DRAFT REPORT

JANUARY 2000 FIRES: AN ASSESSMENT OF PERCEPTIONS

prepared for

Working for Water Programme
Department of Water Affairs and Forestry

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1. INTRODUCTION

1.1 Background to the study

In October 2000 the Working for Water Programme issued a proposal call to undertake an assessment of the insurance risks of invading alien plants in urban areas. The objectives of the study were to:

- Establish whether invading alien plants increase the risk of fires or floods;
- To quantify the risks in terms of costs to property owners and insurance agencies;
- Identify actions that can be taken to minimise insurance costs;

- Identify high-risk areas in the case study area;
- Recommend changes or additions to legal instruments to curb the risks posed by invading alien plants.

In November 2000 the Environmental Evaluation Unit (EEU) of the University of Cape Town was appointed to undertake the required work as set out in the proposal call and the proposal submitted by the EEU, dated October 2000. A review and synthesis of the role of invading alien vegetation in fires in fynbos was subsequently drafted.

The review noted that there are presently gaps in our understanding concerning the consequences of alien plant invasion into fynbos systems. More research is required for developing models that predict the rates of spread (Cowling *et al.*, 1997) and impacts associated with alien plant invasion into fynbos systems. Further research should also not ignore the economic implications associated with managing the impacts of alien encroachment on biodiversity and ecosystem processes. Detailed economic studies in this field are considered to be urgently needed (van Wilgen, 2000)

The review concluded that caution should be taken when discussing the possible relationships between fire intensity and any other factor (such as risk to properties on the urban edge). The broad range of findings derived from the few fire-intensity related studies in fynbos highlight the difficulties associated in measuring and comparing fire intensity in the field, particularly as it is affected by so many variables. Current understanding concerning the nature of fire-intensity and the effects of fire intensity are limited, and cannot, as yet, be extrapolated into generalisations across the entire biome.

Although hard scientific data is therefore limited, fire intensity has been identified (particularly in Australian ecosystems) tio be the principle risk factor in determining property damage (Wilson and Ferguson, 1986 in Scott *et al.*, 2000), and is considered typically lower within indigenous stands of fynbos, relative to those of most alien vegetation species, due primarily, to the fuel characteristics of alien vegetation (see Chapman and Forsythe, 2001). This risk of fire damage to property (due to the presence of invading alien or other vegetation) is particularly high when, during the dry season, (and exacerbated during drought years), there are high wind speeds, and properties are located on steep gradients with sandy substrates. Under such circumstances, the consequences of fire and flooding would be more severe, and as such, there would be higher risk of fire damage to property and personal safety.

However, following meetings with Working for Water staff and the Technical Review Panel, it became apparent that there were a number of potential problems associated with the original set of objectives which would make it extremely difficult for the study to achieve its stated aim, namely to assess the insurance risk posed by invading alien plants in urban areas. Based on the discussions with the Working for Water team, it was agreed that the objectives of the overall study should be revised to ensure that the following issues were addressed, namely:

(i) An estimation of the direct and indirect costs associated with the fire;
(ii) An assessment of the attitudes and perceptions of various groups to a variety of fire related issues, in particular the fire risk posed by invading alien plants;
(iii) Principal factors which contributed significantly to the risk of the fire damage;

(iv) Instruments/incentives/actions that could be implemented to curb the risks posed by fires, with specific reference to the role of invading alien plant species.

However, due to time constraints and the urgency associated with obtaining information from the first 2 issues it was decided that Phase 1 of this study would focus on:

(1) Estimating the direct and indirect costs associated with the January 2000 fires; and
(2) Assessing the attitudes and perceptions of various groups to a variety of fire-related issues, in particular the fire risk posed by invading alien plants.

The Terms of Reference for the study were subsequently revised and various consultants were invited to tender for this project. The EEU was appointed to undertake the study in October 2001.

1.2 OBJECTIVES

The 2 main objectives of this study were to:

1. Provide an assessment of the direct and indirect costs associated with the January 2000 fires; and
2. Assess the attitudes and perceptions of selected groups (in particular property owners living on the urban edge, estate agents, insurance companies, and home loan institutions) to a variety of issues relevant to the January 2000 fires, in particular, the fire risk pose by invading alien plants.

This draft report documents the results obtained from interviews conducted amongst the various groups and provides key findings.

The focus of this report was to gain an understanding of the attitudes and perceptions of a range of groups, in particular property owners living on the urban edge, estate agents, insurance companies, and home loan institutions to a variety of fire-related issues, in particular the enhanced fire risk posed by invading alien plants.

2. METHODS

2.1 Target Sectors

The major group targeted in this study was property owners living on the urban edge within those parts of the Cape Metropolitan area that were impacted by the January 2000 fire event. The key objective was to gain an understanding of the costs, attitudes and perceptions of a representative sample of property owners living on the urban edge that were in some way impacted by the fire and/or post fire related events (e.g. mudslides, flooding etc) to a range of fire related issues. (For this draft report, information gathered on direct and indirect costs incurred by property owners living on the urban edge, and included in the survey, is also included). The attitudes and perceptions of this group were compared with a second group of people, namely those people living on the urban edge in fire prone areas, but not affected by the January 2000 fires. A secondary objective of this survey was to ascertain whether there were substantive differences in the response patterns of people that were directly impacted by the January 2000 fires and those living in the same localities (suburbs) in fire prone areas, but not directly impacted by the January 2000 fires.

The other groups targeted in the perceptual and attitudinal survey included estate agents, insurance companies and home loan institutions. The aim of these surveys was to gauge the level of awareness of these different groups to a range of fire-related matters, in particular their perceptions towards fire risk posed by invading alien plants on the urban edge. Within the time and budget allocated for the study only a limited number of interviews were held with each group. Consequently the results presented must be viewed as preliminary. The methods employed in undertaking these surveys are discussed in the section dealing with each of these sectors.

The universe for the attitudinal study amongst property owners comprised all property owners living on the urban edge of the Cape Metropolitan area. A stratified sampling design was used to select households on the urban edge that were impacted by the fire in four suburbs (hereafter localities), namely Hout Bay, Simon's Town, Constantia and Fish Hoek/Noordhoek. The rationale for limiting the sites to these four localities is purely logistical.

A separate component of the study was concerned with interviewing all property owners of houses that were destroyed. Interviews were held with the owners of 8 out of the 12 houses that were destroyed in the January fires. It was not possible to make contact with the owners of the other 4 houses.

As mentioned above, a secondary objective of the survey amongst property owners was concerned with comparing the attitudes and perceptions of those impacted by the fire with an equivalent group of property owners living on the urban edge, in the vicinity of dense stands of invading alien plants, but in areas which did not burn during the January 2000 fires. The objective here was to assess whether these two groups, with very different fire experiences, hold significantly different views on a range of fire-related issues, in particular with respect to the role of alien vegetation in the fires and the measures that should be taken to reduce such risks. For comparative purposes it was preferable to identify highly vulnerable areas on the urban edge in the same four localities.

2.2 Survey design considerations

2.2.1 Representativeness of the survey versus detection of location specific results.

During the survey design phase of the study it was necessary to weigh up whether it was more important to obtain a representative view of differences between impacted and non-impacted houses, or whether it was necessary to obtain an estimate of how the impacted versus non-impacted perceptions and data differed between localities. Whether it was more important to be able to make a comparison between perceptions from non-impacted and impacted property owners regarding for the Cape Peninsula as a whole, or report on those perceptions in Simonstown for example, had to be established. There is clear conflict between these two survey objectives in the context of a constraint on the total sample size. In order to pick up differences between areas the tendency is to want to increase the sample size per area in order to ensure that relevant areal differences are detected. When, as is usually the case, there is a sample size constraint, this can only be achieved by reducing the number of areas sampled. The logical endpoint of this is to sample only two areas. This is in direct conflict with a survey objective which seeks to obtain maximum representativeness for the Cape Peninsula as a whole, a goal which is achieved by maximizing the number of areas sampled. The pursuit of this goal ends in sampling n/2 areas where n is the total sample size.

The basic principle that was adopted at the design stage was that representativeness was more important than the detection of areal differences. Consequently, the study focused on comparing the responses from 2 main groups, namely those property owners impacted by the fire, and those vulnerable to fires but not impacted by the January 2000 fires. However, for other obvious logistical reasons, this was not taken to its logical endpoint , and as a result 4 areas were chosen for the purpose of the formal balanced survey.

2.2.2 Sample size

Sample size was dictated both by budget constraints and statistical considerations. Budget limitations put an upper limit of about 100 on the sample size. In a complex questionnaire such as was used for this study, a simple surrogate question type must be chosen for the sample size determination based on statistical considerations. This was chosen as the ability of the study to detect a difference in response rates between the impacted and non-impacted groups for a question with dichotomous possibilities, i.e. Yes or No. In such a situation, the requisite sample size is determined by the true proportion of Yes's in the impacted and the non-impacted groups, p_i and p_n respectively, and the Type I (probability of falsely rejecting the null) and II (probability of failing to reject the null under a plausible alternative hypothesis) error rates that are chosen for the χ^2 test that will be conducted to test the null hypothesis of no difference between the two groups. We set these levels at Type I: 5% two tailed, and Type II: 20% (i.e. a power of 80%). Sample sizes that meet these requirements are presented in Table 1.

Table 1: Sample sizes that test the null hypothesis of no difference between the two groups (computations derived from SPSS SamplePower software)

p_i	p_n	Total n required
0.6	0.5	780
0.6	0.4	196
0.6	**0.3**	**84**
0.6	**0.35**	**122**
0.3	0.2	582
0.3	**0.1**	**124**

Table 1 shows that a survey sample size of about 100 will be adequate in situations in which the difference between the proportion of Yes respondents in the two groups is substantive, e.g. 0.6 versus 0.3, or, 0.3 versus 0.1. However, it is inadequate for the detection of finer differences.

2.2.3 Selection of survey sites and sampling procedures

Two considerations motivated the selection of survey sites:

a) A desire to mininimise variance in order to be able to pick up meaningful and real differences between impacted and non-impacted sites.

b) Avoidance of bias.

The main consideration with regard to variance (apart from the trade-off between areal differences and representativeness discussed in the preceding section), was the complication presented by houses that were completely destroyed by the fire of January 2000. It was felt that these cases could potentially introduce confusing outlier effects into the survey database (for example if some of them were vicariously included in the survey following a random selection process) and that it was preferable to omit these from the formal balanced survey and rather carry out a separate survey consisting of all totally destroyed houses.

In surveys where sampling sites have a spatial location, a number of considerations arise. The first is the possible existence of strata. If strata which encompass sites with distinct characteristics exist, and if there are variance differences between these strata, then variance minimization procedures can be adopted. These involve differences in sampling intensity in certain strata compared to others.

In addition to the above considerations, there may be a range of factors in the field which could bias the results. This raises a host of issues, and re-opens the debate about the representativeness of the survey. Two standard approaches commonly employed are either to select sampling sites at random, but imposing a minimum distance between any two sites, or alternatively, a simple systematic approach, e.g. sampling every third house, or sampling houses at distances of every 100, 200 or 300 metres. Although these two approaches seem to be diametrically opposite, the literature remains divided on the best approach.

Based on discussions with Ukuvuka personnel familiar with areas impacted by the January 2000 fires and areas heavily infested with invasive alien vegetation, but not impacted by the January 2000 fires, four localities were selected for the survey. These included Hout Bay, Constantia, Simonstown and the Noordhoek-Fish Hoek area. Aerial photographs and layout plans for the areas to be surveyed were reviewed and used to identify the properties/houses to be included in the study sites. These aerial photographs and layout plans are included in Appendix 1.

The intention was to adopt a systematic approach to the selection of houses to be interviewed. The intention was to interview homeowners from every second property in the locality identified on the urban edge, a maximum of 26 per locality – i.e. 13 from the impacted area and 13 from the non-impacted area in each locality. However, in practice, this site selection approach was complicated by the fact that in many instances there was no one at home and interviewers had to bypass any number of houses before finding someone home. Consequently only persons found home during the 4-day survey period between 10h00-15h00 on day 1 of the survey, and 15h00 and 19h00 thereafter, were interviewed. However, by extending the survey period until 19h00 on three of the days, interviewers were able to interview property owners who were absent from their homes during working hours. Over the four-day period interviewees went back to houses not occupied on the previous day(s) until 26 households had been interviewed in each locality.

2.2.4 Questionnaire design

Because of the low response rate associated with mail surveys and the importance of verifying certain responses (e.g. locality of property in relation to urban edge/alien plants), personal interviews were conducted will all interviewees. The questionnaire was designed in consultation with members of the Working for Water (WfW) Programme and Ukuvuka Campaign involved in this study. Draft questionnaires were circulated to WfW and Ukuvuka members for comment prior to pilot testing. The questionnaire for the property owners was divided into 2 parts. Part 1 focused on the direct and indirect costs associated with the January 2000 fires as well as the nature of action taken by property owners prior to and after the fire to minimize the fire risk. Part 2 was concerned with the attitudes and perceptions of property owners to a range of fire-related issues and their levels of awareness of relevant legislation and the role of agencies responsible for addressing the fire risk posed by invading alien plants. The complete questionnaire is given in Appendix 2.

The questionnaires for the other 3 sectors interviewed namely the banking sector, estate agents and the insurance sector are provided in Appendix 3, 4 and 5 respectively.

2.2.5 Statistical tests

Analysis of the data has primarily involved an examination of differences in response between the two groups, that is, the 'impacted' and non-impacted' households. In all cases, the null hypothesis for the statistical tests is that there is no difference in response between these two groups.

The statistical approach adopted during analysis differs depending on the nature of the data associated with the response information. As with any survey of this kind the following kinds of data are typically encountered:

(i) **Numerical data:** Numerical data would be data such as the monetary amount associated with fire damage. With data such as these it is possible to calculate means and variances. If the normal distribution is a reasonable approximation to the statistical distribution of such data, then an unpaired t-test is appropriate for calculating the probability level associated with the observed data under the null hypothesis, and hence for rejecting the null.

(ii) **Yes/No responses:** If the response to a question is simply "Yes" or "No", then the χ^2 test provides a suitable statistical criterion for rejecting the null hypothesis. It is clear that in such a case, rejection of the null implies that the proportion of Yes's in one of the impacted or non-impacted groups is larger than in the other group, so this test provides an unambiguous interpretation of what is meant by rejecting the null

(iii) **More than 2 possible categorical responses which are not ordered:** A response to the question "Tick which alien plant is most common in your area" when there are 5 possible alien species to choose from gives rise to a 2x5 contingency table (that is, a table with 2 columns headed impacted and non-impacted respectively, and rows indicating the frequency for the 5 alien species chosen as the common alien plant species). In such a situation the χ^2-test would most commonly and correctly be applied to test the null hypothesis that the distribution of "most common alien species" is the same in impacted and non-impacted areas. However, unlike the Yes / No example described above, rejection of the null hypothesis does not provide an unambiguous description of what feature, in the two frequency distributions, is responsible for this result. There are an immense number of kinds of differences in the frequencies which would give rise to a significant result.

(iv) **More than 2 possible responses which are non-numerical but ordered:** Data such as this arise in response to a question like:

"What do you think were some of the major natural factors contributing to increasing the severity and intensity of the fires of January 2000? (Please indicate on scale provided, 1 being least important, 5 being extremely important): Options 1-5 provided in a tick box.

This data will give rise to a contingency table with the same size and dimension as for the alien species example discussed above, where in this table the different importance levels would just be used to assign row names. As with the alien species example, the χ^2- test could be used to test the null hypothesis that the distribution of "level of importance of a particular natural factor" is the same in impacted and non-impacted areas. However, rejection of the null hypothesis based on this test could easily be uninformative, because an unlikely χ^2 value might arise in many different ways, not all of them necessarily implying a difference in the overall level of importance. For example a U-shaped distribution for the impacted group and an inverted U-shaped distribution for non-impacted group might produce a large χ^2 value leading to rejection of the null hypothesis, although the average level of importance in the two groups is the same. In order to get around this problem, it is common practice to scale the data, so that a tick in box 1 is converted to a numerical value 1, a tick in box 2 is converted to a numerical value 2, etc.

This assigns a scale to the ordinal data, implying, for example, that importance level 5 is 20% more than importance level 4, and importance level 4 is 33.3% more than importance level 3. Having converted the ordinal data to numerical data in this way, a t-test or some such criteria is then used to test the null hypothesis that the mean response is the same between the impacted and non-impacted groups. It is important to realize however that these scales are arbitrary, and that there is an infinite number of possible scales that could be assigned. It then becomes easy to find cases in which the significance level of the numerical tests implies either rejection or acceptance of the null hypothesis depending on the scales that are chosen. Neither this approach nor the forementioned χ^2 test are therefore recommended for multi-level ordinal data. Rather an approach which uses ranks is preferred, since strictly the ranks are all that is known about the relationship between different responses. One such test is the Mann-Whitney Test for ordinal data. This involves ranking the data regardless of the group of interest (impacted versus non-impacted), then separating the set of ranks by group. The test statistic is then based on the sum of these rank values by group and the relevant degrees of freedom. As in the case of numerical data, although the standard Mann-Whitney Test is ostensibly a non-parametric test, it does make certain distributional assumptions. These assumptions can be avoided by the use of the SPSS Exact Tests module, which calculates a probability level for the Mann-Whitney test statistic under the null hypothesis which is free of the normal distributional assumptions.

To summarise the above, the following statistical values are cited for different types of data:

1. **Numerical data:** One and two-tailed probability levels associated with the t-test statistic, under the null hypothesis that the mean values in the impacted and non-impacted groups are equal.
2. **Yes/No (dichotomous) responses:** Probability levels associated with the χ^2-test statistic, under the null hypothesis that the mean values in the impacted and non-impacted groups are equal.
3. **More than 2 possible categorical responses which are not ordered:** Probability levels associated with the χ^2- test statistic, under the null hypothesis that the mean values in the impacted and non-impacted groups are equal.
4. **More than 2 possible responses which are non-numerical but ordered:** One and two-tailed probability levels associated with the Mann-Whitney statistic under distribution free conditions as given by the SPSS Exact Tests module, under the null hypothesis that the mean values in the impacted and non-impacted groups are equal.

All statistical analyses were carried out by SPSS-SA (Pty) Ltd using the "SPSS Base" product. The sample size calculation presented for the survey design phase of the study was carried out using the SPSS product "Sample Power". Computer generated analogues of the questionnaires were designed with the SPSS product "Data Entry Builder". Data capture was achieved using the SPSS product "Data Entry Station". The analysis of open ended questions was carried out using the SPSS product "Text Smart".

2.2.6 Pilot Testing

Once the feedback obtained from personnel from WfW and Ukuvuka had been integrated into the modified questionnaire, pilot testing was undertaken in one of the localities selected for the survey, but in a different area within that locality – namely Bokkemanskloof in Hout Bay. This area in Hout Bay mirrored the situation in the selected sampling sites, namely properties on the urban edge directly impacted by the fire and those vulnerable to fire risk due to the presence of dense aliens but not impacted by the fire. Ten questionnaires were administered in Bokkemanskloof and minor changes were made to the questionnaire in light of feedback obtained from the interviewers. Data from the Pilot tests were not included in the final analysis.

2.2.7 Training interviewers

Eight post-graduate students (four from the University of Cape Town and four from the Peninsula Technikon) were employed to assist with the administration of the questionnaires. All students were required to attend a one-day training at the EEU, UCT prior to conducting the interviews. A copy of the training programme agenda is provided in Appendix 3.

2.2.8 Conducting the interviews

Students were divided into four groups and allocated a locality (i.e. a team of two students per locality, one student from each institution comprising the team). Each group was supervised by a senior post-graduate student or member of the EEU staff. Groups were transported by the supervisor to the sampling sites each day and were in contact with the supervisor after each interview. The supervisor co-coordinated the selection of houses for interview, kept a record of erf numbers of houses where property owners interviewed, and provided support to interviewees when necessary. In most localities, homeowners were willing to be interviewed and answered the questions with interest. However, gaining access to houses in Constantia proved difficult and time-consuming, and therefore required additional time and resources in order to complete the 26 interviews.

3. RESULTS AND DICUSSION

The results and discussion section reports on information obtained from four groups interviewed in this survey, and is divided into four parts (A-D), based on the sectors studied (property owners on the urban edge, members of the banking sector, estate agents and representatives from the insurance industry).

A. Property owners on the urban edge

The questionnaire aimed at deriving information from property owners living on the urban edge, was structured in two parts: Part I dealt with the direct and indirect costs associated with the January 2000 fires, while Part II focused on attitudes and perceptions of property owners to a range of issues relevant to the January 2000 fires. In keeping with the objectives of this study, the results section focused on a comparison between impacted and

non-impacted group response, and whether the responses obtained from these two groups were significantly different.

The tables presented in this section provide a summary of responses by group (Impacted or Not-Impacted) as frequencies, as well as summary data obtained from 8 houses that were destroyed. DNA denotes the category of respondents 'Did Not Answer'. Three different possible probability levels are considered, those associated with the χ^2 statistic (by definition a one-tailed probability level), the Mann-Whitney U statistic (using a two tailed probability level), and the t-statistic (also using a two-tailed probability level). These are appropriate for categorical, ordinal and quantitative responses respectively. Where it is stated that a difference is statistically significant, this is at the 5% confidence level. The 'destroyed homes' category of responses provided in the tables where relevant, are not included in the statistical test results shown. N/A indicates that a particular test statistic is not appropriate for the particular data case indicated.

PART I: DIRECT AND INDIRECT COSTS

Part I of the questionnaire sought to obtain information on the direct and indirect costs associated with the January 2000 fires. The results comparing impacted versus non-impacted households are summarised in the Tables provided. Summary data obtained from the respondents of the eight houses that were destroyed is also provided in the Tables where appropriate.

1.1.Nature of the impact experienced

The first two questions focused on the nature of impact experienced by property owners living on the urban edge.

Respondents were asked to indicate whether their property or home had been destroyed[1], damaged or threatened in any way during the January 2000 fires. Table 1.1 tabulates, and Figure 1.1 illustrates the comparison between the two areas concerning the number of houses damaged and threatened, versus those neither damaged nor threatened.

[1] All houses that were destroyed in the January 2000 fires were treated as a separate group.

Table 1.1 Nature of the impact experienced

1. Was your property or home destroyed, damaged or threatened in any way by the fire of January 2000?	GROUP	DNA	Neither threatened nor damaged	Threatened	Damaged	*TOTAL N*	χ^2 p-value	U p-value
	Impacted		4	28	20	52	N/A	1.67×10^{-11}
	Not-Impacted		36	16	1	53		
	Destroyed					8		

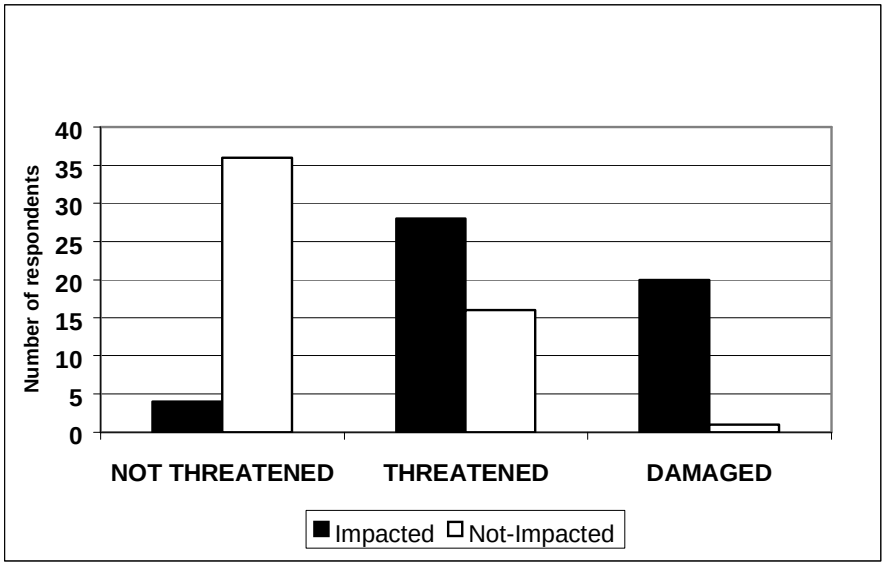


Figure 1.1 Nature of impact experienced

Since the geographical areas were selected according to exposure to fire related activities during the January 2000 fire event, Figure 1.1. confirms appropriate identification of geograhical areas, as very few respondents from the "impacted" areas were not threatened by the fire, whilst many of the "not-impacted" respondents were not threatened by the fire event. Almost twice the number of respondents in the "impacted", relative to the "not-impacted", area indicated that they were threatened, and twenty times the number of respondents in the "impacted" area indicated they suffered some form of fire-related damage.

This difference in the numbers of threatened and damaged houses in the impacted group is substantial and clearly statistically significant (Mann-Whitney Test two tailed probability level < 0.001). This confirms the selection of the impacted and non-impacted households underpinning the survey.

Responses concerning the evacuation from property during the course of the January 2000 fires further affirms the choice of impacted versus non-impacted households as viable categories for comparison, as indicated in Table 1.2 and Figure 1.2 below.

Table 1.2 Evacuation of property

2 (a). Did you evacuate your home during the course of the January 2000 fires?		DNA	YES	NO	TOTAL N	χ^2 p-value	U p-value
	Impacted		36	16	52	1.67E-09	N/A
	Not-Impacted		6	47	53		
2(b). If Yes, for how long (hours)		**DNA**	**Mean**	**S.E.**	**TOTAL N**	**χ^2 p-value**	**U p-value**
	Impacted	47	8.98	1.845	5	N/A	N/A
	Not-Impacted	17	1.47	0.952	36		

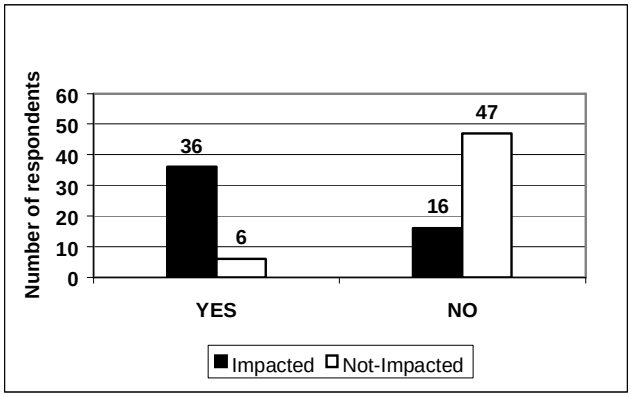


Figure 1.2. Respondent evacuation of property

Both Table 1.2 and Figure 1.2 show that a substantially greater proportion of homeowners evacuated their homes in the impacted group (69% of the respondents in impacted group, compared to only 11% of the respondents in the non-impacted group). This difference is statistically significant at the 5% level (Table 1.2).

The response to Question 2(b) shows that the length of evacuation was a mean of 8.98 hours in the case of impacted evacuees, compared to only 1.47 hours for the so-called non-impacted evacuees, and the difference between the two is statistically significant at the 5% level (Table 1.2).

1.2.Level of awareness

Question 3 sought to ascertain the level of awareness of potential property owners to the fire risks associated with living on the urban edge.

Table 1.3 Level of (a) general awareness, and (b) informed awareness and (c) the source of such information

(a)

3 (a). Were you aware of the potential fire threat posed by veld fires when you purchased / took occupation of the property		DNA	YES	*NO*	TOTAL N	χ^2 p-value	U p-value
	Impacted	1	32	19	52	3.09E-01	N/A
	Not-Impacted		28	25	53		
	Destroyed		5	3	8		

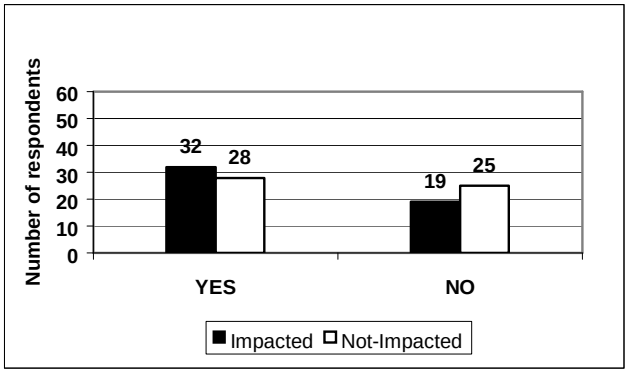
(b)

3 (b). Were you informed of the potential fire threat posed by veld fires when you purchased / took occupation of the property		DNA	YES	*NO*	TOTAL N	χ^2 p-value	U p-value
	Impacted		8	44	52	9.67E-01	N/A
	Not-Impacted		8	45	53		
	Destroyed		2	6	8		

(c)

c) If yes, by whom?		TOTAL N
	Estate agents	3
	Neighbours	3
	Own research	3

(a



(b

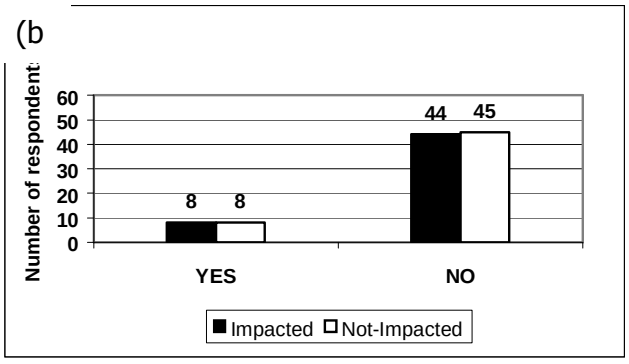


Figure 1.3 (a) Level of general awareness and (b) informed awareness

As one might expect, Table 1.3(a) shows that there is no statistically significant difference in perception about the potential fire threat posed by veld fires at the time of purchase and/or occupation of the property, between the impacted and non-impacted groups. Overall 60 persons (58%) responded that they were aware of the threat posed by veld fires to properties on the urban edge, while 44 persons (42%) said that they were not aware of the risks. The level of awareness amongst interviewees whose homes had been destroyed, 5 of the 8 interviewees indicated that they had been aware of the threat posed by veld fires to properties on the urban edge.

Very few (16 out of 105 persons, that is 15%), of the two main groups interviewed indicated (in response to question 3(b), as presented in Table 1.3(b) and Figure 1.3(b)) that they had been informed about the risks of veld fires on the purchase and/or occupation of their property. The source of this information, where indicated, is split equally between estate agents,

neighbours and their own personal research – only 9 persons offered information as to the source of this information (see Table 1.3(c)). This result is surprising, given the feedback from the survey conducted amongst estate agents in the study area, which showed that half of the estate agents interviewed (section C) indicated that they did inform potential buyers of all the information relevant to their purchase including the fire risks associated with living on the urban edge.

1.3.Nature of damage and associated costs

The following group of questions was concerned with the nature of damage and the costs associated with damage during and after the fire. Table 1.4 (a) provides an indication of the nature of the damage incurred by property owners from the impacted group, as well as the number of properties impacted.

Table 1.4 (a) Nature of the damage and (b) strict statistical costs (in Rands) and (c) extrapolated costs (in Rands, assuming a 50/50 split between impacted and non-impacted households on the urban edge) associated with the damage

(a)

4. What was the nature of the damage and what were the costs associated with the damage						
a) Damage to roofs/ceilings	**GROUP**	**DNA**	**YES**	**NO**	***TOTAL N***	**χ^2 p-value**
	Impacted		**6**	**46**	**52**	**1.126E-02**
	Not-Impacted		**0**	**53**	**53**	
b) Damage to walls of houses	**Impacted**		**7**	**45**	**52**	**5.93E-03**
	Not-Impacted		**0**	**53**	**53**	
c) Damage to contents of house	**Impacted**		**5**	**47**	**52**	**8.96E-02**
	Not-Impacted		**1**	**52**	**53**	
d) Damage to garden infrastructure	**Impacted**		**14**	**38**	**51**	**1.00E-05**
	Not-Impacted		**0**	**53**	**53**	
e) Damage to garage/other buildings	**Impacted**		**7**	**45**	**52**	**5.38E-05**
	Not-Impacted		**0**	**53**	**53**	
f) Damage to garden	**Impacted**	**1**	**20**	**29**	**52**	**5.93E-03**
	Not-Impacted		**0**	**52**	**53**	
g) Other		**98**				
	Ash		**4**			
	Carpets		**2**			
	Sewage drains		**2**			

(b)

a) Damage to roofs/ceilings	GROUP	DNA	Mean	SE	Median	TOTAL N
	Impacted	47	R99100	R76228	R20000	5
	Not-Impacted	53				
b) Damage to walls of houses	Impacted	48	R8950	R7055	R2500	4
	Not-Impacted	53				
c) Damage to contents of house	Impacted	50	R40120	R39880	R40120	2
	Not-Impacted	52	R400			1
d) Damage to garden infrastructure	Impacted	42	R34409	R17436	R9000	11
	Not-Impacted	53				
e) Damage to garage/other buildings	Impacted	46	R85667	R35723	R50000	6
	Not-Impacted	53				
f) Damage to garden	Impacted	42	R15220	R4917	R10000	10
	Not-Impacted	53				
g) Other	Impacted	48	R77100	R74304	R3500	4
	Not-Impacted	53				

(c)

	GROUP	DNA	Total number of respondents	TOTAL N	*Extrapolation*
a) Damage to roofs/ceilings	Impacted	47	5	52	R4 762
b) Damage to walls of houses	Impacted	48	4	52	R338
c) Damage to contents of house	Impacted	50	2	52	R772
d) Damage to garden infrastructure	Impacted	42	11	53	R3 639
e) Damage to garage/other buildings	Impacted	46	6	52	R4 942
f) Damage to garden	Impacted	42	10	52	R1 463
g) Other	Impacted	42	10	52	R2 965

Responses to question 4 (presented in Table 1.4 (a)) indicate the nature of the damage suffered during the fire, obviously predominantly by the impacted group. Not all persons indicating damage to a particular part of the house or property provided information on the costs of the damage, however Table 1.4 (b) does provide this information where it was forthcoming from the respondents. The sample size for this information was small, so for example, 6 persons provided financial estimates concerning costs incurred from damage to roofs and ceiling. This provides a statistical mean cost of R99100 and a standard error of R76228 for costs incurred from damage to roofs/ceilings.

The large size of the standard error means that this information provides a weak basis for estimating the average cost of damage. Focusing on roofs and ceilings, and attempting to gauge a statistically meaningful result, , if only 5 out of 52 of the impacted group suffered damage to roofs and ceilings, then the average cost of damage to roofs and ceilings for the group as a whole is 5/52 multiplied by the mean of R 99 100, a figure of R 9 529. This approach has been undertaken in order to extrapolate costs associated with impacts to

households on the urban edge regardless of the grouping (impacted or non-impacted). Assuming a 50/50 split between impacted and non-impacted households on the urban edge, an overall figure for damage to roofs and ceilings of R 4 764 is obtained. Using the same approach for the other kinds of damage produces the average costs listed in Table 1.4 (c).

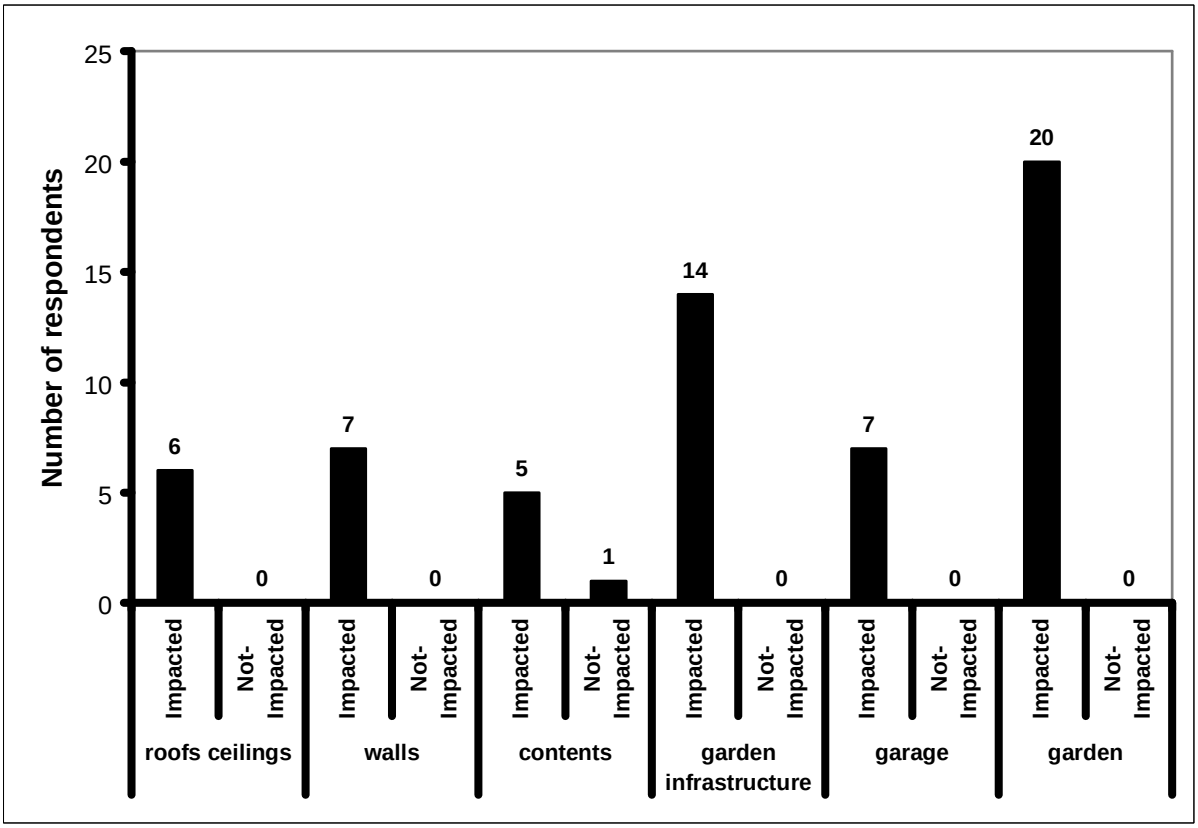


Figure 1.4 Nature of damage experienced

Damages listed most frequently were predominantly associated with damage to garden infrastructure, however greatest costs incurred were associated with damage to roofs/ceiling and damage to garages or other buildings. Under the category of 'other', damage by ash is listed most frequently (4 out of 8 responses), relative to damage to carpets and sewage drains.

1.4.Post fire- related events

The main kinds of damage associated with post fire-related events (Question 5) was provided by all interviewees. Their responses are documented in Table 1.5 below.

Table 1.5 Post fire-related events

5. Was your home or property damaged/affected by any fire related events that occurred after the fire.	GROUP	DNA	YES	NO	*TOTAL N*	χ^2 p-value
	Impacted		26	26	52	6.31E-02
	Not-Impacted		17	36	53	
If yes please indicate what type of effect/damage						
a) Actual fire damage	Impacted		3	49	52	7.75E-02
	Not-Impacted		0	53	53	
b) Flooding of garden	Impacted		4	48	52	4.05E-02
	Not-Impacted		0	53	53	
c) Excessive soil/silt build up in garden	Impacted		2	50	52	1.51E-01
	Not-Impacted		0	53	53	
d) Flooding of home	Impacted		4	48	52	6.78E-01
	Not-Impacted		3	50	53	
e) Damage to pool and/or garden	Impacted		6	46	52	4.85E-02
	Not-Impacted		1	52	53	
f) Damage to infrastructure e.g. stormwater pipes	Impacted		3	49	52	7.75E-02
	Not-Impacted		0	53	53	
g) Other damages	Ash		30		30	
	Dead tree removal				1	

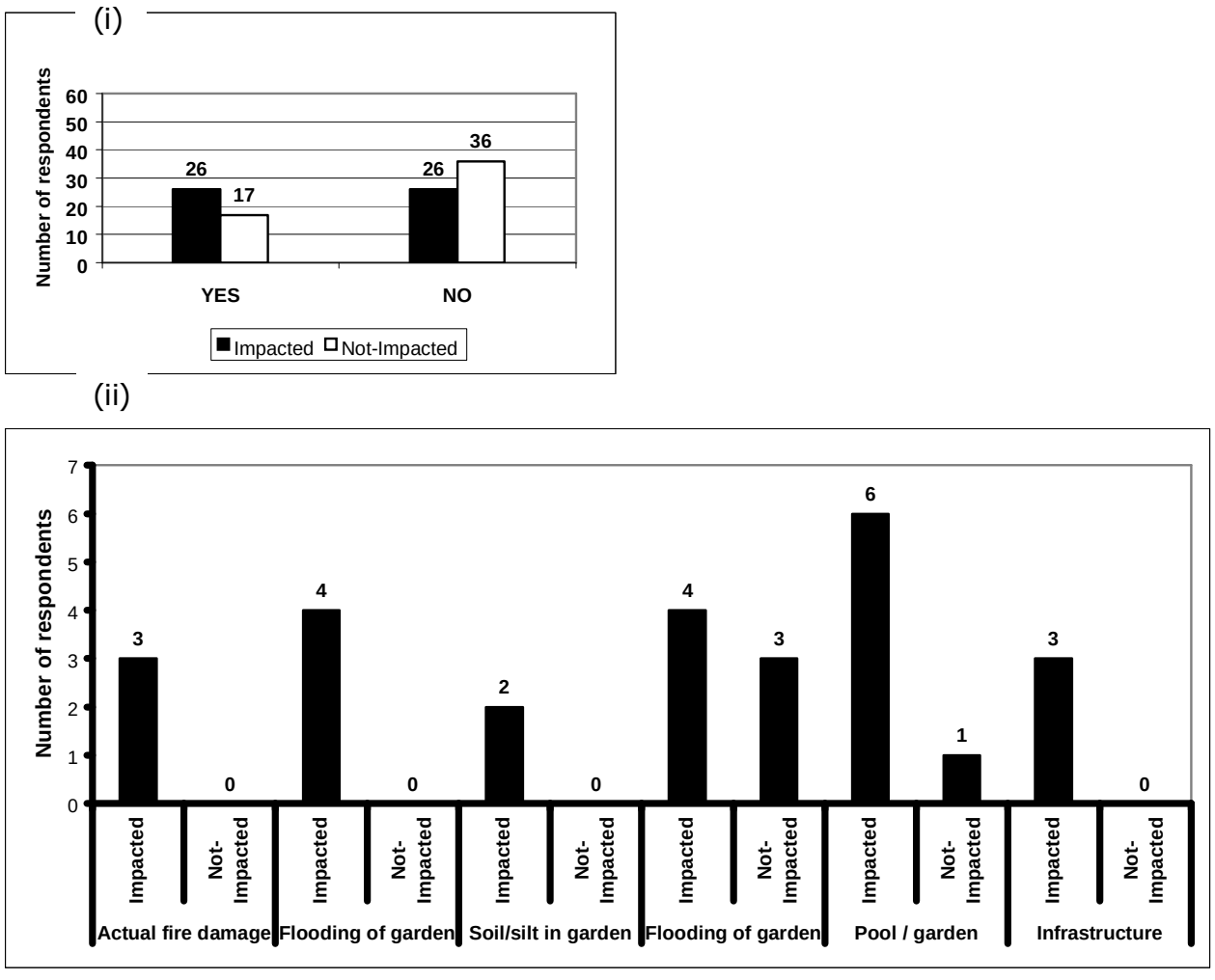


Figure 1.5 Graphical indication of the (i) total and (ii) main kinds of damage associated with post fire-related events.

While much attention is given to the actual damage and the costs of damage associated with the fire event itself, 43 out of 105 respondents (41%)

indicated that they suffered negative impacts from post-fire related events such as flooding of homes and gardens, mudslides in the garden and pool area, excessive soil/silt buildup in gardens, ash, and damage to garden infrastructure from the above. These effects were mainly experienced in the winter season following the January fires. There were no significant differences between the impacted non-impacted groups (Table 1.5 and Figure 1.5(i)). This suggests that this kind of damage is more widespread and not confined to the impacted areas as one might have expected. The 17 respondents from the "Not-impacted" area did not however specify the type of post-fire damage they experienced, and amongst the respondents from the "impacted" area, damage was spread across all categories (Figure 1.5(ii)).Damage due to ash is the dominant problem identified which is listed under '(g) Other damages'

1.5.Action taken to reduce the risk of fire damage to households prior to the January 2000 fires

This section of the interview (Part 1 Question 6) asked interviewees whether they had implemented any preventative action to reduce the risk of fire damage prior to the January 2000 fires, and if so, to indicate the type of measures they had taken.

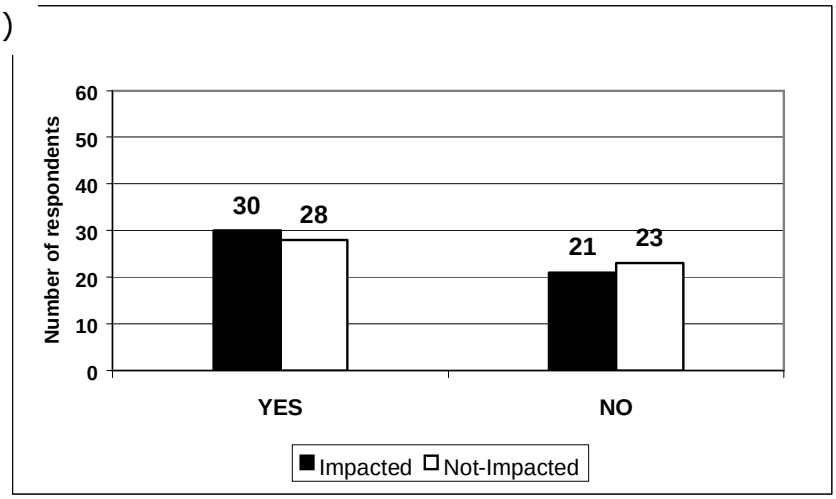
As may have been expected, there is no statistically significant difference in the number of persons who implemented preventative action between the two groups (that is, the impacted, versus the not-impacted areas), in order to reduce the risk of fire damage to households prior to the January 2000 fire (Table 1.6.1 and Figure 1.6(a)).

Table 1.6.1 Action taken to reduce the risk of fire damage to households prior to the January 2000 fire

	GROUP	DNA	YES	*NO*	*TOTAL N*	χ^2 p-value
6) Did you implement any preventative action to reduce the risk of fire damage to your house prior to the January 2000 fire?						
	Impacted	**1**	**30**	**21**	**52**	**6.91E-01**
	Not-Impacted	**2**	**28**	**23**	**53**	
	Destroyed		**4**	**4**	**8**	
If yes please indicate what preventative fire management measures you implemented before the fire						
a) Undertook research to reduce risk of fire damage to homes from veld fires	**Impacted**		**1**	**52**	**52**	**3.01E-01**
	Not-Impacted		**3**	**49**	**53**	
	Destroyed		**2**	**6**	**8**	
b) Cleared overgrown grass, undergrowth, trees, accumulated rubbish on your property	**Impacted**		**20**	**33**	**52**	**8.99E-01**
	Not-Impacted		**19**	**33**	**53**	
	Destroyed		**3**	**5**	**8**	
And/or on land adjacent to your property	**Impacted**		**7**	**45**	**52**	**8.119E-01**
	Not-Impacted		**8**	**45**	**53**	
	Destroyed		**2**	**6**	**8**	
c) Removed vines/creepers/shrubs from walls of home	**Impacted**		**0**	**52**	**52**	**4.44E-02**
	Not-Impacted		**4**	**49**	**53**	
	Destroyed		**2**	**6**	**8**	
d) Planted fire resistant plants adjacent to dwelling	**Impacted**		**5**	**47**	**52**	**2.69E-01**
	Not-Impacted		**9**	**44**	**53**	
	Destroyed			**8**	**8**	
e) Prepared fire break	**Impacted**		**7**	**45**	**52**	**8.12E-01**
	Not-Impacted		**8**	**45**	**53**	
	Destroyed		**3**	**5**	**8**	
f) Removed alien vegetation on property	**Impacted**		**20**	**32**	**52**	**4.81E-01**
	Not-Impacted		**24**	**29**	**53**	
	Destroyed		**2**	**6**	**8**	
g) Removed alien vegetation on land adjacent to property	**Impacted**		**12**	**40**	**52**	**5.98E-01**
	Not-Impacted		**10**	**43**	**53**	

	Destroyed		2	6	8	
h) Installed sprinkler system in roof/garden	Impacted		10	42	52	6.69E-01
	Not-Impacted		12	41	53	
	Destroyed		1	7	8	
i) Installed fire hoses, water points and/or water tanks	Impacted		6	46	52	4.28E-01
	Not-Impacted		9	44	53	
	Destroyed		2	6	8	
j) Installed/utilized fire resistant materials in home and garden	Impacted		4	48	52	9.78E-01
	Not-Impacted		4	49	53	
	Destroyed		1	7	8	
k) Provided access to urban edge for fire fighting	Impacted		5	47	52	1.78E-01
	Not-Impacted		10	43	53	
	Destroyed		3	5	8	
l) Established/joined neighbourhood group to address fire risks	Impacted		4	49	52	4.881E-01
	Not-Impacted		6	46	53	
	Destroyed		1	7	8	
m) Other damages	No common responses					

(i)



(ii)

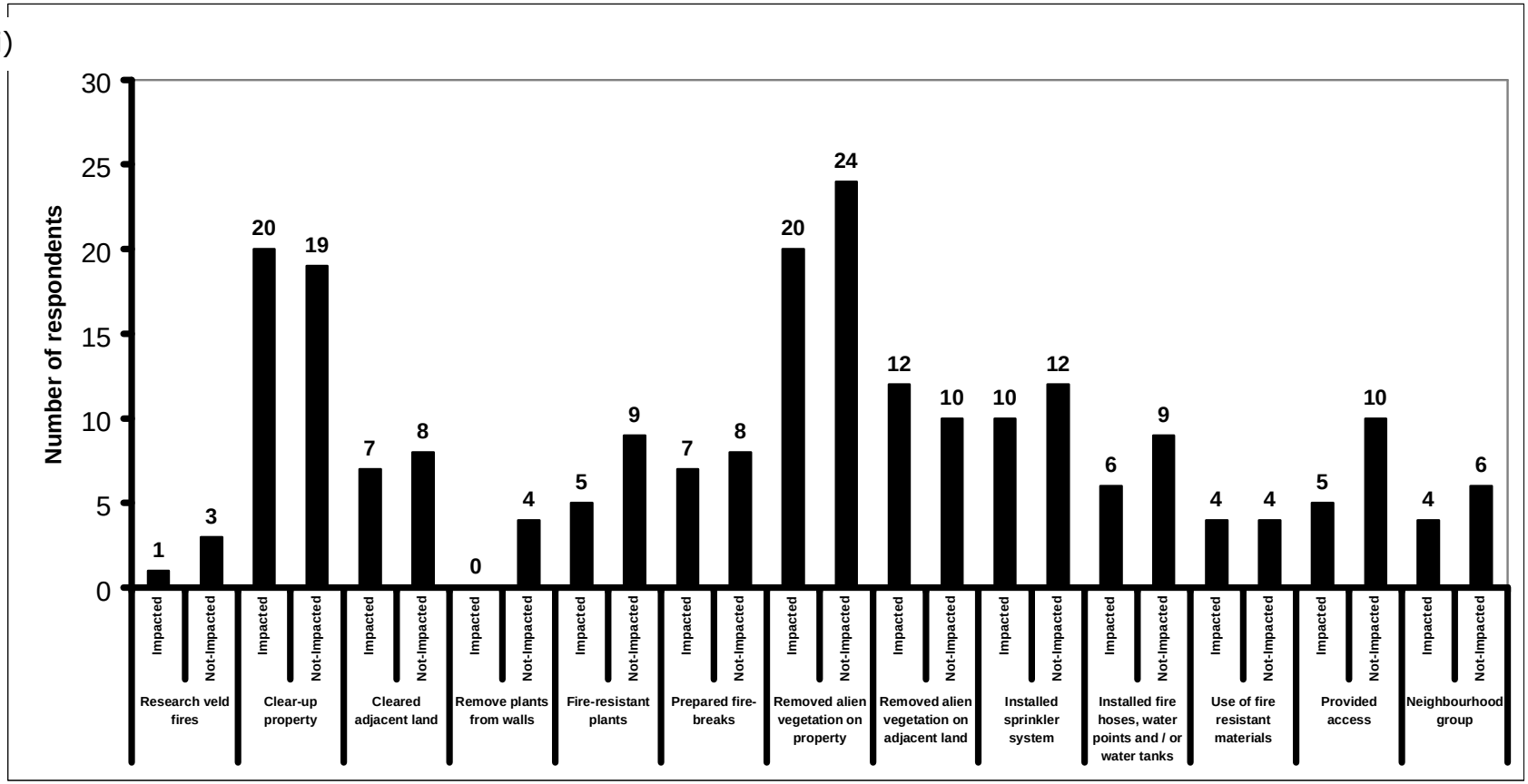


Figure 1.6 (i) Degree and (ii) type of action taken by respondents to reduce the risk of fire damage to households prior to the January 2000 fires.

Over half the respondents (58 out of 105 persons (55%)) indicated that they did take such preventative action however. (Exactly half of the respondents whose properties had been destroyed had (or had not) taken action). Out of the different measures that were taken the most common were the following: clearing overgrown grass, undergrowth, trees, accumulated rubbish on properties; removing alien vegetation on properties; removing alien vegetation on land adjacent to properties; installation of sprinkler system in roof/garden (see Table 1.6.2 below).

Table 1.6.2 Total number of respondents (i.e. from both groups) engaged in each type of action prior to the January 2000 fires.

ACTION	**Number of persons**	**Total number of persons**	**Percentage**
Removed alien vegetation on property.	44	105	42%
Cleared overgrown grass, undergrowth, trees, accumulated rubbish on property.	39	105	37%
Removed alien vegetation on land adjacent to property.	22	105	21%
Installed sprinkler system in roof/garden.	22	105	21%
Installed fire hoses, water points and/or rain tanks	15	105	14%
Prepared a fire break	15	105	14%
Provided access to urban edge for fire fighting	15	105	14%
Planted fire resistant plants adjacent to dwelling	14	105	13%
Established/joined neighbourhood group to address fire issues	10	105	10%
Installed/utilized fire resistant materials in home and garden	8	105	8%
Removed vines/creepers/shrubs from walls of home	4	105	4%
Undertook research to reduce risk	4	105	4%

1.6.Action taken to reduce the risk of fire damage to households after the January 2000 fires

Again, as one may have expected, there is a statistically significant difference in the number of persons from the impacted group of interviewees who implemented preventative action to reduce the risk of fire damage to households after the January 2000 fire, relative to the not-impacted group of interviewees (Table 1.7 and Figure 1.71). 43 out of 52 persons (83%) in the impacted group took such action, while a lesser proportion, 24 out of 53 persons (45%), in the non-impacted group took such action.

Table 1.7.1 Action taken to reduce the risk of fire damage to households after the January 2000 fire

7) Did you implement any	**GROUP**	**DNA**	**YES**	**NO**	***TOTAL N***	**χ^2 p-value**

preventative action to reduce the risk of fire damage to your house after the January 2000 fire?	Impacted		43	9	52	1.609E-04
	Not-Impacted	2	24	27	53	
	Destroyed	3	3	2	8	
If yes please indicate what preventative fire management measures you implemented after the fire.						
a) Undertook research to reduce risk of fire damage to homes from veld fires.	Impacted		4	48	52	6.779E-01
	Not-Impacted		3	50	53	
	Destroyed		2	6	8	
b) Cleared overgrown grass, undergrowth, trees, accumulated rubbish on your property	Impacted		23	29	52	3.83E-01
	Not-Impacted		19	34	53	
	Destroyed		3	5	8	
And/or on land adjacent to your property	Impacted		15	37	52	1.50E-01
	Not-Impacted		9	44	53	
	Destroyed			8	8	
c) Removed vines/creepers/shrubs from walls of home	Impacted		3	49	52	4.812E-01
	Not-Impacted		5	48	53	
	Destroyed		1	7	8	
d) Planted fire resistant plants adjacent to dwelling	Impacted		11	41	52	2.82E-01
	Not-Impacted		7	46	53	
	Destroyed		1	7	8	
e) Prepared fire break	Impacted		9	43	52	6.55E-01
	Not-Impacted		11	42	53	
	Destroyed		1	7	8	
f) Removed alien vegetation on property	Impacted		32	20	52	4.10E-02
	Not-Impacted		22	31	53	
	Destroyed		2	6	8	
g) Removed alien vegetation on land adjacent to property	Impacted		20	32	52	7.97E-02
	Not-Impacted		12	41	53	
	Destroyed		1	7	8	
h) Installed sprinkler system in roof/garden	Impacted		8	44	52	4.37E-02
	Not-Impacted		2	51	53	
	Destroyed		2	6	8	
i) Installed fire hoses, water points and/or water tanks	Impacted		6	46	52	2.84E-01
	Not-Impacted		3	50	53	
	Destroyed		1	7	8	
j) Installed/utilized fire resistant materials in home and garden	Impacted		4	48	52	1.645E-01
	Not-Impacted		1	52	53	
	Destroyed		1	7	8	
k) Provided access to urban edge for fire fighting	Impacted		6	46	52	7.261E-01
	Not-Impacted		5	48	53	
	Destroyed			8	8	
l) Established/joined neighbourhood group to address fire risks	Impacted		10	42	52	2.618E-01
	Not-Impacted		6	47	53	
	Destroyed		1	7	8	
m) any other actions	Purchased water pump				4	
	Helped fix hydrants				3	

(i)

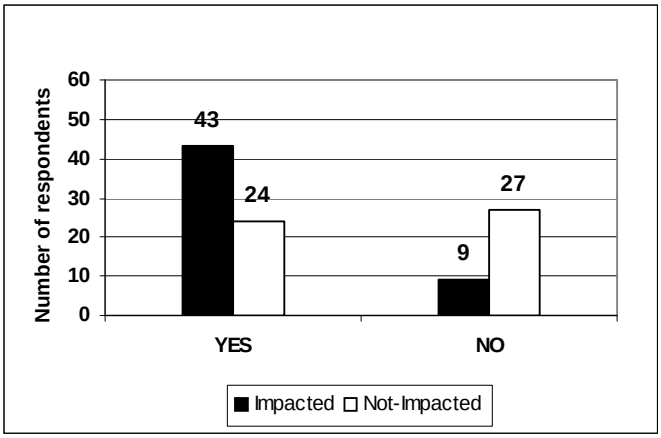


Figure 1.7 (i) Response to the question "Did you implement any preventative action to reduce the risk of fire damager after the January 2000 fire event"?

(ii)

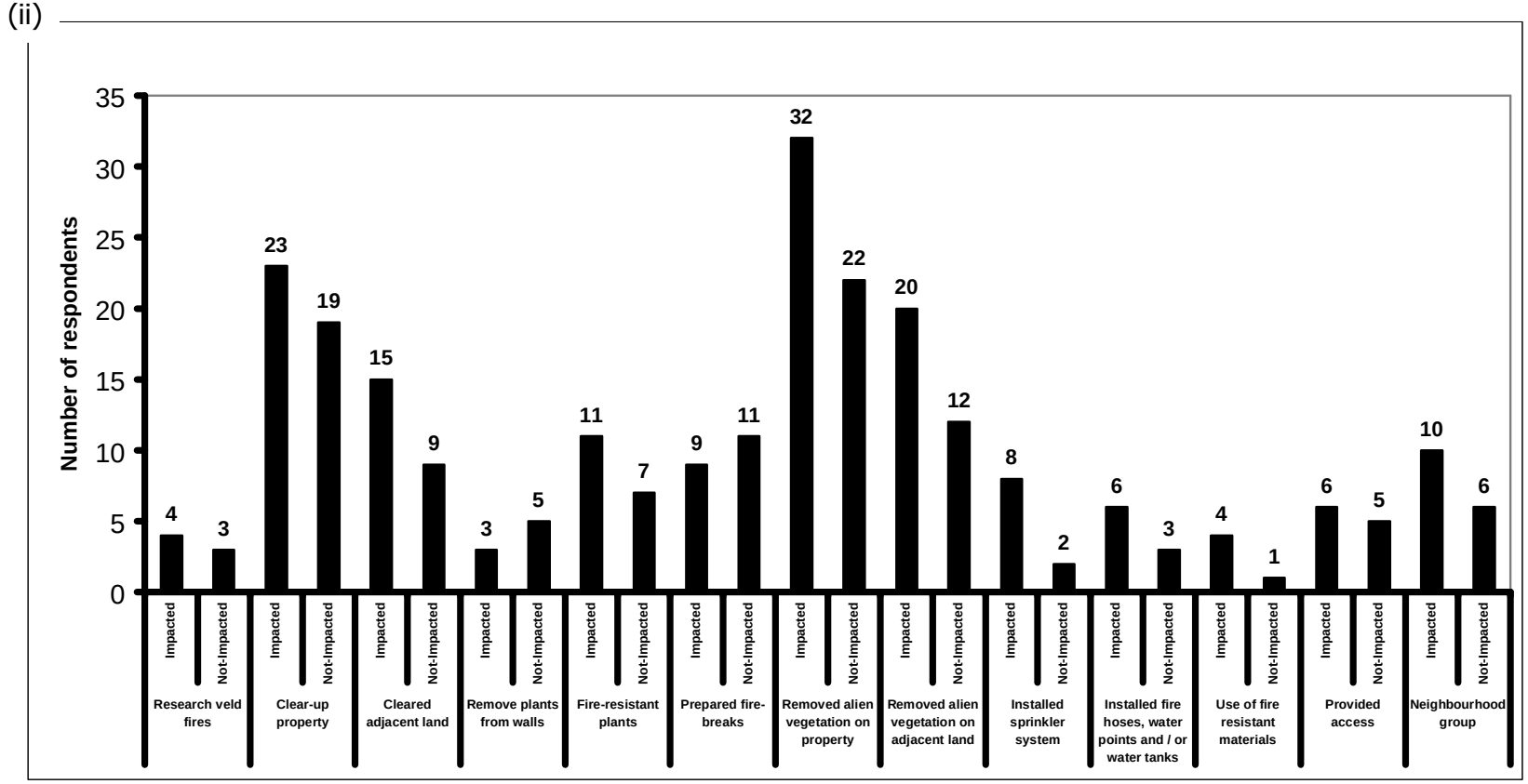


Figure 1.7 (ii) Type of action taken to reduce the risk of fire damage to households after the January 2000 fires.

Table 1.7.2 Total number of respondents (i.e from both groups) engaged in each type of action taken to reduce the risk of fire damage to households after the January 2000 fires.

ACTION	Number of persons	Total number of persons	Percentage
Removed alien vegetation on property.	54	105	51%
Cleared overgrown grass, undergrowth, trees, accumulated rubbish on property.	42	105	40%
Removed alien vegetation on land adjacent to property.	32	105	30%
Prepared a fire break	20	105	19%
Planted fire resistant plants adjacent to dwelling	18	105	17%
Established/joined neighbourhood group to address fire issues	16	105	15%
Provided access to urban edge for fire fighting	11	105	11%
Installed sprinkler system in roof/garden.	10	105	10%
Installed fire hoses, water points and/or rain tanks	9	105	9%
Removed vines/creepers/shrubs from walls of home	8	105	8%
Undertook research to reduce risk	7	105	7%
Installed/utilized fire resistant materials in home and garden	5	105	5%

Out of the different measures implemented by all respondents engaged in the taking of action in order to reduce the risk of fire damage to households after the January 2000 fire (Table 1.7.2), the most common activities were the removal of alien vegetation on the property (51%), the clearing of overgrown grass, undergrowth, trees, accumulated rubbish on property (40%), the removal of alien vegetation on land adjacent to the property (30%), and the preparation of fire breaks (19%). It is interesting to note that the most common action taken by interviewees all show an understanding of the threat posed by the presence and proximity of highly combustible vegetation, including invasive alien plants.

Comparison between the activities taken by impacted and non-impacted groups prior and post the January 2000 fires (Figure 1.8) indicates that, for the impacted respondents, a statistically significantly ($p<0.0143$ χ^2 test statistic) larger number of interviewees (43 out of 52 persons (83%) took action after the fire (relative to 30 out of 51 respondents (59%) from the impacted group who took action prior to the fire event). In contrast, there was no statistically significant difference ($p<0.26$ χ^2 test statistic) in action taken before or after the fire event amongst respondents from the not-impacted group.

In terms of the greater proportion of action taken within each type of activity, there was an average increase of roughly 66% within the group of respondents from the impacted area. Within the not-impacted group, there was a 17% decline in the average number of respondents engaged in any of the activities following the fire event (This is qualitatively consistent with the decline in response (from 28 to 24 out of 52 persons) associated with the generic question responses (for Questions 6 and 7).

A greater number of interviewees from the impacted group removed alien vegetation on their property and cleared up their property following the fire event. A higher proportion of interviewees from the impacted group also realized, subsequent to the fire event, the importance of clearing land adjacent to their property, and removing alien vegetation occurring on this adjacent land.

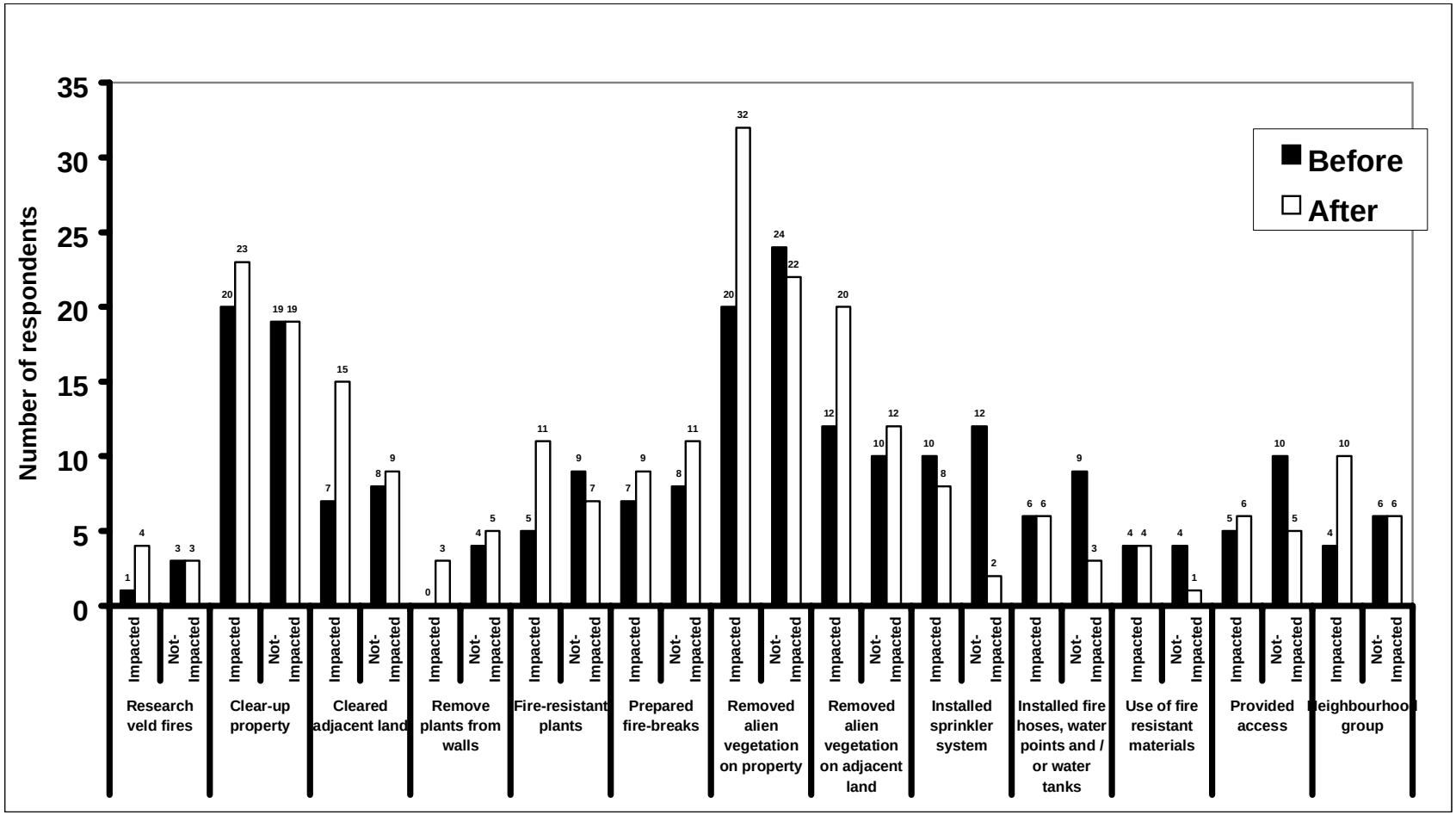


Figure 1.8. Comparison between action taken by both impacted and not-impacted households prior to and post the January 2000 fires