and assessment
The information generated has been used extensively in local implementation of the TEAM project to characterise fire risk temporally and spatially within targeted settlements and across informal settlements in the Metro.

Focus on risk reduction knowledge management
The MANDISA information has been extensively used for strengthening understanding and strategic intelligence on fire risk patterns in the Metro. Specifically, this includes:

- Use and accessible presentation of data in workshops, consultations with local government officials, community based organisations and informal settlement residents.
- Use of information to support both formal graduate teaching and learning programmes at UCT as well as short course professional training for development and disaster management practitioners
- Application of data to support graduate research – both in disaster risk science and Actuarial Science

Focus on reducing risk
The collection, consolidation and accessible presentation of fire loss information in spatial, graphic and tabular forms has served several critical risk reduction objectives. First, it has provided important information for strategic risk reduction planning – especially at settlement level. Second, it has justified the need for strengthened risk management as an integral component of sustainable infrastructural development in the Western Cape. Third, it has demonstrated the value of applying integrated risk science

methods to what has in the past been viewed as a 'chaotic' disordered phenomenon that is not easily amenable to management and reduction by municipal services.

Focus on emergency preparedness
MANDISA provides a complementary form of 'early warning' to the traditional tracking systems for weather and other natural hazards. The capabilities to visualise densification of informal fire events, and to monitor sudden increases in incident severity underlines MANDISA's role as an early warning application for settlements highly vulnerable to high magnitude fire events. This area has yet to be fully explored.

During the AURAN research project, it was found that practitioners have difficulty engaging with the quantitative information generated by MANDISA – even although they are the originators of the data. To address this, a workshop will be held towards the end of March 2006 with the aim of having 10 to 12 participants from every department of the fire services. The programme for the workshop will cover the generation of tables, graphs and maps. It will also include the use of a GPS.

In May 2005, a domain name for the AURAN website was registered www.auranafrica.org.The specifications for the site were finalized in June, but unfortunately development of the site could only begin in late November due to the unavailability of **GoMedia Productions** who were developing the administrative and content management components of the system. The website is now live, with the administration of the site successfully transferred to DMTC/UCLAS in Dar Es Salaam, Tanzania.

An exchange visit was arranged between Cape Town, South Africa and Dar es Salaam, Tanzania. Two practitioners from the Programme Management Department of the City of Cape Town Metropole were identified for the visit. Their work involves provision of services to informal settlements in Cape Town. This was an ideal opportunity for them to learn from the urban risk research conducted in Dar es Salaam. During the two-day visit, scheduled for the first week of March, the practitioners will be taken to the sites used in the AURAN project.

During the AURAN research project, it was found that practitioners have difficulty engaging with the quantitative information generated by MANDISA – even although their departments generate the data. To address this, a two-day workshop focussing on interpreting this type of information was convened with 14 fire fighters on 10-11 April. The workshop proved to be successful, with participants acknowledging that data collection, capturing and analysis are critical for mitigating fire risks in some areas and minimising the fire severity in others.

With respect to its continued advocacy in urban risk reduction and related research. In this context, UCT/DiMP will focus on the following urban risk reduction priorities:

- The generation of multi-lingual training materials in community risk assessment and reduction in informal settlements (English, Afrikaans, isiXhosa)
- Continued collaboration with Munich Reinsurance and the Actuarial Science Department at UCT to provide the risk science necessary to inform the development an insurance product targeted to informal dwelling residents
- Development of a training module in community risk assessment in informal settlements for adaptation and application in other contexts in Africa

- Development of a social vulnerability assessment guideline for assessment of extreme weather impacts in informal settlements

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I. Narrative Report

1. Introduction

In 2004, the University of Cape Town's Disaster Mitigation for Sustainable Livelihoods Programme signed an implementing agreement with the International Institute for Environment and Development to execute activities planned as part of the newly established African Urban Risk Analysis Network (AURAN). Specifically, these activities focused on:

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- Building capacity among local partners to more effectively use and apply quantitative and spatial information on risk patterns in informal and low-income areas.
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- Facilitating and undertaking one exchange visit to another AURAN-affiliated partner.

This narrative report reviews these four activities.

Section 2 specifically reviews efforts related to urban fire loss estimation within the City of Cape Town and their relevance in informing strategic development planning.

Section 3 reflects on initiatives aimed at strengthening capacity building of partners in using applied disaster risk information

Section 4 addresses the processes associated with website development

Section 5 discusses the exchange visit to Tanzania

Section 6 outlines interim steps taken and financed by UCT/DiMP to enable the development of a Phase II AURAN support programme.

Finally, section 7 describes UCT/DiMP's continuing efforts in urban risk reduction advocacy and capacity development foreseen until March 2007.

2. Report on Urban Fire Loss Estimation

2.1 Background

This AURAN focus area constituted the priority activity for the UCT-funded project. It particularly emphasised informal settlement fires, as these are an increasing priority risk in the City of Cape Town. The project specifically aimed at strengthening understanding of the drivers of risk in informal settlements as well as low-income formal housing areas. It resulted in the updating of the MANDISA disaster events database[4] from 1999 to 2004 – providing fifteen years of consolidated disaster incidents for the City of Cape Town. This provided an invaluable opportunity to obtain greater insight into the city's risk

[4] The Disaster Mitigation for Sustainable Livelihoods Programme (DiMP) at the University of Cape Town has developed the MANDISA database (Monitoring, Mapping and Analysis of Disaster Incidents in Southern Africa) that can be used as a strategic planning tool by disaster risk management and development practitioners/decision-makers.

profile, and has resulted in consolidation and geo-referencing of more than 19 000 incidents from 1990-2004.

The sub-report on urban fire loss estimation is presented in four parts.

2.2 presents the methodology applied
2.3 presents and reflects on research outputs and findings generated
2.4 addresses methodological and institutional constraints
2.5 profiles opportunities for mainstreaming risk reduction in multiple contexts.

2.2 Methodology applied

2.2.1 Data collection and consolidation

The AURAN project required that fire and flood-related incident records were collected from 2000 to 2004. This section describes the context within which fire records were collected and outlines specific challenges in recording and collecting fire data.

a) Context within which records collected

In 2000 the new City of Cape Town was formally constituted, amalgamating six metropolitan local councils. These include Blaauwberg Municipality, City of Cape Town, City of Tygerberg, Helderberg Municipality, Oostenberg Municipality, South Peninsula Municipality and the Cape Metropolitan Council.

Prior to 2000, each fire service in each local council used a different incident management system, resulting in lack of uniform methods for reporting and recording of fire incidents. Upon amalgamation, a slow phased process began to streamline all administrations onto the same system. This was completed in 2003, when all administrations began using the Linux-based Emergency Services System (ESS).[5]

b) Challenges in recording and collecting fire data

DiMP's two disaster risk analysts encountered many challenges in the course of collecting and consolidating the fire data. These included considerable unevenness in the storage of incident reports across the Metropole and in the quality of information. This specifically related to the capturing of incidents on the Emergency Services System (ESS) system and the completeness of the information recorded for each incident. It was found that the dataset was more robust in the local administrations with more reliable and consistent recording processes.

c) Data-capturing and consolidation

After the data were collected and filed by UCT/DiMP, it was captured electronically into the MANDISA database. This task could not have been undertaken by unskilled data-capturers and required data analysts specially trained to understand Cape Town's

[5] There are currently six fire control centres in the Metropole, one in each local administration and 41 fire stations. The server for ESS is housed at the main control centre and all records are stored here. The fire control centres in other local administrations are connected to this server.

disaster risk profile as well as the varying recording formats from different disaster management and fire control centres.

The fire-related information that was captured included:

- Incident location, which was mapped,
- date, time of day and duration of the incident
- type of fire
- source of the information
- cause or trigger of the fire if it is recorded in the incident report. Often this was unknown, as the fire fighter did not have the time or the authority to conduct a forensic investigation.
- impact of the fire. This included those dwellings that were damaged and destroyed. The cost to the service responding was also entered.

d) Incidents recorded

Incident reports, totalling approximately 11 000 incidents, were collected for 2000 to 2004. The total number of reports collected for each municipality is shown in Table 1.

Table 1: Total number of records collected

Local Administration	2000	2001	2002	2003	2004	Total
Blaauwberg	151	129	224	187	159	850
Cape Town	527	723	745	663	732	3,390
Helderberg	238	58	55	58	193	602
Oostenberg	118	114	207	143	38	620
South Peninsula*	1,271	1,358	780	594	240	4,243
Tygerberg	0	168	433	638	439	1,678
Total	2,305	2,550	2,444	2,283	1,801	11,383

*2000 to 2003 includes bush and grass fires

There were many challenges in reconciling data between the ESS and MANDISA systems, underlining the limitations of 'blind' electronic importation of data from one system to another. These included mismatching of spatial location information – especially in informal areas or on long roads that transect several suburbs. They also included misclassification of fire types where, for instance the electronic ESS record indicated a 'formal' fire event, which, on detailed manual review of the original hardcopy, revealed that it was initially recorded as an 'informal' fire event.

Once this cleaning process was completed, a more detailed analysis was undertaken of five informal areas in the Metro most affected by fire occurrences.

2.3 Research outputs and findings generated

This section specifically focuses on informal dwelling fires from 1990-2004.[6] It is divided into the following levels of analysis:

- Macro analysis - across the entire Metropole.
- Intermediate or meso analysis - across suburbs thus enabling comparison between suburbs.
- Micro analysis – examining patterns and trends individually within selected suburbs.

2.3.1 Macro Analysis

Table 2 shows the total number of all fire incidents recorded for a fifteen-year period amounts to 18,504. This includes fires that affected formal and informal homes, commercial, industrial and institutional buildings. Of all the fires recorded, over 8 000 involved informal dwellings. This is about 47% of the total incidents from 1990 to 2004. However, from 2001, the proportion of informal dwelling incidents shows a steady upward trend, relative to all fire events – constituting approximately 56% of all incidents by 2004.

Table 2: Fire incidents recorded in MANDISA currently

Year	Number of Fire Incidents	Number of Informal Fire Incidents	Informal Fires as % of All Fire Incidents
1990	535	251	46.92
1991	702	259	36.89
1992	560	183	32.68
1993	743	278	37.42
1994	963	390	40.50
1995	1,566	624	39.85
1996	1,358	578	42.56
1997	1,492	704	47.18
1998	1,364	665	48.75
1999	1,448	727	50.21
2000	1,976	918	46.46
2001	1,537	799	51.98
2002	1,314	718	54.64
2003	1,350	802	59.41
2004	1,596	891	55.83
Total	**18,504**	**8,787**	**47.49**

[6] The project team defined this as a 'structure used as a dwelling made of wood and iron materials' – the definition used and applied by Fire Services

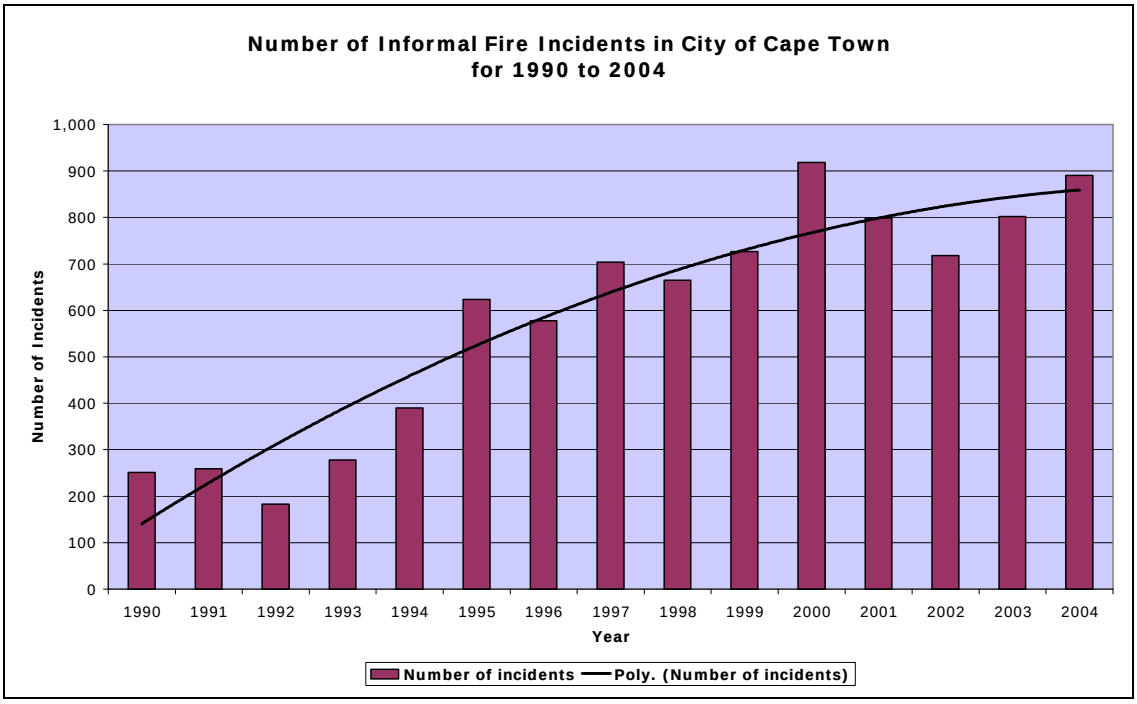


Figure 1: The total number of informal dwelling fire incidents for City of Cape Town (1990 to 2004)

Figure 1 represents the total number of informal dwelling fire incidents per year for Cape Town, rising from 535 in 1990 to 891 in 2004. This 67% increase in occurrence is partly explained by the introduction of electronic reporting in 1995. Even after 1995, however, the number of incidents increased by 43% from 624 to 891 to 2004.

The number of dwellings affected comprised those that were either damaged or destroyed by fire. From 1990 to 2004, this constituted approximately 41,000 dwellings as shown in Table 3.

Table 3: Informal dwelling fires that are currently recorded in MANDISA

Year	Number of Informal Fire Incidents	Number of Informal Dwellings Damaged	Number of Informal Dwellings Destroyed	Total Informal Dwellings Affected
1990	251	893	263	1,156
1991	259	1,042	561	1,603
1992	183	394	266	660
1993	278	783	353	1,136
1994	390	908	1,664	2,572
1995	624	95	2,821	2,916
1996	578	196	4,526	4,722
1997	704	94	3,276	3,370
1998	665	68	2,081	2,149
1999	727	57	4,118	4,175
2000	918	577	2,360	2,937
2001	799	987	953	1,940
2002	718	905	1,277	2,182
2003	802	762	1,733	2,495
2004	891	2,064	5,224	7,288
Total	**8,787**	**9,825**	**31,476**	**41,301**

Figure 2 illustrates the number of dwellings affected over the fifteen-year period. It should be noted that the years that recorded the highest number of dwellings affected are those that had a local or national election. These events occurred in April (national elections in 1999 and 2004) and May (local elections in 1996).

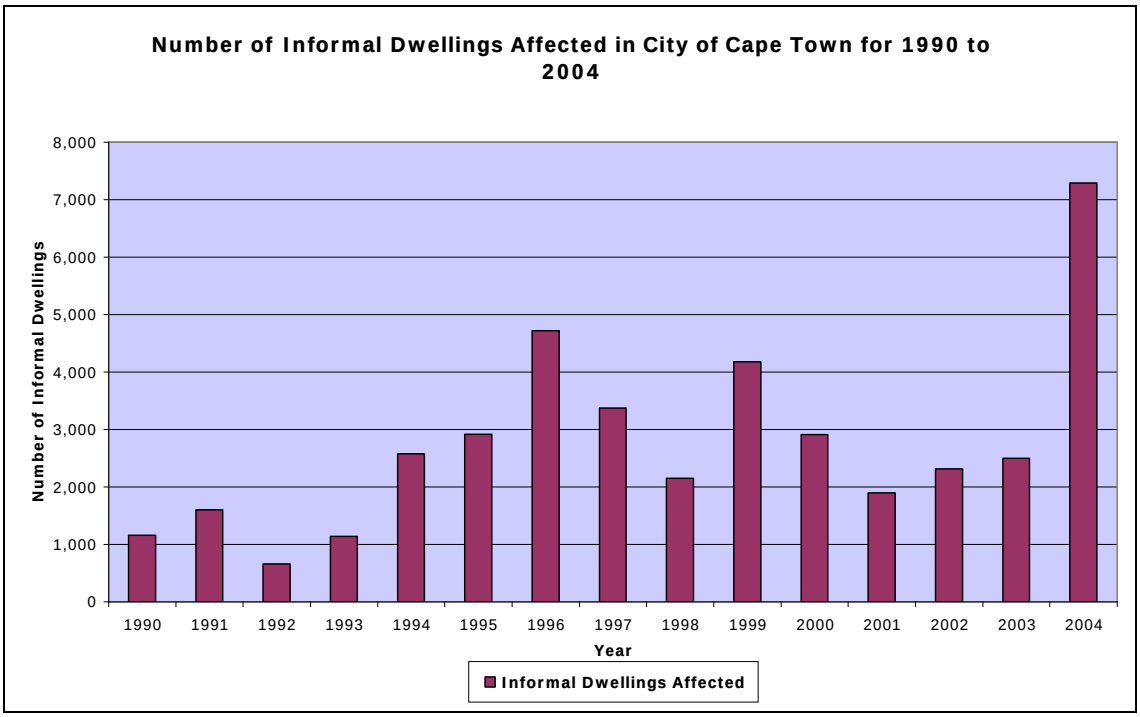


Figure 2: The total number of informal dwellings affected by fire in the City of Cape Town (1990 to 2004)

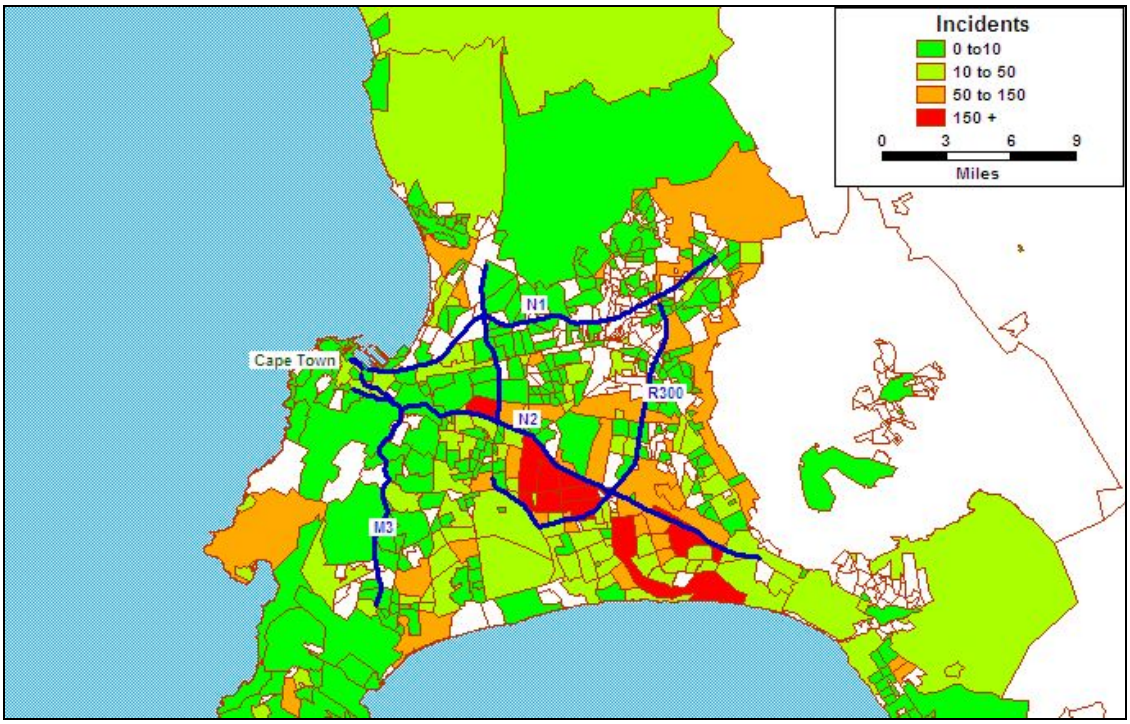


Figure 3: The number of informal dwelling fire incidents for the City of Cape Town (1990 to 2004)

Figure 3 represents the total number of informal dwelling fires across the Metropole for fifteen years illustrated by suburb. The green category represents those suburbs where between 0 and 10 informal fire incidents occurred from 1990 to 2004. The red category is for those suburbs where more than 150 incidents occurred during the study period.

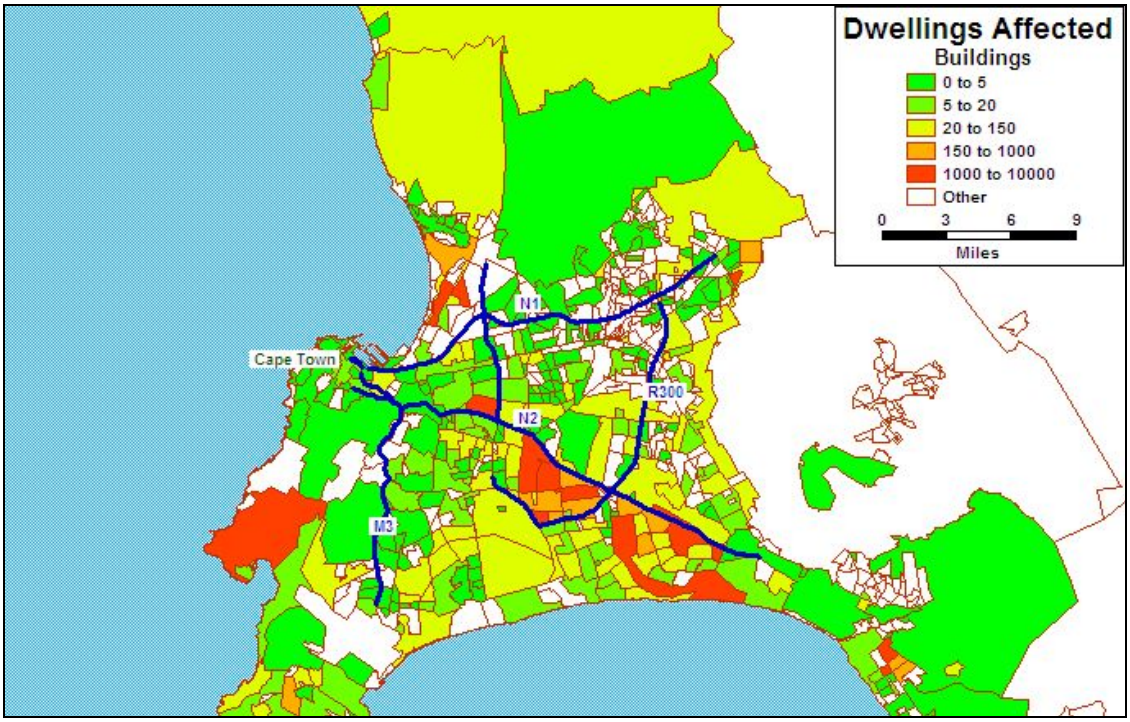


Figure 4: The total number of informal dwellings affected by fire in the City of Cape Town (1990 to 2004)

Figure 4 illustrates the total number of informal dwellings either damaged or destroyed by fire from 1990 to 2004. Again, the map represents the total number of dwellings for each suburb over the fifteen-year period.[7]

2.3.2 Intermediate Analysis

The intermediate analysis focused on the suburb level. This provided an opportunity to draw comparisons between different areas within the Metropole. The following suburbs were selected:

- Langa
- Khayelitsha
- Guguletu
- Nyanga
- Crossroads

These areas are circled in Figure 5. The suburbs comprise a combination of low-income housing and informal settlement areas. The low-income housing areas generally have what is known as 'backyard' dwellings. These are wood and iron structures that have been built in the back of a formal, brick and mortar structure. The information presented

[7] The maps indicate those areas facing increased fire risks. However, maps do not effectively represent trends over time, seasonality or cyclicity. Moreover, the ranges chosen were not determined statistically. This means that a suburb that recorded only 200 incidents over fifteen years was classified in the same category as a suburb that has experienced over 1,000. Therefore, mapped ranges at macro level cannot be used in isolation of more detailed tables and graphs.

includes fires that have affected these backyard structures – as well as those that affected adjacent informal settlements.[8]

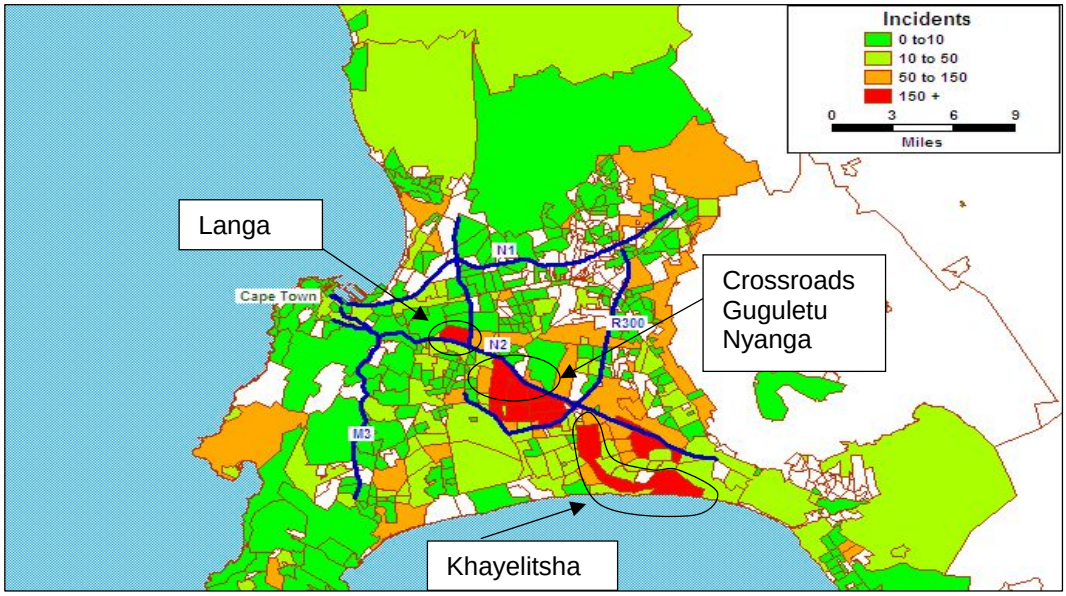


Figure 5: Map illustrating where chosen suburbs are located within the Metropole

The data for Crossroads, Guguletu and Nyanga were consolidated. These three areas are located next to one another – and lack clear spatial boundaries to demarcate them individually. Therefore it was decided to merge the information into one area spatially. Data were then analysed from 1995 to 2004, as the information gathered during this period was considered to be more robust than that for previous years.

Table 4: The number of informal dwelling fire incidents in the five suburbs

Suburb	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Total
Langa	55	55	58	53	63	46	44	37	35	34	480
Khayelitsha	177	44	35	29	76	158	147	188	213	205	1,272
Crossroads / Guguletu / Nyanga	133	160	202	222	161	118	147	153	133	157	1,586
Total	**365**	**259**	**295**	**304**	**300**	**322**	**338**	**378**	**381**	**396**	**3,338**

Approximately 3,338 incidents of fire occurred in the selected suburbs as can be seen in Table 4. This constitutes about 38% of the 8,787 informal dwelling fire incidents in the Metropole (refer to Table 3).

[8] The informal settlement areas are large areas within the suburbs where there are many informal dwellings and where formal dwellings are absent.

Table 5: Number of informal dwellings destroyed by fire in the five suburbs

Suburb	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Total
Langa	788	395	160	460	1,473	1,419	298	513	336	1,222	7,064
Khayelitsha	372	323	529	224	62	52	80	307	320	399	2,668
Crossroads / Guguletu / Nyanga	615	436	1,703	387	452	136	348	294	321	370	5,062
Total	**1,775**	**1,154**	**2,392**	**1,071**	**1,987**	**1,607**	**726**	**1,114**	**977**	**1,991**	**14,794**

Table 5 shows that 14,794 informal dwellings were destroyed for the five areas. Although Langa comprises only 14% of the total incidents, it constitutes approximately 48% of the total dwellings destroyed for the five areas – underlining an unusually high level of fire severity (14.7 dwellings affected/fire event for the entire period, compared to 2.09 dwellings for Khayelitsha and 8.2 dwellings/incident for Crossroads / Guguletu / Nyanga over the same period).

When suburbs are compared, striking differences are noted. Figure 6 illustrates the frequency of informal fire incidents from 1995 to 2004 for the selected areas. This suggests that while the frequency of incidents for Langa is declining, fire incidence in Khayelitsha is increasing, most dramatically from 1999.

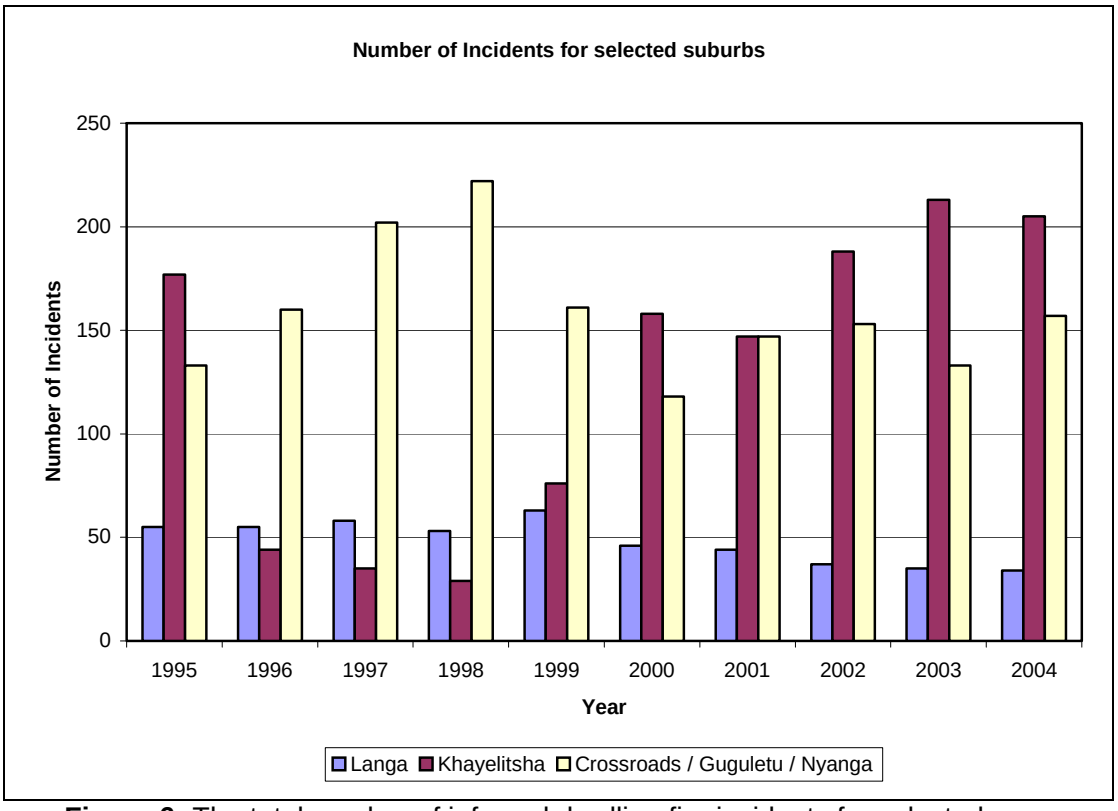


Figure 6: The total number of informal dwelling fire incidents for selected areas

Similarly Figure 7 compares informal dwelling loss patterns for the selected suburbs.[9] However the graphs illustrate significant inter-settlement differences, challenging the belief and assumption that fire risk is homogeneous across informal settlements within the Metro.

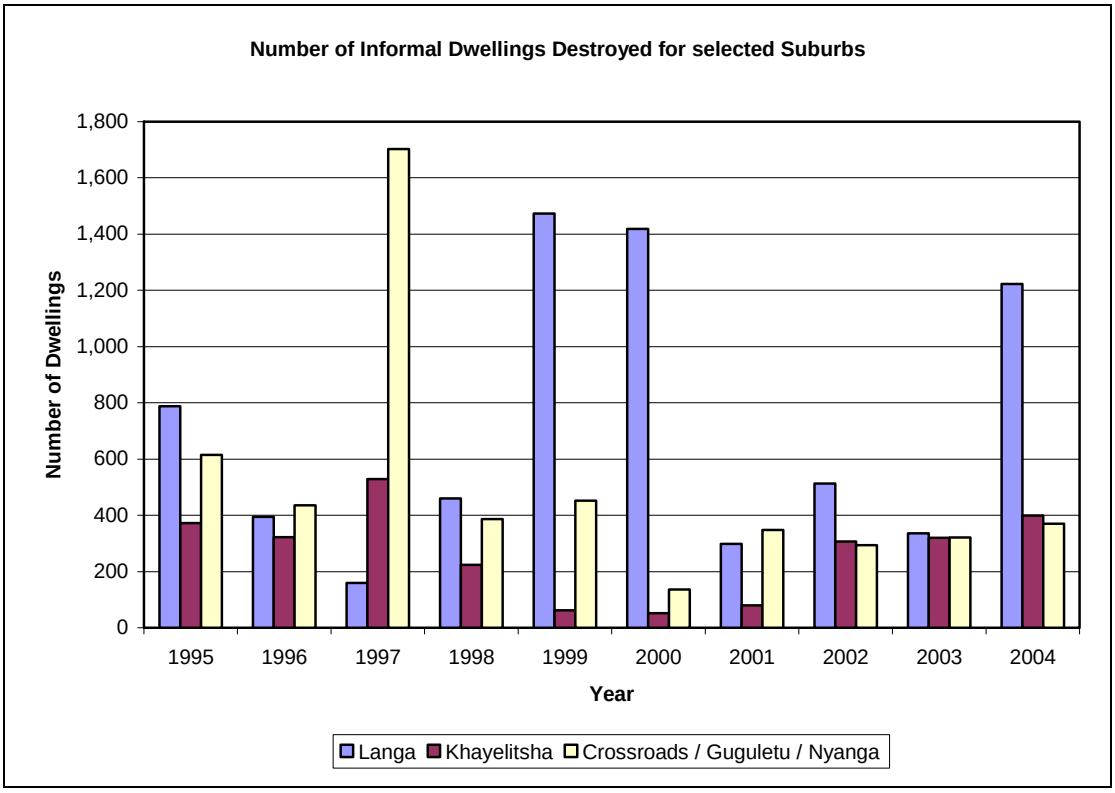


Figure 7: The number of informal dwellings that were affected by fire for the selected areas.

Table 6: Compared Average Losses/Fire Incident 1995-2004 and 2000-2004

Suburb	No. fires 1995-2004	No. dwellngs dest. 1995-2004	Ave. loss/fire 1995-2004	No. fires 1995-1999	No. dwellngs dest. 1995-1999	Ave. loss/fire 1995-1999	No. fires 2000-2004	No. dwellngs dest. 2000-2004	Ave. loss/fire 2000-2004
Langa	480	7,064	14.7	284	2 488	8.8	196	3 788	19.3
Khayelitsha	1,272	2,668	2.09	361	1 510	4.2	911	1 158	1.3
Crossroads / Guguletu / Nyanga	1,586	5,062	8.2	378	3 593	4.1	708	1 469	2.1
Total	**3,338**	**14,794**	4.43	1 523	7 591	5.0	1 815	6 415	3.5

[9] It would be more useful to investigate the rate of fire incidence for the different years, adjusted by population size for each area. This would control for the varying population sizes residing in the selected settlements.

Table 6 illustrates the differentiated character of fire loss trends between the three areas, demonstrating that while Khayelitsha and Crossroads / Guguletu / Nyanga have achieved significant reductions in severity of losses/fire event, Langa has increased its severity/incident by 119% between the 1995-1999 and 2000-2004 reporting periods. This illustrates the very specific fire risk conditions that prevail in the Langa-Joe Slovo suburb.

Analysis was also initiated to determine if a relationship exists between the frequency of fires of various severities/magnitudes. The initial analysis applied severity ranges that were broadly consistent with those applied by Disaster Risk Management Services. However, the results generated suggest that these indicative categories are insufficiently robust and will need to be determined statistically. Table 7 shows the initial analysis, in which single dwelling losses constitute approximately 62.5% of the overall total number of informal dwelling fires. Langa-Joe Slovo deviates from this pattern with fire events respectively affecting 20-49 and $\geq$ 50 dwellings 14% and 6% of the time.

Table 7: The number of informal fire incidents by severity category

	0 Dwellings Destroyed		1-9 Dwellings Destroyed		10 - 19 Dwellings Destroyed		20 - 49 Dwellings Destroyed		50 - 109 Dwellings Destroyed		>109 Dwellings Destroyed		Total Number of Incidents
Suburb	**No of Incidents**	**% of total Incidents**	**No of Incidents**	**% of total Incidents**	**No of Incidents**	**% of total Incidents**	**No of Incidents**	**% of total Incidents**	**No of Incidents**	**% of total Incidents**	**No of Incidents**	**% of total Incidents**	
Langa	102	21.25	268	55.83	43	8.96	40	8.33	16	3.33	11	2.29	480
Khayelitsha	640	50.31	603	47.41	24	1.89	3	0.24	2	0.16	0	0.00	1,272
Crossroads / Guguletu / Nyanga	289	18.22	1,218	76.80	31	1.95	32	2.02	11	0.69	5	0.32	1,586
Total	1,031	30.89	2,089	62.58	98	2.94	75	2.25	29	0.87	16	0.48	3,338

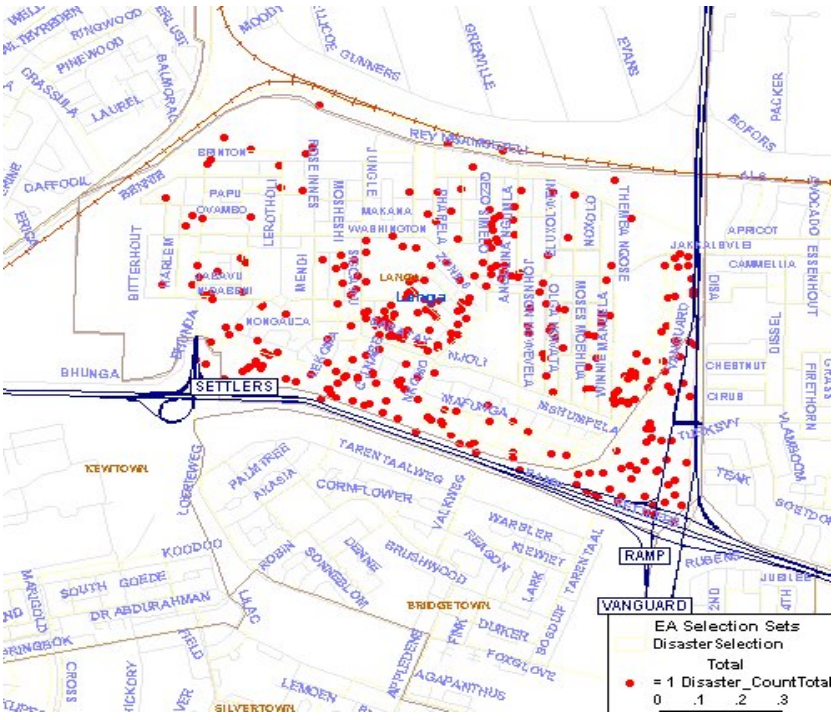
2.3.3 Micro Analysis

The MANDISA dataset was also applied to informal fire risk occurrence at micro or suburb (or settlement) level. When accompanied by a systematic participatory community risk assessment, the data provide useful insight into frequency and severity patterns – as well as spatial differentiation. However, they require complementary information from aerial photographs, census and other sources – as well as grounded community consultation to usefully guide risk reduction planning at such fine scale.

a) Example 1: Langa – Spatial data

The map below reflect spatial data from MANDISA to show the distribution of fire incidents in Langa- Joe Slovo between 1995 and 2004. The area represented between the heavy black lines is the Joe Slovo informal settlement. The high fire incidence reflected in earlier graphs and tables is confirmed spatially. However, the map also illustrates extremely high and increasing levels of 'informal fire' occurrence within the formally planned suburb of Langa, well beyond the boundaries of the informal settlement. Such trends are of considerable concern to a wide range of stake-holders – including poverty alleviation professionals, low income housing developers and the short-term insurance industry which is now required by law to offer affordable insurance cover to low income property owners.

Figure 8: Informal dwelling fire losses, Langa-Joe Slovo 1995-2004



b) Example 2: Masiphumelele – Informal fire incidence and severity

Masiphumelele is a high fire risk informal settlement in the Southern Metropole. MANDISA data were applied to this settlement to assist the TEAM Project.[10]

The first three graphs below apply MANDISA data to represent fire frequency, seasonality and severity from 1994-2004.

- Figure 9 shows that prior to 2000, fewer than 10 fire incidents occurred annually in the settlement. This has now increased to more than 20.

- Figure 10 indicates a seasonal bias towards winter fires – explained and elaborated on by the community risk assessment - which revealed large numbers of informal dwellings located in the wetland adjacent to the settlement.

- Figure 11 shows increasing annual severity per fire incident, sharply rising from less than 3 dwellings affected per fire event in 2002 to approximately 16/fire event in 2004

Figure 12 provides some insight into increasing fire incidence and severity by reflecting the settlement's significant population growth from 4 000 to 26 000 over a 13 year period – resulting in considerable internal densification as well as expansion into the adjacent wetland.

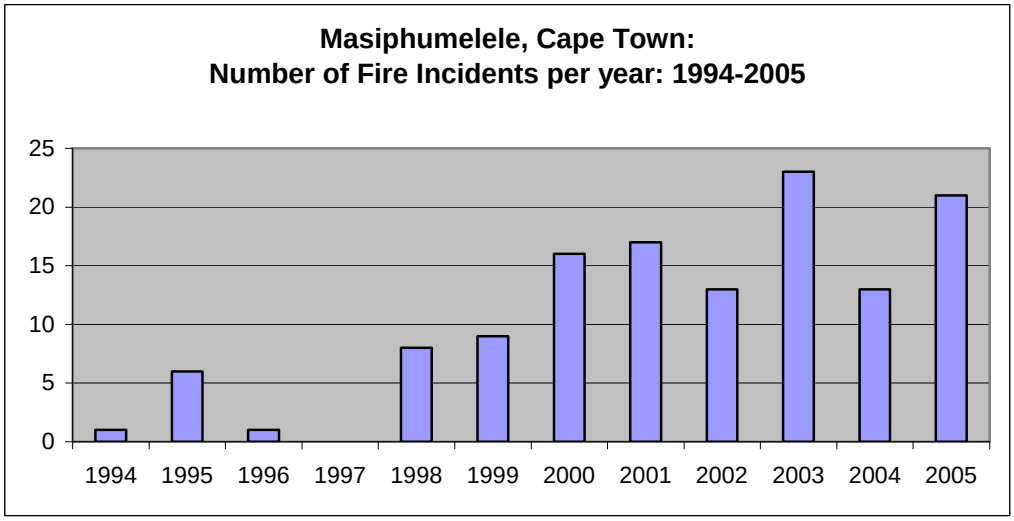


Figure 9: Masiphumelele, Cape Town. Number of fire incidents per year 1994-2004

[10] Training, Education, Awareness and Marketing Project. This is a community capacity development initiative, which will increase the disaster resilience of ten at-risk areas in the Western Cape Province.

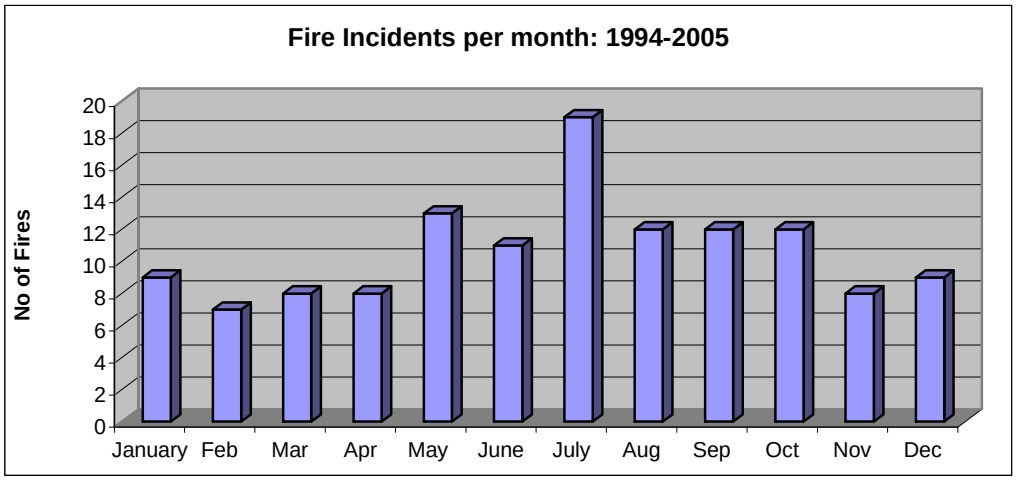


Figure 10: Masiphumelele, Cape Town. Number of fire incidents by month 1994-2004

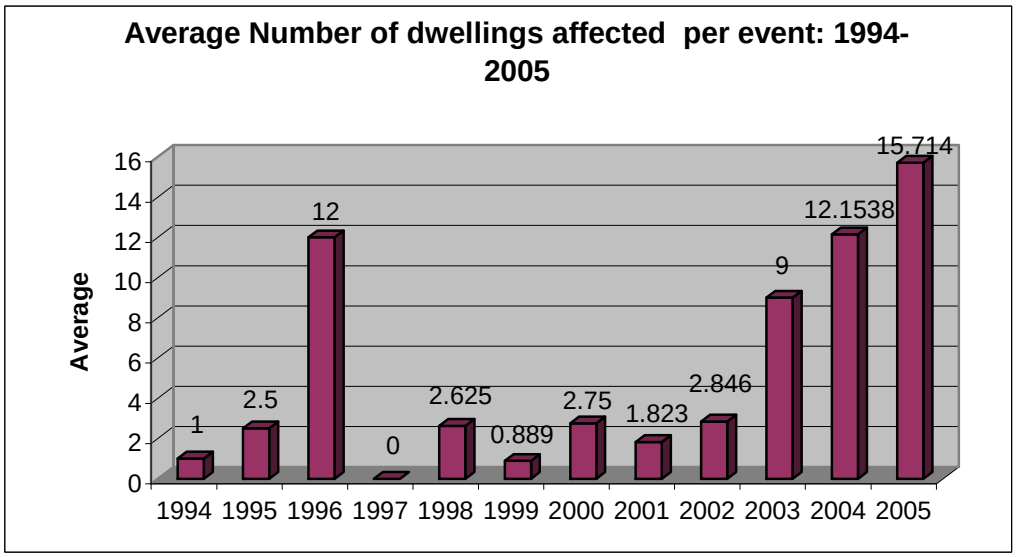


Figure 11: Masiphumelele, Cape Town. Average number of fdwellings affected per fire event 1992-2004

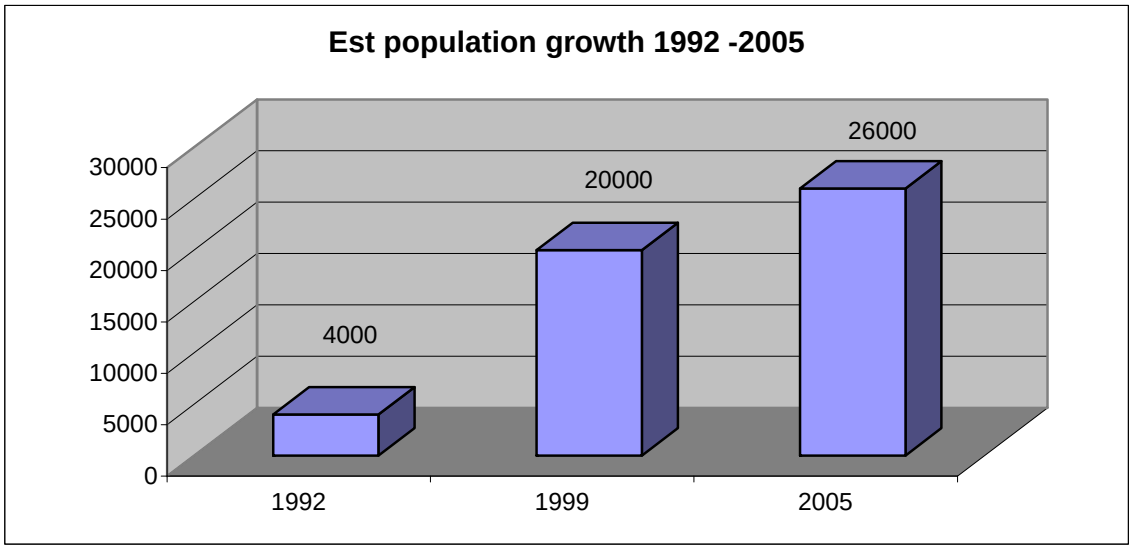


Figure 12: Masiphumelele, Cape Town, Estimated population growth 1992-2005

2.4 Methodological and Institutional Constraints

In addition to the challenges already described, significant methodological and institutional constraints were encountered.

2.4.1 Methodological constraints

A pervasive constraint concerned accurate georeferencing of fire events by Fire Services in informal settlements.[11] Such areas lack formal street addresses or other permanent spatial identifiers. Robust recording of fire locations was further compromised by the burgeoning development of nested clusters of informal dwellings that have emerged with their own identity and name – but are subsumed within larger longer established informal areas.[12] In this context, the spatial boundaries between settlements are highly dynamic.

In addition, large numbers of informal fire occurrences occur within formal neighbourhoods – blurring the distinction between 'formal' and 'informal' – especially when fire events involve more than one housing type.

With particular respect to fire impact information, there was some unevenness in the recording of houses destroyed and direct economic losses to affected households. There is concern that these estimates have not been informed by accurate assessments of the actual assets/property retained within households facing fire risk - and may significantly under-estimate the true and proportionate impact of fire events in poor households.

[11] Precise georeferencing of fire incidents will only commence in Cape Town in 2006 with GPS technology to be installed on fire engines.
[12] In 2006, the Cape Town Metro contained more than 170 distinct informal settlements, with their own identity and name.

Analytically, there are many constraints in estimating incidence and severity. These include the mismatch of census, aerial photograph and house-to-house assessments of true settlement size. This confounds analyses requiring calculation of standard rates. There are also challenges in the analysis of this disaster risk category that spans 'everday' risks and 'disastrous' occurrences. To address these analytic concerns, a range of economic, epidemiological and actuarial science methods will be examined and applied to identify the most useful approaches and/or combinations of methods for analysing fire loss patterns.

2.4.2 Institutional Constraints

DiMP is extremely appreciative of the effort and support extended both by the City of Cape Town's Fire Services and Disaster Risk Management Department. Despite the extraordinary demands placed on them – and the complex character of fire risk within the Metro, Cape Town's Fire Services lack dedicated IT and risk analysis personnel.

Until 2006, there has been limited uptake of the MANDISA outputs or demand for updated information by fire services operational personnel. However, recent changes in leadership of the service have resulted in greater openness for strategic approaches to fire risk reduction – along with increased willingness to work more collegially with partners such as DiMP

A key obstacle to the mainstreaming and uptake of the risk information generated is that the sectors that are strategically positioned to reduce disaster risks, and which are well-resourced with analytic capital have not historically engaged with disaster risk issues. Conversely, while the fire, disaster risk management and emergency services have strong insights about the generation of fire and related risks, their focus is powerfully operational, rather than analytic.

To address these gaps, DiMP has applied MANDISA in complementary ways – by disseminating economic and other fire loss information so that it is accessibly taken up by strategic risk reduction sectors … and by aiming to strengthen the strategic analytic and planning capabilities of selected fire fighters. These opportunities are addressed in Sections 2.5 and 3. below.

2.5 Opportunities for Mainstreaming Risk Reduction

This initiative was implemented with an explicit emphasis on informing and strengthening prospective disaster risk management efforts in fire-prone informal households, communities and areas – as is required both by South Africa's disaster management legislation and the Hyogo Framework for Action.

2.5.1 Focus on policy and institutional arrangements

The value-adding support from AURAN co-financed the updating of both the MANDISA data-base to 2004, along with funding from the Office of the Mayor in the City of Cape

Town and SASRIA.[13] Within three governmental spheres (local, provincial and national), the information has actively informed risk reduction policy.

- Locally, the information has influenced priority-setting in the TEAM capacity-building initiative by assisting in the objective identification of high fire-risk settlements requiring urgent risk reduction action.

- Provincially, the accessible provision of objective temporal and spatial fire loss information has resulted in the profiling of disaster risk as a critical consideration in the Provincial Strategic Infrastructure Plan, practically resulting in:
  - the inclusion of an explicit 'Risk Reduction and Emergency Management' Sector in the provincial plan,
  - the drafting of a potential provincial project to develop policy and processes to incorporate risk management as a transversal consideration in future construction and infrastructure development within the Western Cape.

- Reference to and inclusion of fire loss information in the Province of the Western Cape's strategic study on the impact of climate change, commissioned by the Provincial Department of Environmental Affairs and Tourism.

- Nationally, economic loss information generated by MANDISA was presented in accessible graphs that were presented by the Provincial Department of Local Government and Housing and Provincial Treasury to National Treasury to motivate allocation of National Treasury funds for the implementation of the Disaster Management Act. This information effectively and robustly substantiated disaster risk management funding requirements for municipalities and provinces.

2.5.2 Focus on risk identification and assessment

The information generated has been used extensively in local implementation of the TEAM project to characterise fire risk temporally and spatially within targeted settlements and across informal settlements in the Metro.

2.5.3 Focus on risk reduction knowledge management

The MANDISA information has been extensively used for strengthening understanding and strategic intelligence on fire risk patterns in the Metro. Specifically, this includes:

- Use and accessible presentation of data in workshops, consultations with local government officials, community based organisations and informal settlement residents.
- Use of information to support both formal graduate teaching and learning programmes at UCT as well as short course professional training for development and disaster management practitioners
- Application of data to support graduate research – both in disaster risk science and Actuarial Science

[13] South African short-term insurer with history of government catastrophic loss cover and with explicit interests in exploring potential insurance products to cover local government informal settlement losses.

2.5.4 Focus on reducing risk

The collection, consolidation and accessible presentation of fire loss information in spatial, graphic and tabular forms has served several critical risk reduction objectives. First, it has provided important information for strategic risk reduction planning – especially at settlement level. Second, it has justified the need for strengthened risk management as an integral component of sustainable infrastructural development in the Western Cape. Third, it has demonstrated the value of applying integrated risk science methods to what has in the past been viewed as a 'chaotic' disordered phenomenon that is not easily amenable to management and reduction by municipal services.

2.5.5 Focus on emergency preparedness

MANDISA provides a complementary form of 'early warning' to the traditional tracking systems for weather and other natural hazards. The capabilities to visualise densification of informal fire events, and to monitor sudden increases in incident severity underlines MANDISA's role as an early warning application for settlements highly vulnerable to high magnitude fire events. This area has yet to be fully explored.

3. Strengthening Capacity Building of Fire Services to use Fire Risk Information

3.1 Introduction

During the AURAN research project, it was found that practitioners have difficulty engaging with the quantitative information generated by MANDISA – even although tare their departments generate the data. To try to understand this, a workshop focussing on interpreting this type of information was proposed. The audience to be targeted were from fire services within the City of Cape Town Metropole.

Initially there was limited interest from the fire services resulting in the postponement of the workshop. A meeting was then held with the head of the training department within fire services to determine what the needs of the fire services are regarding skills for interpreting quantitative data. As a result, there was joint agreement with Fire Services to convene a workshop with selected fire fighters.

14 participants attended the workshop on the 10 and 11 of April. The plenary consisted of heads of various departments within the fire services across the Metro, i.e. Training, Operations, Fire Safety and Command and Control.

3.1.1 Objectives

The initial concept was for this workshop to be treated as a pilot, which DiMP would use to test the level of seniority to whom the workshop should be targeted and the depth of detail given in the presentations, exercises and other material. The programme included an introduction to quantitative analysis, introduction to GPS and introduction to the MANDISA information System.

The workshop's main objective was to illustrate the importance of robust data and how application of the information generated can be used to mitigate or at least the minimise

the risk and severity of fires in the Cape Metro. The research team used 3 presentations and 3 practical exercises to achieve this objective.

3.2 Exercises undertaken

3.2.1 Introduction to Quantitative Analysis

One of the objectives of the workshop was to introduce quantitative analysis and to identify the difference between quantitative and qualitative analysis. The participants were adequately familiar with these concepts but approximately 78 percent of the participants did not engage with the practical side of qualitative analysis on a day to day basis.

The 14 participants were assigned to 4 groups, with each group receiving fire reports for Masiphumelele, Fish Hoek, Ocean View and Muizenberg. These informal areas/suburbs were specifically chosen by the research team because most of the participants were very familiar with these sites and did not need information on their respective risks and vulnerabilities. A few incomplete fire reports were purposely included in the batch to highlight a few key issues/concerns without mentioning it before-hand.

The participants were expected to list all the fire incidents using the fire reports, then from this list, draw up a table by grouping the commonalities. From this exercise it was clear participants had trouble distinguishing between lists and tables. Two out of the four groups generated the table without generating a list first; the DiMP team explained how the processes made working with more complex and bigger data sets much easier and skipping the list generation process left a bigger margin of error.

The participants were instructed to do the next exercise which involved generating a graph. The 4 groups did this with almost no difficulty. The purpose of exercise 1 and 2 was to show participants how one can progress from having the raw data in the form of fire reports to generating graphs, which is a more approachable way of presenting data. One of the four groups represented the data incorrectly due to the incomplete fire reports. This error illustrated the importance of good and complete data. Common errors were highlighted and thoroughly discussed. At the end of the first session, the participants felt confident about their new acquired skills.

3.2.2 Introduction to Global Position Systems and Spatial Data

Most of the participants had never engaged with a GPS handset before and some assistance was needed. Again the 14 participants were assigned to 4 groups with different exercises. Group 1 had to track the perimeter of the area surrounding the Epping fire service training facility, Group 2 had capture the co-ordinates of the 3 corners of the area surrounding the training facility, Group 3 had to capture specified features in the surrounding area (i.e. a pylon, an intersection and the parking area) and Group 4 had to use the GPS handset to navigate and find another set of specified features. Each GPS exercise had a specific purpose. See figures 13, 14 and 15 below.

Figure 13
Track logs of the area surrounding the training facility

Group 1's GPS exercise illustrated the ideal way a GPS handset could be used to record the extent of a fire. In reality this approach is not very practical and presents a number of issues, resource-related and other.

Figure 14:
Waypoints captured on the corners of the area surrounding the training facility

Group 2's GPS exercise illustrated another way of using a GPS handset to record the extent of a fire that does not require walking around the fire's perimeter but still captures the extent of the fire. This way has its limitations but is more accurate than the current method.

Figure 15
Waypoints of specific featured captured

Group 3's GPS exercise showed how a GPS handset can be used to capture the starting point of the fire. This method also has its limitations but because most of the fires in the Metro are small to medium, this method was considered adequate.

Group 4 used the GPS handset to navigate and find specified features. This exercise illustrated the role of a GPS handset for locating features like fire hydrants. Finding fire hydrants is a critical issue faced when fire services respond to fires in informal areas.

3.3 Introducing MANDISA information System and Feedback and Recommendations

This workshop was an excellent platform to introduce MANDISA to the participants who were not familiar with it, to show examples of outputs and stress the value of good, complete data.

The workshop proved to be successful with participants acknowledging the importance of a data and data analysis workshop as most of the fire service officers had never undergone training of this nature. Participants recognised that data collection, capturing and analysis are critical for mitigating fire risks in some areas and minimising the fire severity in others.

The plenary recommended that the research unit facilitate a workshop similar to this but focus on district level.

It was also suggested that DiMP facilitate a one day workshop focusing on the importance of correct data-capturing and help develop skills within in the fire service. This skill development workshop should run in conjunction with the 7 day fire service training course, as each rank level should be able to collect, capture and analyse data efficiently.

Mandisa was well-received and it was suggested that this information system be used to identify the areas to target the fire safety and awareness campaigns that the fire service is involved and also be used to monitor the success of these campaigns.

The participants suggested a more in-depth demonstration of the Mandisa Information System, showing all the processes that the research team follows from interpreting and capturing the raw data to querying the internet reporting module. A discussion for such a workshop/meeting is still in progress.

The participants agreed with the suggestion of installing a MANDISA server in the Goodwood fire control centre. This will allow the fire services to query, analyse and interpret their own data for strengthened fire risk management.