

# **An economic and condition analysis of public urban green spaces in Grahamstown, Eastern Cape.**

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## **Abstract**

With rapid world population growth and urbanisation, the study of the urban environment has become an important yet neglected area of focus. Public urban green spaces (PUGS) provide direct and indirect benefits to humans as well as environmental benefits. However, if not managed properly, PUGS may have a negative effect on the environment and on society. The reason for this study was to determine through condition and economic evaluation, the quality, valuation and use of PUGS across three social-economic areas in Grahamstown. The project was designed around the DPSIR Framework use in SoE reporting. The affluent areas PUGS proved to be in the best condition with the greatest diversity, amenities, security, as well as the least amount of litter. Non-market value of PUGS using a willingness-to-pay approach showed that the affluent area had the highest value, followed by RDP and then the township area. The cost-benefit analysis showed that PUGS in Grahamstown amounted to approximately R 20.8 million per year, and outweighed costs by approximately R 7 million. It was also found that properties further away from PUGS are worth more than properties bordering PUGS for Grahamstown as a whole. Policy responses to improve PUGS in Grahamstown include clearing alien species, increase funding to improve amenities and to increase community involvement and services.

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## **1. INTRODUCTION**

With rapid world population growth and urbanisation, the study of the urban environment has become an important yet neglected area of focus (McConnachie *et al.*, 2008). Natural land and green space is continually being destroyed and developed, with no concern for environmental quality or its value being taken into account (Kwak *et al.*, 2003). Public urban green spaces (PUGS) provide direct and indirect benefits to humans. This includes areas for exercise, recreation and meeting (Tzoulas and James, 2010), scenic views (Nagendra and Gopal, 2010), as well as the opportunity to experience nature and the bequest value people place on the existence of PUGS for future use (O'Garra, 2009). Environmental benefits include carbon sequestration, water capture, refuge for animals and birds as well as many other ecosystem services (Kwak *et al.*, 2003). PUGS also act as noise buffers (Pathak *et al.*, 2011), as well as reduce the effect of heat islands in cities (Georgi and Dimitriou, 2010; Smargiassi *et al.*, 2009). However, if not managed properly, PUGS may have a negative effect on the environment and on society, such as alien invasions, providing a space for public dumping and littering (McConnachie *et al.*, 2008), and a possible security threat (Troy and Grove, 2008).

South Africa has unique city structures with easily noticeable affluent areas, large townships on the outskirts and more recent state built RDP housing settlements, thus resulting in disparities in PUGS between the areas (Donaldson-Selby *et al.*, 2007). RDP areas are the result of a low-cost high-density housing program which was developed by the government to address the problem of housing shortages after the apartheid era (Donaldson-Selby *et al.*, 2007). RDP is a socio-economic policy framework that seeks to redistribute wealth and improve the quality of life of poor South Africans. Many environmental benefits are gained by the existence and maintenance of green spaces and therefore PUGS are an important consideration in the improvement of the quality of life and general well-being (Donaldson-Selby *et al.*, 2007). Studies conducted in the Western world have found that there are noticeable differences in the provision of PUGS between the wealthy, affluent areas and the poorer, working class areas (Martin *et al.*, 2004; McConnachie and Shackleton, 2010; Zhang *et al.*, 2008).

Many housing developments, especially in the poorer areas, do not have private gardens or private green spaces attached to their household (Shackleton and Blair: unpublished). Other

household dwellings simply do not have large enough gardens to provide the multiple benefits that are obtained through the existence of PUGS (Shackleton and Blair, unpublished). “Thus, PUGS have a particular role to play in sustainability and liveability of towns and cities, and the provision of which requires appropriate planning approaches, implementation strategies and financial resources” (Shackleton and Blair, unpublished).

Thaiutsa *et al.* (2008) define green space as areas that have contiguous vegetated areas and spaces, such as artificially created city parks, stands with natural vegetation and land areas such as botanical gardens, as well as isolated street trees, street medians and private gardens. However, this project will focus on PUGS, thus ruling out private gardens and plots, street trees and road verges will also not be included. McConnachie and Shackleton (2010) included school grounds/sports fields and public sports fields in their study of green space; however this study will not include sports fields either. This project will therefore focus on public vegetated areas within Grahamstown, including the botanical gardens, parks and stands of natural vegetation. This study will include both formally designated green space as well as informal green space.

The reason for this study is to determine through evaluation of the economic value and condition and quality of PUGS in Grahamstown, whether these PUGS are beneficial to the society of Grahamstown. The different use values and economic values between the affluent, township and RDP areas are assessed to determine if these spatially defined groups of people benefit more or less from PUGS by comparison.

The project is designed around State of Environment reporting. SoER aims to provide information that is related to the natural, economic as well as social environment of a particular area. SoER is an internationally recognised system of environmental reporting (DEAT, 2007). SoER leads to stakeholder awareness, aids in decision-making ability from a local to global scale and helps with the implementation and measuring of sustainable development (DEAT, 2007). The DPSIR is a widely used framework of SoE Reports and focuses on identifying the drivers, pressures, state and trends in the environment, socio-economic and biological impacts of the environment and responses to the above (Kristensen, 2004). Drivers of environmental change are a very important consideration to identify those practices which are resulting in environmental harm and to encourage those that are

sustainable to the environment (Eastern Cape State of the Environment Report, 2004). Thus, using the DPSIR framework of SoER reporting we will be able to make informed recommendations to the municipality in terms of drivers, pressures, state and trends in the PUGS in Grahamstown and will be able to identify biological, social and economic impacts of the PUGS in Grahamstown.

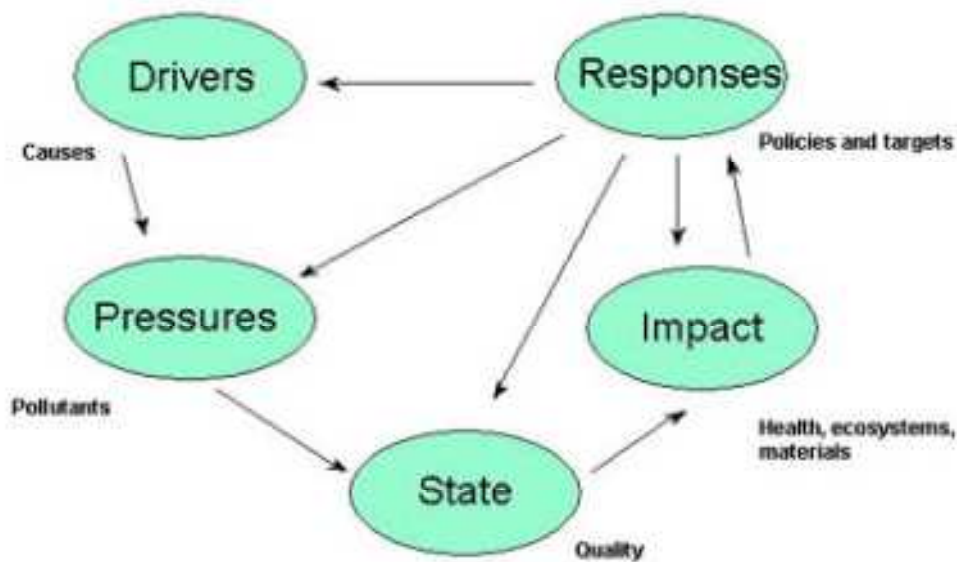


Figure 1. The DPSIR assessment framework

**Figure 1: A DPSIR assessment framework (Kristensen, 2004)**

The DPSIR framework plays an important role in integrated environmental reporting (Kristensen, 2004). The framework enables feedback to policy makers. It enables us to identify the relations between origins and consequences of environmental problems. The DPSIR framework consists of a chain of causal links that begins with *driving forces* through to *pressures* and onto *states* and *impacts* and lastly resulting in *responses* (Smeets and Weterings, 1999). This causal chain is complex and therefore not easily understood. To make sense of this process, it is necessary to understand the pressure-state relationship and the links between the DPSIR elements (Smeets and Weterings, 1999).

A driving force can be described as the underlying cause of environmental problems (Kristensen, 2004). Examples are human demands for land, transport and energy (Giupponi, 2002).

Human activities are necessary to be able to meet particular needs. These activities result in pressures being extended onto the environment, normally through consumption and production activities (Giupponi, 2002). Three main types of pressures have been identified. These are exploitation of environmental resources, changes in land use and various emissions (Kristensen, 2004). These pressures affect the 'state' of the environment and are direct impacts. "The state of the environment is thus the combination of the physical, chemical and biological conditions" (Kristensen, 2004:2). The changes in the state of the environment result in adverse impacts relating to quality of ecosystems and human well-being (Kristensen, 2004:2). A response is necessary when these undesirable impacts are harmful. A response is an effort from society to address these impacts and often results in policy change (Giupponi, 2002). It is therefore necessary that drivers, states and impacts relating to our project are identified. This is so that we can formulate responses via recommendations and policy changes.

### 1.1 Aims and Objectives

The overall aim is to develop a SoE Report using economic evaluation and the condition of PUGS in Grahamstown to formulate the best policy response for the future, by implementing the following objectives.

- Assessing the condition of PUGS in Grahamstown across township, RDP and affluent PUGS, using five key indicators taken from Bullock (2006).
- Calculating the non-market value of PUGS in Grahamstown using a willingness-to-pay approach.
- Calculating the market value of PUGS in Grahamstown using input costs. A total economic value can then be calculated for PUGS in Grahamstown.
- Undertaking a cost-benefit analysis for PUGS in Grahamstown.
- Assessing the impact of PUGS on property prices.
- Using the results from our research and literature from other studies to provide appropriate policy responses for the future maintenance and development of PUGS in Grahamstown.

## 1.2 Hypotheses

1. The condition of PUGS in Grahamstown will be highest in the affluent areas and lowest in the RDP area.
2. PUGS in Grahamstown will slightly decrease property values, as security risks will be higher bordering the public urban green space.
3. Willingness-to-pay and the value of PUGS will be highest in the affluent areas and lowest in the RDP area.
4. People who cannot afford to pay will make up for this by offering free labour to the community.
5. It is hypothesised that the benefits of PUGS within Grahamstown will exceed that of the costs.

## **2. STUDY AREA**

Grahamstown (33°18'S; 26°32'E) is located 60 kilometres inland between the two major cities Port Elizabeth and East London in the Eastern Cape province, South Africa. The Eastern Cape has the poorest population in South Africa, resulting in high unemployment and low literacy rates (Statistics South Africa, 2004). The Grahamstown economy is driven by education (it is home to Rhodes University and a number of schools, of which three are private) however, there is a lack of other economic activity. Approximately 49.3 percent of the labour force was unemployed in 2001, according to the last census (Alebiosu, 2005). Grahamstown has a population of 57 030, of which 78 percent reside in the township or RDP housing (Kuruneri-Chitepo, 2010).

Grahamstown has seasonal fluctuations of temperature, ranging from 5 °C up to 35 °C and receives, on average, 669 mm of rainfall annually (State of the Environment in South Africa, 2004). Therefore it falls into the category of semi-arid landscape (State of the Environment in South Africa, 2004). The majority of Grahamstown is located within the Sub-Tropical Thicket Biome, which can be narrowed further down to Grahamstown grassland thicket or Xeric succulent thicket (McConnachie *et al.*, 2008). South Coast Renosterveld can also be found in patches around the borders of Grahamstown (Voegt, 2001). Small patches of

Afromontane forest, grassland and Nama Karoo can also be found in the vicinity of Grahamstown (Voegt, 2001).

Due to the regime of Apartheid, South Africa has a unique city and town structure (Donaldson-Selby *et al.*, 2007). This has resulted in easily identifiable affluent areas, dominated by white citizens, with high education levels, high disposable income, large plot sizes and numerous green spaces (McConnachie and Shackleton, 2010). The townships with generally less educated and poorer people living in high density housing on small plots in areas lacking PUGS or have poorly managed PUGS (McConnachie and Shackleton, 2010). There is newly set up RDP areas, in which high density housing is provided by the government and lacks urban greening development (Donaldson-Selby *et al.*, 2007). This study will compare the condition and economic value of public urban greens space across these three different residential areas.

The study area consisted of six PUGS in the affluent area, seven PUGS in the township and four PUGS in the RDP. These included both formally proclaimed and informal PUGS within the borders of the town, excluding the periphery. A complete list of the urban public green spaces is provided below, and depicted in figure 2.

#### *Affluent Area*

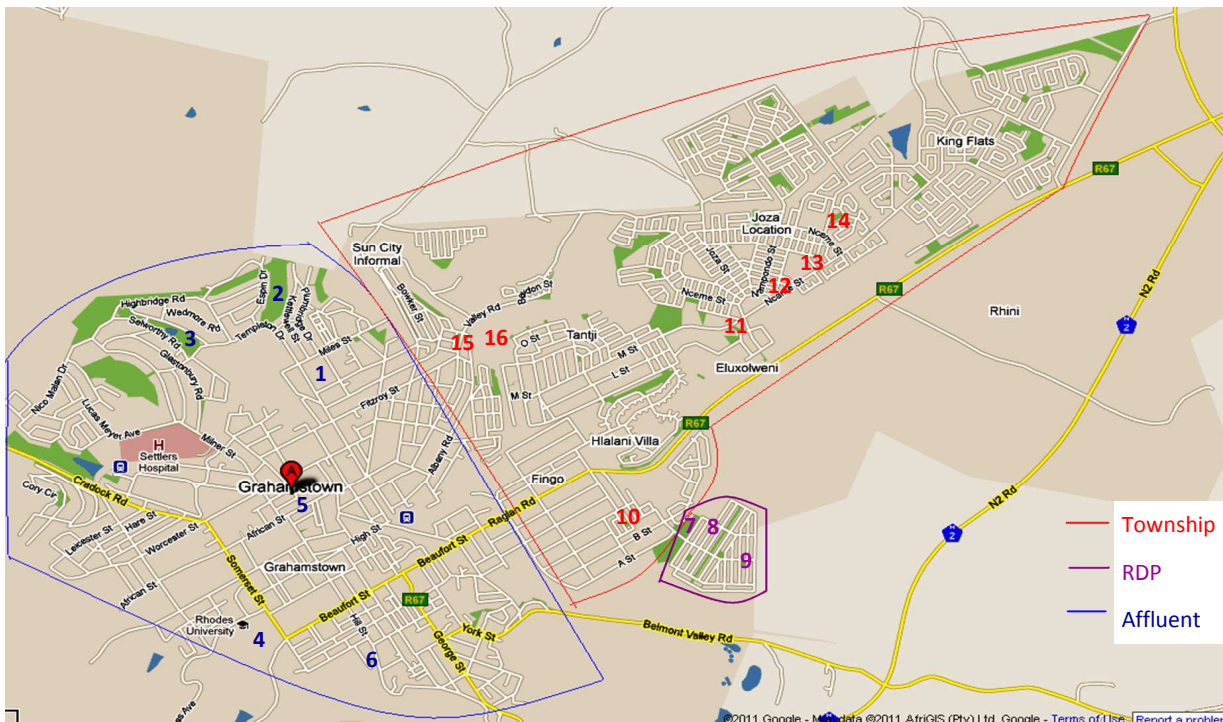
Currie Park (1), Oatlands North (2), Gowie Dam (3), Botanical Gardens (4), Oatlands Park (5), Beadle Street (6).

#### *RDP*

Belmont Vally View Street (7), Northern RDP (8), and Upper RDP PUGS (9).

#### *Township:*

Lady Grey/ Wood Street (10), Big area on Sani Street (12), Ncame Street Park (13), Close to new police station on Sani Street (14), Benjamin Mahtuhlela (15).



**Figure 2: Grahamstown, showing the affluent area, the township and the RDP area, as well as the PUGS that were studied. Source: [googlemaps.com](https://www.google.com/maps)**

### **3. METHODS**

In this study 150 household surveys were conducted, 50 in each of the three study locations (affluent, RDP and township). The survey consisted of questions pertaining to general demographics, people’s economic values and willingness-to-pay for PUGS in Grahamstown, as well as their feelings, attitudes and opinions on the condition of PUGS in Grahamstown. Random households were selected within the three areas by placing a grid over a map of Grahamstown and taking houses on the top left corner of each box in the grid. These surveys were conducted at each residence directly i.e. face-to-face, so that all information and data could be collected accurately. A pilot study was done and the survey was adapted, with certain questions taken out or rephrased accordingly.

#### **3.1 Assessment of PUGS condition**

To assess the condition of PUGS in Grahamstown, we formulated six key points from a study by Bullock (2006) in Dublin. Bullock (2006) used core choice experiments to determine the attributes of green spaces that provide people with the most utility. This resulted in eight key attributes, namely; park size, maintenance, vegetation, water features, play facilities, other facilities (seating, paths and trails), number of users and journey time. For our study we identified the key points of PUGS condition as; use of PUGS, biodiversity of woody species,

amenities and play facilities (seating, paths and trails), security, litter, and distribution of PUGS throughout Grahamstown.

McConnachie *et al.* (2008) did substantial work on PUGS size in Grahamstown and so it was not necessary to repeat this as it not likely PUGS sizes have changed since this study was done three years ago. Journey time is directly linked to distribution of PUGS in Grahamstown which was easier to sample. Maintenance was left out of our study due to the fact that it was clear that most of the PUGS had no maintenance at all, this was also the case for water facilities.

Security and crime is a problem in South Africa and so the element of security was brought into our study which was not in Bullock (2006). Demombynes and Ozler (2005) discuss that South Africa has high levels of crime which may be linked to the problems with local inequality in the country. Associated with the lack of amenities in many of the PUGS of Grahamstown, litter was also observed to assess the appearance of the PUGS, and can be linked to maintenance.

### 3.1.1 Number of users

The number of users was assessed in the survey, by asking people if they used green spaces, which ones and how often.

### 3.1.2 Biodiversity

To asses tree biodiversity, three 100 metre transect lines were laid out at equal intervals across the width of the 17 PUGS. If the PUG was greater than 100 metres in width, then the transect was placed over the centre of the green space. If the PUG was narrower than 100 metres the transect was placed across the total width of the PUG, the width was recorded. Every tree (taller than half a metre) one metre on either side of the transect line was recorded by species name. A complete tree inventory was done for the PUGS that contained less than 120 trees, therefore the PUGS that were either small or very open. A comparison between the numbers of alien species and trees to the number of indigenous tree species and trees was conducted. The Shannon-Wiener Index was used to calculate the species diversity in terms of richness and abundance for each of the PUGS. Tree species were identified on site, and cuttings of unknown species were pressed and then taken to the Schonland Herbarium for

identification. Peoples view on having biodiversity in PUGS was also gauged from questions pertaining to biodiversity in the survey.

### 3.1.3 Amenities and play facilities

All amenities, their quality and condition were recorded through observation of the 17 PUGS and tabulated to compare between the affluent, RDP and location study sites. People's perceptions and view on the amenities in the various PUGS in Grahamstown was also assessed in the survey.

### 3.1.4 Security

Three factors were looked at when assessing security of the selected PUGS. These included; lighting (brightening of the park during the evening), fences around the park and presence of any form of security. Each factor was recorded on a tick list where present.

The public's feelings on security on PUGS were gauged through the questions in the survey. Looking at property prices bordering and away from PUGS also provided information on the security threat of PUGS.

### 3.1.5 Litter

To determine the litter cover in each of the 17 PUGS a one metre by one metre quadrat was set up every 10 metres along three transect lines at equal distance apart across the width of the PUGS. The litter cover within each quadrant was recorded as a percentage cover of the one metre by one metre quadrat.

### 3.1.6 Distribution of PUGS

Distribution of PUGS was assessed through the surveys by asking each of the respondents to state how close the nearest PUG is to them. This provided data on the distribution of PUGS and whether or not it is appropriate for the majority of the population.

## 3.2 Economic valuation of PUGS

Through the 150 household interviews a non-market value for PUGS within Grahamstown was obtained. The market value for PUGS was obtained through interviewing the Financial Department of Makana Municipality. Many of the respondents surveyed did not know how to go about giving or how to determine a monetary or economic value for the PUGS in

Grahamstown. Therefore, a hypothetical scenario approach to create a market for the PUGS in Grahamstown was used (Lewis and Tietenberg, 2010). People were given a hypothetical scenario where the PUG nearest to their residence would be developed and the participant would lose the opportunity to use the PUGS and the benefits the PUGS provide for the participant, if any. Many people in the township and RDP areas were unable and more unwilling-to-pay due to poverty (Kong *et al.*, 2007). Therefore, a question in the surveys was asked on how much time the participant would be willing to do unpaid volunteering work in the local community, to ensure the upkeep and maintenance of the PUGS (Lewis and Tietenberg, 2010). The number of hours the participants were willing-to-volunteer their labour to the upkeep and maintenance of PUGS was multiplied by the minimum wage for a farm workers at R 7.04 per hour during 2011. This would then represent willingness-to-pay of those people with potentially limited financial resources.

Equation 1 was used to calculate total benefits of PUGS.

*Total Benefits per year [Rands] = (Mean cash value [Rands] willingness-to-pay x Proportion of households willing-to-pay) + (Mean Number of volunteering hours willing-to-work x minimum wage [rands] x Proportion of households willing to volunteer work in Grahamstown). Eq. 1*

The Makana municipality and the manager of the Botanical Gardens were interviewed to find the total costs involved for the general upkeep, maintenance and improvements of the PUGS. The costs included were wages for grounds staff, equipment and machinery costs, and cost of improvements and facilities/infrastructure on the PUGS. The municipality's annual budget accounts for all of Grahamstown's PUGS except for the Botanical Gardens. The Botanical Gardens is under the management of Rhodes University. Therefore, the funding of these PUGS are exclusive of each other and to get the total costs of all the PUGS in Grahamstown we had to consider both the municipality's annual budget for PUGS and the annual budget for the Botanical Gardens.

The housing rates foregone to the municipality due not developing PUGS into housing were calculated and used as an opportunity cost of PUGS.

Equation 2 was used to calculate total costs of PUGS

*Total Costs per year [Rands] = (Annual Municipality Budget) + (Annual Botanical Budget) + (Total Land Area of PUGS x Rates per Square Meter [Opportunity Cost (Rates)]). Eq. 2*

To obtain the market value for PUGS, a cost-benefit analysis was conducted, by weighing up the economic benefits (in Rands), against the economic costs (in Rands) of having PUGS (Lewis and Tietenberg, 2010). If costs exceed benefits other land use options need to be taken into consideration. This is because the land occupied by PUGS would be an inefficient land use option as it is more expensive to upkeep and maintain compared to the value Grahamstown's population places on the PUGS. If the benefits exceed the costs then the PUGS are valuable to communities.

From this we were able to determine the total economic value of PUGS within Grahamstown, as *Total Economic Value = Non-market Value + Market value*. (Lewis and Tietenberg, 2010).

To evaluate whether PUGS have an effect on property values, a comparison of property prices in relation to distance away from the PUGS was conducted. This was done through interviewing the Finance Department of the Makana Municipality on the property values of 119 houses in Grahamstown.

### 3.3 Statistical analyses

A Principal Component Analysis (PCA) was conducted to explore patterns between the general demographics and all other variables on people's perceptions on condition of PUGS and their economic valuation of PUGS. ANOVA tests were done to test for statistical significance between the willingness-to-pay between the three areas. A chi-squared test was used to compare statistical significance between the three sites for data represented as a percentage, such as percentage litter cover. All means were reported with standard deviations.

### 3.4 Assumptions

To determine the economic value of urban green space a willingness-to-pay approach was used. To do a willingness-to-pay survey a hypothetical scenario was established to create a market for PUGS. We assumed that people would be able to engage in the hypothetical markets scenario. Using a Willingness-to-pay approach can lead to biased or vague responses

(Chen and Jim, 2005). Therefore, to account for this possible pitfall, a pilot study was done to gauge if the scenario would provide non-biased responses.

It is assumed that the willingness-to pay values given by the participants will be an accurate representation of the whole Grahamstown population and that the participants are actually able to pay the value they stipulated in the surveys.

It is assumed that willingness to volunteer services free of charge for the upkeep and maintenance of PUGS is synonymous with willingness-to-pay.

### 3.5 Ethical considerations

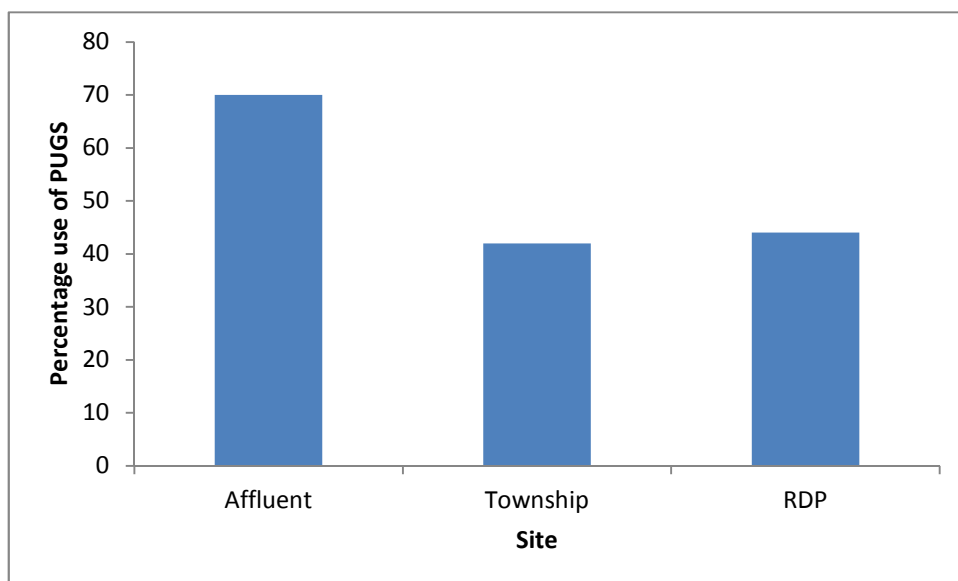
The study team adhered to the Rhodes University ethical guidelines throughout the study.

## **4. Results**

### 4.1 Condition

The affluent area showed the highest use of PUGS, while the smallest percentage of use of the PUGS could be found in the township (Figure 3). Chi-squared tests show that there are significant differences ( $X^2 = 19.55$ ,  $df= 2$ ,  $P < 0.005$ ) between the affluent site and the township and RDP, but no statistical difference between use levels between the township and RDP.

It must be noted that of the users of PUGS respondents in the RDP area used them most frequently at an average of  $2 \pm 2$  times a week, followed by the affluent area at an average of  $1.3 \pm 1.4$  times a week and lastly the township at  $0.8 \pm 0.3$  times per week.



**Figure 3: Percentage of people that use PUGS**

People interviewed in the affluent area preferred natural green spaces to those that are human made (Table 1). Both the township and RDP areas preferred human-made green spaces. The category, “other”, represented those who were indecisive or unsure on which type of green space they preferred, or said they liked a mix and so they would prefer both. It can be seen that the overall Grahamstown residences (41 %) preferred human made PUGS. With ( $X^2 = 72.10$ ,  $df = 4$ ,  $P < 0.005$ ) the chi-squared test suggests that there is a significant difference in the responses in terms of preference of PUGS across the three areas.

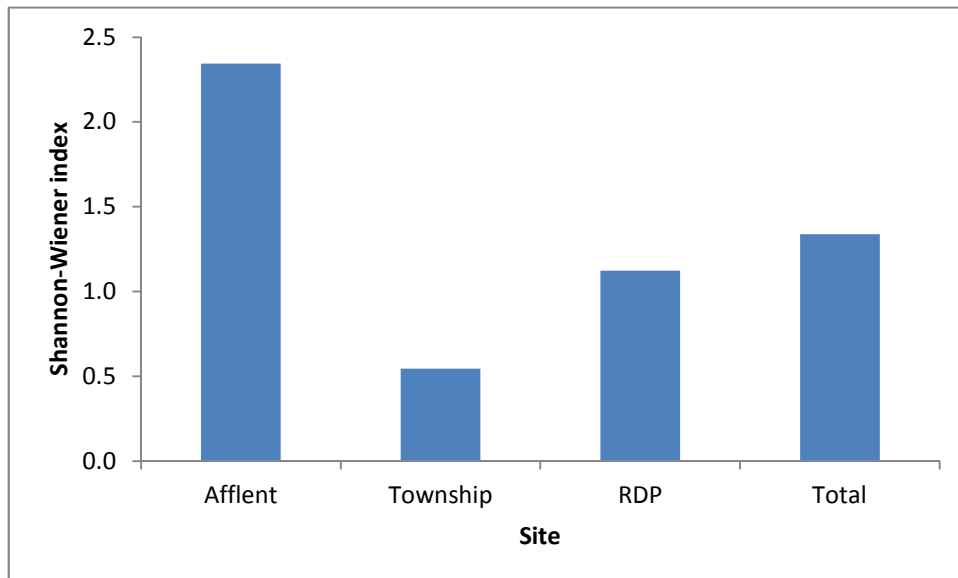
Most respondents in the RDP and township said that they prefer PUGS to have sports facilities, and do not like densely vegetated PUGS as it provides a place for criminals to hide.

**Table 1: The percentage of people who preferred natural, human-made or had different opinions for each of the three areas.**

	Natural (%)	Human made (%)	Other (%)
<b>Affluent</b>	64	16	20
<b>Township</b>	20	48	32
<b>RDP</b>	14	58	28
<b>Total</b>	33	41	27

The affluent area has by far the highest Shannon-Wiener diversity index, and that the township and RDP have a relatively low Shannon-Wiener diversity index (Figure 4).

Normally the Shannon-Wiener diversity index ranges from 1.5 to 3.5, however the values can be uncommonly higher and lower than these two values. A value of 1.5 shows very low species richness and evenness and a value of 3.5 shows a very high species richness and evenness. It can be seen that the affluent area has on average species richness and evenness rating at just under 2.5. The RDP 1.1 and township 0.5 shows very poor diversity and evenness. The township Shannon-Wiener diversity index was so low due to the fact that only three out of the seven PUGS had tree species.

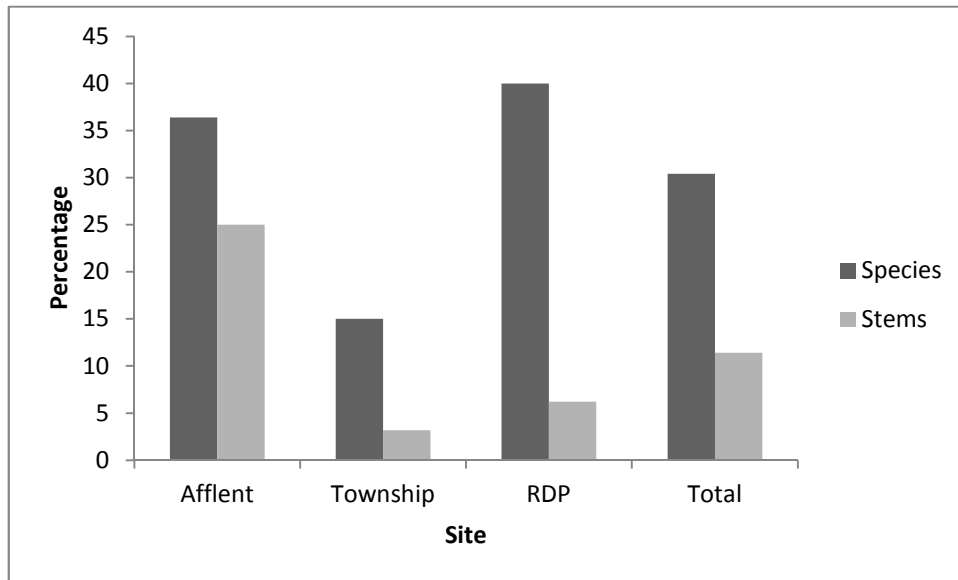


**Figure 4: The Shannon-Wiener diversity index**

Figure 5 shows the percentage of alien species across Grahamstown is on average 30 %. It can be seen that the RDP area has the highest proportion of alien species (40 %) compared to indigenous shortly followed by the affluent area (36 %) and below that the township area with (15 %). According to a Chi-squared test there is no significant difference in alien species between the affluent area and the RDP area. There is statistical significance ( $X^2 = 9.76$  and  $6.45$   $P < 0.0001$ ) between the affluent area and the township and the RDP are and the township.

On average, 11 % of the trees counted in PUGS in Grahamstown are alien. The affluent area had by far the highest proportion of alien trees in PUGS (25%), followed by the RDP area (6%) and lastly the township (3%). According to a Chi-squared test there is no statistical significance between the RDP and township sites. However, there is a statistical significance ( $X^2 = 20$  and  $17.8$   $P < 0.0001$ ) between the affluent area and the township, as well as the RDP

site. At the end 119 different species were recorded and over a thousand trees were counted. It is interesting to see that the proportion of alien species is higher in all three sites compared to actual stems.



**Figure 5: The percentage of alien species and stems**

It can be seen that the affluent area had by far the highest number of species (103) with a dramatic drop in the township (20) and by far the least in the RDP area with only nine species (Table 2). The RDP area had the most of one species (*Diospyros dichrophylla*) counted across the three sites thus representing the homogenous nature of species in the area. In the township the top four species were all only found in one PUGS.

**Table 2: The top five and total number of species recorded for the three different sites.**

	Affluent	No.	Township	No.	RDP	No.
1	<i>Pinus halepensis</i> (alien)	45	<i>Plumbago auriculata</i>	44	<i>Diospyros dichrophylla</i>	123
2	<i>Burchellia bubalina</i>	35	<i>Ekebergia capensis</i>	41	<i>Aloe ferox</i>	60
3	<i>Chrysanthemoides monilifera</i>	34	<i>Aloe arborescens</i>	24	<i>Gymnosporia buxifolia</i>	15
4	<i>Hippobromus pauciflorus</i>	31	<i>Tecomaria capensis</i>	20	<i>Plectranthus barbatus</i> (alien)	6
5	<i>Grewia occidentalis</i>	27	<i>Acacia karroo</i>	18	<i>Gymnosporia nemorosa</i>	5
	Total no. of species	103	Total no. of species	20	Total no. of species	9

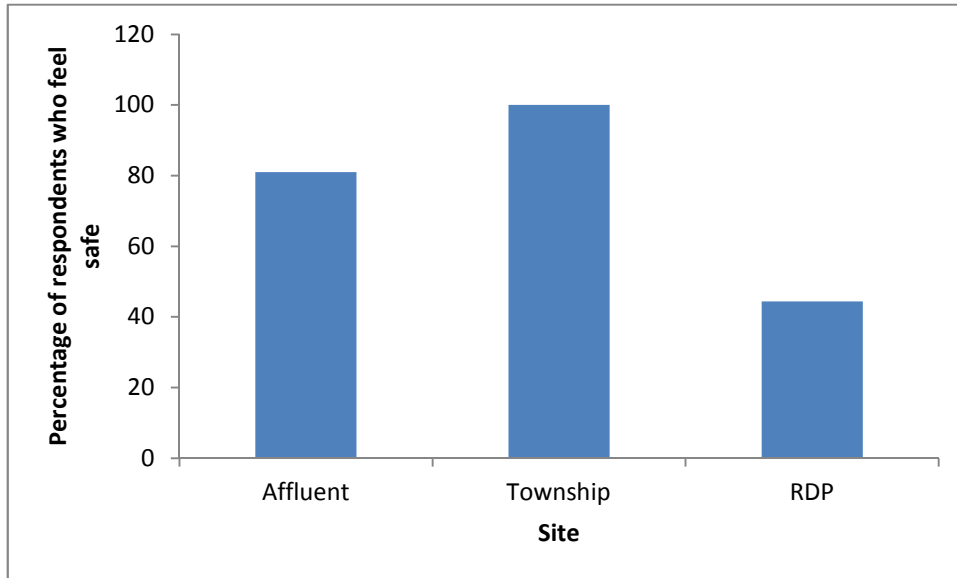
Most of the PUGS in Grahamstown did not have any amenities with only three in 16 having proper amenities (Table 3). The RDP did not have PUGS with proper amenities with only one informal path running through one of the PUGS. There was also a security light but that was not intentional for the PUGS. Only one of the PUGS had proper amenities in the township (Ndlovo Street) and 2 in the affluent area (Botanical Gardens and Oatlands Park).

**Table 3: Amenities in Grahamstown's PUGS**

PUG	Amenities					
	Benches	Bins	Paved paths	Sand Paths	Fence	Other
<b>Affluent:</b>						
Beadle Str.	0	0	0	0	0	0
Botanical Gardens	16	7	0	8	1	Toilets
Currie Park	0	0	0	1	0	0
Gowie Dam	0	0	0	0	0	0
Oatlands North	0	0	0	1	0	Garden Waste disposal trailer
Oatlands Park	2	9	2	1	0	0
<b>Township:</b>						
Ncama Str.	0	0	0	0	0	0
Merryland	0	0	0	1	0	Drainage system
Ndlovo Str.	4	6	1	0	1	Rotating steel gate
Near school	0	0	0	2	0	Garden waste disposal trailer
Police station	0	0	0	0	0	0
Raglan/Ncanga Str.	0	0	0	1	0	0
Wood/Lady Grey Str.	0	0	0	1	0	0
<b>RDP:</b>						
Beaumont/ Valley View Str.	0	0	0	1	0	Security light
Northern RDP	0	0	0	0	0	0
Upper RDP Green space	0	0	0	0	0	0

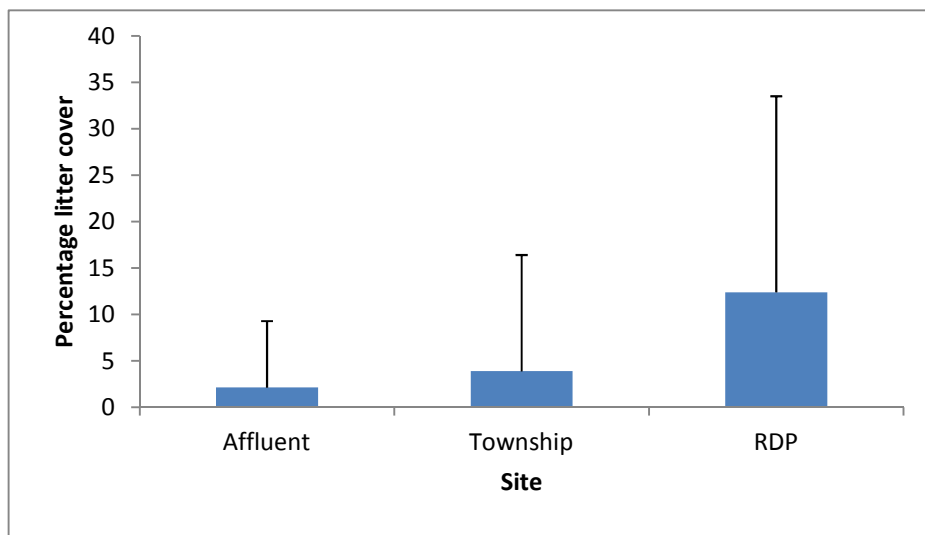
Of the people who said they use PUGS, 80 % felt safe in the township 100 % felt safe when using PUGS in the affluent areas and 43 % of respondents felt safe in the RDP area (Figure 6). A lot of respondents in the affluent area felt safe as they had dogs with them. Many people

that responded that they did not use PUGS due to safety issues. Of respondents across all three areas 100 % discuss that crime, including mugging and rape, were the biggest negative aspects associated with PUGS in Grahamstown.



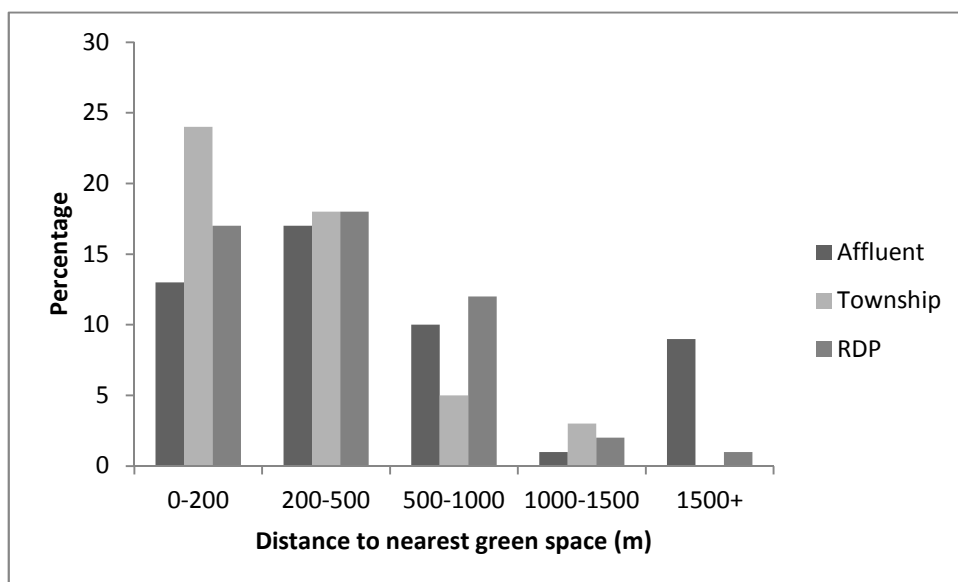
**Figure 6: Percentage of respondents who said they used PUGS views on their safety**

The greatest amount of litter was found in the RDP (12 %  $\pm$  21) area, followed by the township (3 %  $\pm$  12.5) and then the affluent area (2 %  $\pm$  7) (figure 7). The affluent and township area have overlapping standard deviation bars and could suggest that there is no significant difference between the two areas. A single factor ANOVA was done ( $F = 10.15494$ ,  $df = 302$ ,  $P < 0.005$ ) It was found that there was a significant difference between the affluent and the RDP area, but not for the affluent area and township and RDP and township.



**Figure 7: Percentage litter cover**

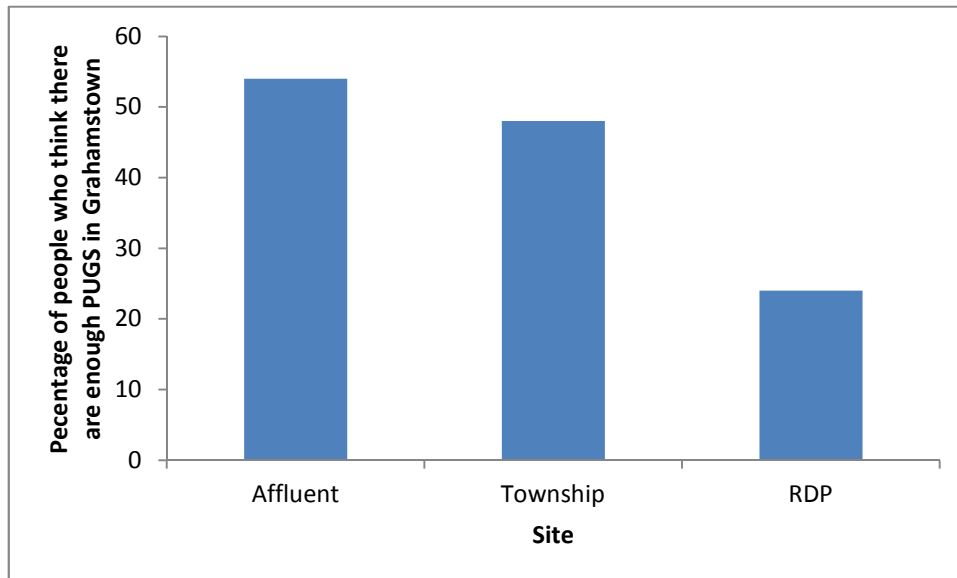
According to Figure 8 the affluent households have to travel further to get to the closest PUGS compared to those in the township and RDP areas. Approximately 36 % of interviewed household across all areas live between 200-500 meters from a PUG, and 18 % of interviewed households in the affluent areas live more than 1500 meters away from a PUGS. This is substantially higher than the 0 % and 2 % of the township and RDP respectively. The township had on average the closes PUGS to people houses at 24 %.



**Figure 8: Distance to the closest PUGS**

In the affluent area more than 54 % of people believed that Grahamstown had PUGS. In the township 47 % believed that there were sufficient PUGS in Grahamstown, while in the RDP

area only 24% believed this to be the case (Figure 9). A Chi-squared test was conducted suggesting that there were significant differences between the three areas ( $X^2 = 28.88$ ,  $df = 4$ ,  $P < 0.005$ ).

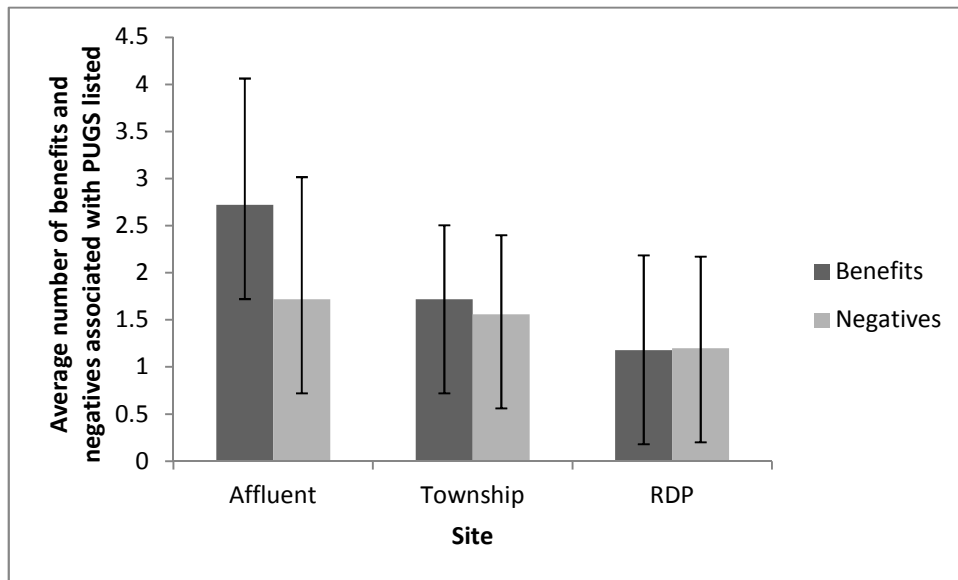


**Figure 9: Percentage of people interviewed that felt Grahamstown had enough PUGS in each of the respective sites.**

More benefits were listed in the affluent area and the township whereas on average people in the RDP area listed more negative issues associated with PUGS (Figure 10). The affluent area could, on average, list many more beneficiaries that PUGS provide than the township and RDP whereas the negative issues associated between the three areas were very similar. The large standard deviation bars however make it hard to conclude if there is in fact a true difference in the ability to list benefits and negative aspects provided by PUGS across the three sites, except for the number of benefits discussed by people in the affluent area. A single factor ANOVA ( $F = 24.953$ ,  $df = 147$ ,  $P < 0.005$ ) suggests that there is a highly significant difference between the number of benefits of PUGS people could list across the three areas. A single factor ANOVA ( $F = 3.210$ ,  $df = 147$ ,  $P < 0.005$ ) suggests that there is also a significant difference between the number of negatives the respondents could list about PUGS in the respective areas.

Common benefits listed across the three areas was area for exercise, place to walk dogs, place for sports and recreation (often linked to getting the youth involved with something/taking them off the streets where they would otherwise be trouble makers) and job creation. All

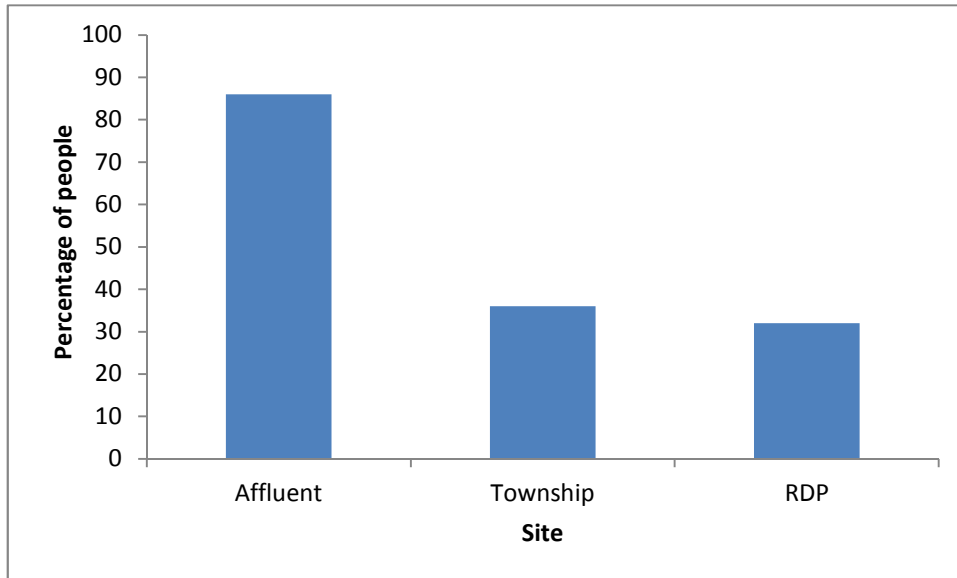
respondents said the fear of crime and presence of crime was a big negative associated with PUGS. Other negatives included noise, dangerous wildlife, potential injuries to children, litter as well as damage to property through balls being played with in PUGS.



**Figure 10: Average number of benefits and average number of negatives that respondents could list about PUGS**

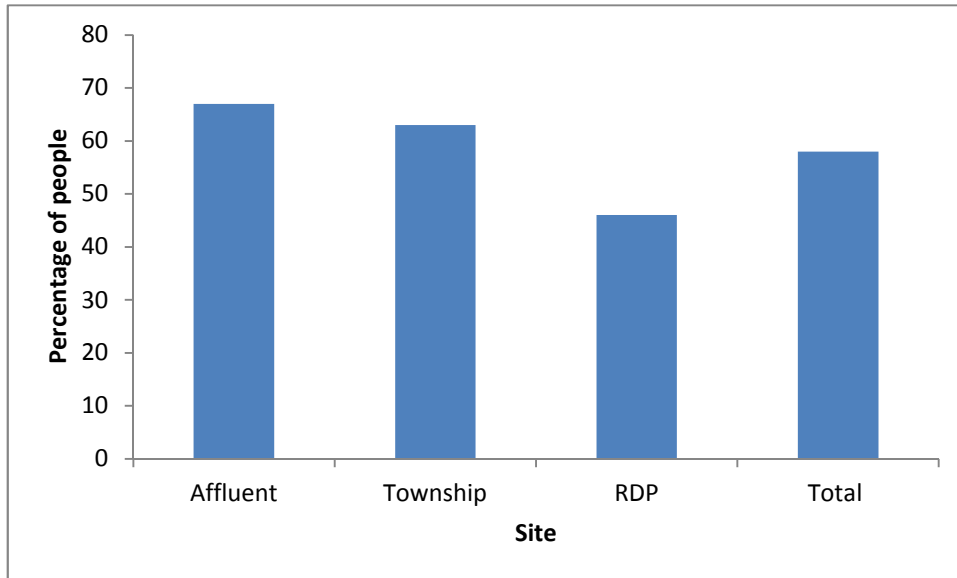
#### 4.2 Economic

It can be seen that on average (86 %) of people in the affluent area responded that they would oppose the transformation of the nearest PUGS to them into housing, compared to a much lower percentage in the township (36 %) and RPD areas (32 %) (Figure 11). A Chi-squared test ( $X^2 = 41.92$ ,  $df = 4$ ,  $P < 0.0005$ ) showed that the respondents' views were significantly different between the three areas. People in the affluent area mostly opposed the conversion of PUGS into housing as it would impact their view and reduce the area for them to walk dogs. People in the RDP and township discuss that not many people use the PUGS and that they create unsafe areas and to having them created into housing would not be a problem. They also discussed that if more houses were to be built they would be very far from town and so building on PUGS would allow new houses to be closer to town.



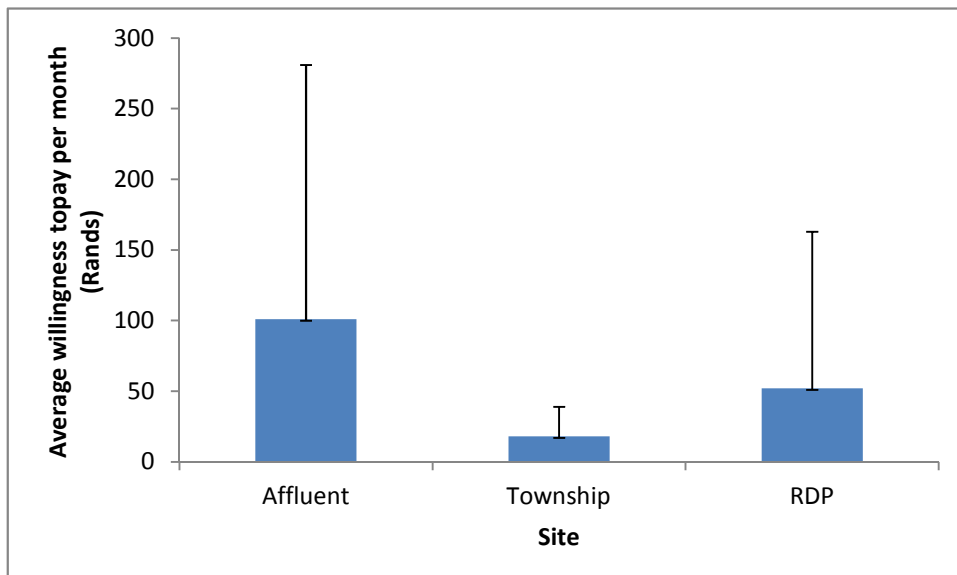
**Figure 11: The percentage of people that would oppose the conversion of the nearest PUGS into a housing development**

Figure 12 shows that that the affluent area has the highest percentage of people willing to pay (67 %) to prevent the nearest to them PUGS to be developed into housing and to help with the upkeep of that PUGS, followed by the RDP area at (63 %). The township area had the lowest percentage of people willing to pay at 46 %. The average willingness-to-pay across the whole of Grahamstown is 58 %. Using a chi-squared test ( $\chi^2 = 9.20$ ) it was found that there is no statistically significant difference between the affluent and RDP areas willingness-to-pay. However, there was a statistical significant ( $p < 0.005$ ) difference between the willingness-to-pay in the township compared to the other two sites.



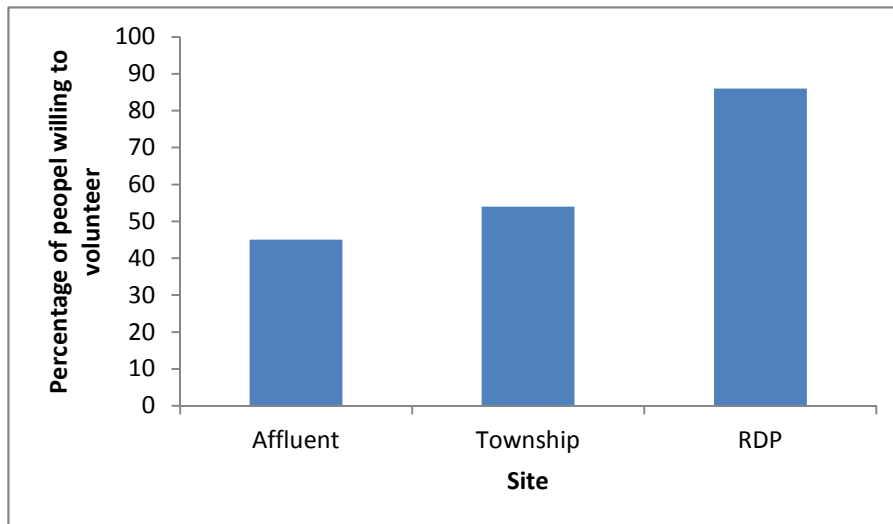
**Figure 12: The percentage of people willing to pay**

Figure 13 shows that the affluent area has the highest willingness-to-pay per month (R 101 ± 180) followed by the RDP area (R 52 ± 111) and lastly the township (R 18 ± 21). The large standard deviation bars on make it hard to conclude if there is a true difference in the amount people willing-to-pay across the three sites. A single factor ANOVA was conducted ((F = 5.767, df = 147, P < 0.005) which suggests that there is a highly significant difference in the willingness-to-pay per month across the three areas.



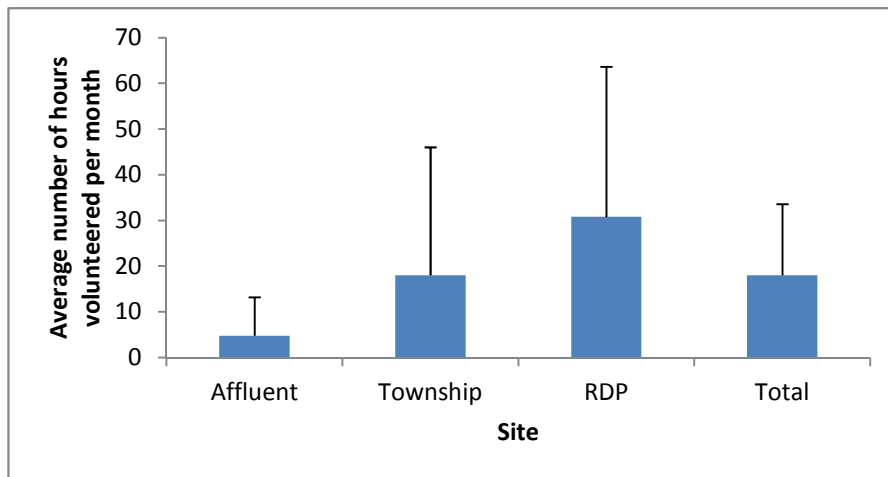
**Figure 13: The average willingness-to-pay in rands per month**

Figure 14 shows that a higher proportion (45 %) of people in the affluent area are not willing to volunteer their services for the up keep of PUGS. Whereas in the township 54 % said they would be willing to volunteer their services to maintain PUGS. The RDP had the highest percentage of people willing to volunteer their services to maintain PUGS at (86 %). A Chi-squared test ( $X^2 = 25.5$   $P < 0.005$ ) suggests that there is a significant difference between the RDP area compared to the township and affluent area, but not for the township and affluent area.



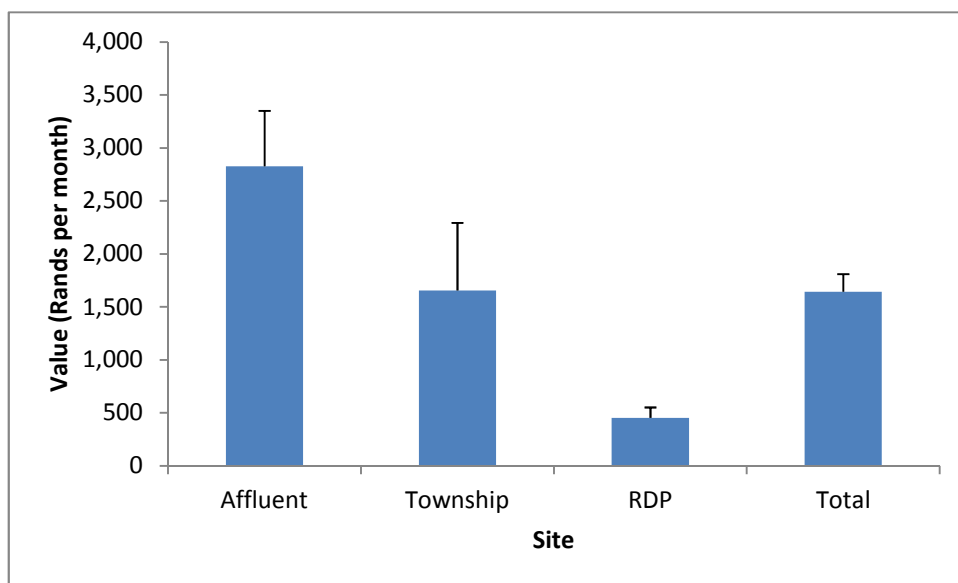
**Figure 14: The percentage of people willing-to-volunteer their services to upkeep and maintain PUGS.**

The affluent area had on average the least number of hours per month people were willing-to-volunteer at ( 4.8 hours  $\pm$  8.4) followed by the township with an average of 18 hours  $\pm$  28 (Figure 15). The RDP area had the highest average number of hours people were willing to volunteer per week (31 hours  $\pm$  33). The average across the whole of Grahamstown was 18 hours  $\pm$  15.5. The Chi-squared analysis showed that there is a significant difference between the three sites in terms of number of hours volunteered per week ( $X^2 = 27$   $P < 0.005$ ).



**Figure 15: Average number of hours people are willing-to-volunteer per month to maintain PUGS**

The RDP site has a the highest value in terms of value created by the amount of time willing to volunteer their services to the upkeep and maintenance of PUGS in Grahamstown (Figure 16). This value is R 2,826 ± 532 per year on average per a household. The township has the second highest value created by the amount of time willing to volunteer their services to the upkeep and maintenance of PUGS, valued at R 1,654 ± 639 per year on average per a household. The affluent site has the lowest value created by the amount of time willing to volunteer their services to the upkeep and maintenance of PUGS, valued at only R453 ± 98 per year on average per a household.



**Figure 16: The average Rand worth per month created by people's willingness-to-volunteer their services for the upkeep and maintenance of PUGS.**

It can be seen that the total benefits (use, non-use and bequest value) for PUGS in Grahamstown amounts to approximately R 20.8 million per year (Table 4). The highest proportion of that value coming from people's willingness-to-volunteer their services free of charge.

It can be seen that the total costs per year for PUGS in Grahamstown are estimated to be approximately R 13.7 million per year.

**Table 4: The total costs and benefits in Rands per year of PUGS in Grahamstown**

Benefits	Amount	Costs	Amount
Cash Value willing-to-pay	5,469,634	Municipality Budget	9,900,000
Value from community service	15,407,960	Botanical Gardens Budget	3,554,793
		Opportunity Cost of PUGS (rates and taxes on land)	254,000
Total	20,877,595	Total	13,708,793

The general budget for PUGS in Grahamstown is just under R 10 million. Of that approximately R 3 million goes towards salaries, R 1,8 million to running costs such as petrol

and repairs on capital, etc. and R 5 million on capital including tractors, vehicles buildings lawn mowers, etc.

The Botanical Garden is funded by Rhodes Univeristy as well as by SANBI. Wages account for R134 thousand per year and the capital and running costs amount to R120, 000 per year giving the Botanical Guarden a total cost of R254, 000 per year.

**Table 5: The breakdown of the municipality and Botanical Gardens annual budget for PUGS in rands per year**

Municipality	Amount	Botanical Gardens	Amount
Capital / Infrastructure	R 5,000,000	Wages ( two permanent workers)	134, 000
Wages (skilled workers and labourers)	R 3,100,000	Capital / Infrastructure and Running Costs	120, 000
Running costs	R 1,800,000		
Total Budget	R 9,900,000	Total Budget	254, 000

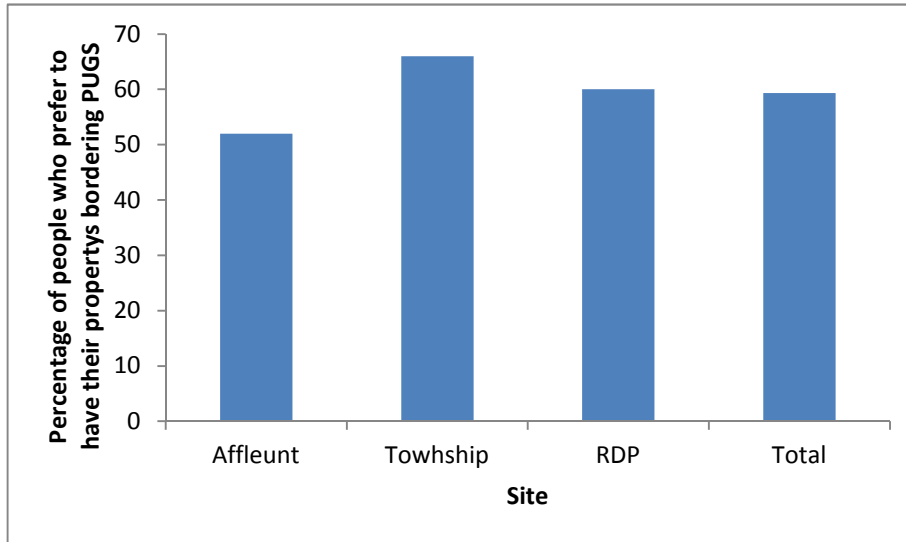
It can be seen that the benefits of PUGS in Grahamstown outweigh the costs by approximately R 7.1 million per year (Table 6). It must be noted that costs may be over estimated and benefits underestimated therefore this may be an underestimate in the favour of costs. This is a benefit/cost ratio of 1: 0.65

**Table 6: A cost/benefit analysis for PUGS in Grahamstown in millions of rands**

Total Benefits	R 20,877,595
Total Costs	R 13,708,793
Benefits Outweigh Costs	R 7,186,801

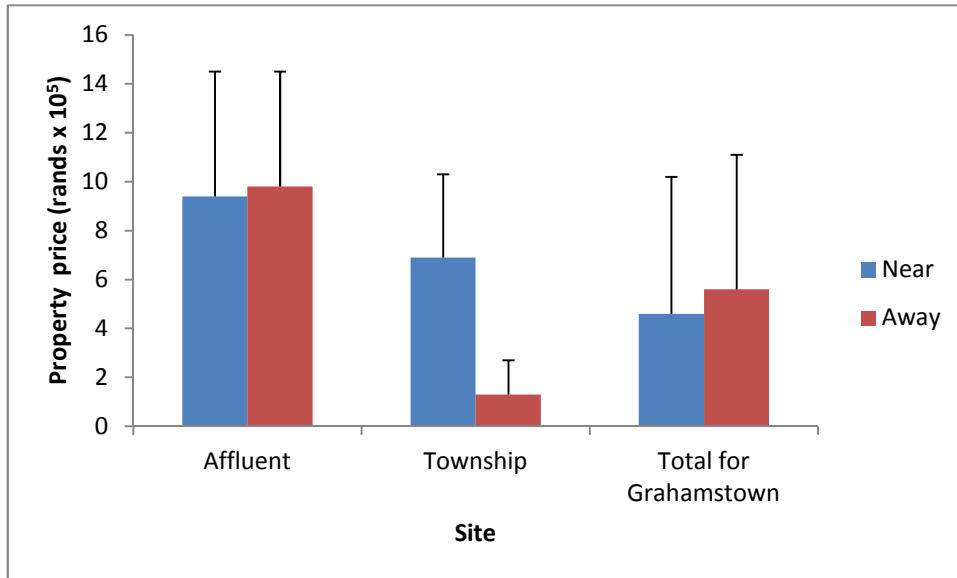
According to Figure 17, on average most people (59 %) in Grahamstown would prefer to have their property bordering PUGS. The affluent area had the smallest proportion of people (52 %) preferring their properties to border PUGS followed by the RDP (60 %) and the highest proportion was found in the township (66 %). A Chi-squared test ( $X^2 = 27.80$ ,  $df = 4$ ,

P < 0.005) showed that there is a significant difference in the respondents' views in terms of preference of PUGS being further or closer to their place of residence between the three areas.



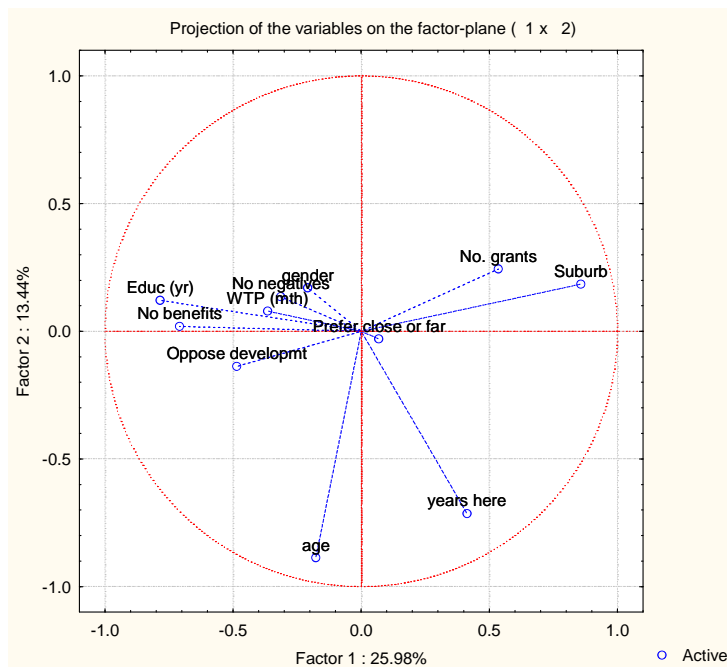
**Figure 17: Percentage of people who prefer living on a property bordering a PUGS**

It can be seen that on average the property prices in the affluent area are four times higher than those in the township (Figure 18). At both sites properties further away from PUGS are worth more than properties bordering PUGS. The same trend can be seen for Grahamstown as a whole. There is no statistical significance between near and away in the affluent area and for the total in Grahamstown. However, this is statistical significance (P < 0.05) between near and away property prices in the township.



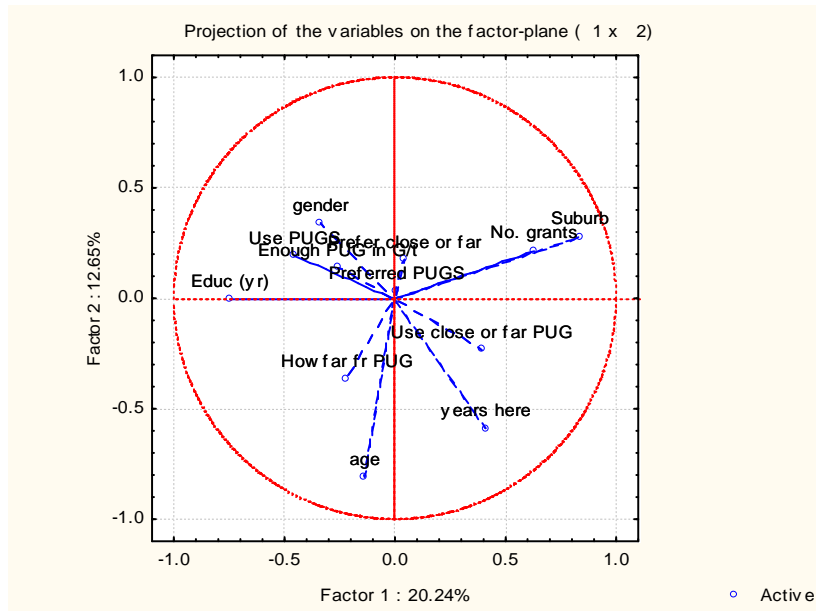
**Figure 18: A comparison of property prices bordering and away from PUGS**

Figure 19 illustrates that there are not any very strong trends between any of the variables. However it can be seen that there is a slight relationship whereby, men on average can list more negatives associated with PUGS and are on average more willing-to-pay than women. It can also be seen that people with higher education can on average list more benefits.



**Figure 19: PCA for demographic variables, perceptions on benefits and negatives of PUGS and for willingness-to-pay.**

There are no very strong relationships in Figure 20. It can be seen that on average men use PUGS than women as well as prefer to use closer PUGS. People that have lived in Grahamstown are more likely to use closer PUGS.



**Figure 20: PCA for demographic variables, the used of PUGS and whether there are enough PUGS.**

## **5. DISCUSSION**

### **5.1 Condition**

Species richness and abundance as shown by the Shannon-Wiener was the highest in the affluent area (Figure 4). This is due to the fact that the PUGS in this area have a lot of natural dense bush, but also contain trees that do not naturally occur in the Eastern Cape (aliens). Most of the PUGS in the affluent area have been well planted with numerous species accounting for a high Shannon-Wiener Index. This is appropriate, as through the surveys we have found that people in the affluent site prefer natural vegetation opposed human made. This is because people in the affluent area value the biodiversity and ecosystem services that are provided by PUGS, such as air regulation and storm water control. This is different from the township where the majority of PUGS are just grass and do not have trees, thus resulting in very low tree species richness and evenness. Iverson and Cook (2000) found that in Chicago wealthier suburbs had more public trees than poorer suburbs which is similar to our findings.

The RDP had very small PUGS with semi-cleared natural vegetation. The largest green space comprised of mainly grass and therefore the tree species richness and evenness in this area was low. The attitudes of the people in the townships and RDP reflected that the municipality neglects the PUGS and lose interest in the long-run as so planted tree just die. Biodiversity is a measure of the health of ecosystems, and greater biodiversity implies greater health (Rapport *et al.*, 1998). By measuring the biodiversity of PUGS an accurate comparison between affluent, RDP and township can be made. PUGS with natural vegetation will have a high biodiversity index. This has many potential benefits such as providing refuge for animals and birds in the urban areas (Sandstrom *et al.*, 2006; Cornelis and Hermy, 2004; Van Herzele and Wiedemann, 2002). According to Brown and Grant (2005), the conservation of nature in an urban environment has a direct impact on people in terms of health, well-being and standard of living. Therefore the RDP and Township areas are deprived of this due to the lack of conservation and municipal engagement in these areas. According to Bullock (2006), PUGS with high tree biodiversity will generally attract more visitors.

Figure 5 shows that on average across Grahamstown 30 % of the woody species counted were alien. The RDP area had the highest proportion of alien species (40 %) compared to indigenous shortly followed by the affluent area (36 %) and below that the township area with (15 %). This is a lot less than the findings from McConnachie *et al.* (2008) which showed that the proportion of alien woody species was approximately 56 % in Grahamstown. This big different may be due to the fact that in numerous PUGS many (up to 50) new indigenous trees have been planted which were not there during the McConnachie *et al.* (2008) study, and so has reduced the proportion of alien species in PUGS in Grahamstown. A study of 32 cities across Europe found that the percentage of native species varied from 48 % in city squares to 65 % in city parks (Lososova *et al.*, 2011). In Bangalore approximately 77 % of the tree species in urban parks were aliens (Harini and Divya, 2011). It can therefore be seen, that when compared to other PUGS across the world the proportion of alien species in Grahamstown's PUGS are a lot lower, and decreasing which is a positive sign.

Table 2 shows the top five species in each area, as well as the total number of different species counted. It can be seen that the three different sites had very different species, and they all had different top five species with no overlap. It can also be seen that the affluent area had by far the most number of species (103), compared to the other two areas. This is

due to the fact that the PUGS in the affluent areas were much larger, and the township had many areas with only grass thus having much less tree species. There was a low number of tree species in the RDP area due to the fact that the PUGS in that area are much smaller. There were two alien species in the top five species namely *Pinus halepensis* which is native to the Mediterranean areas in Europe and *Plectranthus barbatus* which is a woody shrub often used in gardens for its ornamental value (van Wyk *et al.*, 2008). Interestingly, a lot of *Plectranthus barbatus* was seen in the gardens of the RDP inhabitants and must have escaped from there. van Wyk *et al.* (2008) discusses that *Pinus halepensis* is a very commonly planted tree in parks and also streets in the Cape due to its tolerance to drought as well as extreme temperatures.

People in the township and RDP prefer to have human made PUGS with play facilities and sports fields, compared to people in the affluent areas who prefer to have well vegetated PUGS. This is associated with less woody species biodiversity. Open PUGS with sports and play facilities are preferred as it gives children and older people something constructive to do in the PUGS. This is important as in the RDP and township it came across that PUGS were associated with negative behaviour such as criminal activities, underage drinking, drugs and fighting. Thus human made PUGS are conducive to good behaviour will stop children partaking in these negative activities and bad habits and allow them to embrace nature and recreation.

Much of the legislation that has been put in place in recent decades to improve PUGS due to the increase in urban sprawl in many areas (Bengston *et al.*, 2004). This has been done in order to manage urban growth and to protect open spaces from development. In the United States of America, policies for protecting open spaces are at the centre of the issue on sustainable development, therefore making development of an area economically, environmentally and socially sustainable (Bengston *et al.*, 2004). However, more legislation needs to be put in place to standardise the provision of PUGS in different areas (Bengston *et al.*, 2004). On average, the PUGS in the RDP area were the smallest and had the least amenities. The PUGS in the RDP area were all informal and not listed with the municipality. The township and affluent area had similar sized parks and McConnachie *et al.* (2008), shows that on average PUGS in Grahamstown are 1.93 ha. This can be supported by our findings which discuss that only half the people in the affluent area and township believed

that there were enough PUGS in their suburb and in Grahamstown and only 24 % in the RDP area. Shackleton and Blair (Unpublished) found that in Fort Beaufort, a town close to Grahamstown, 60 % of the residence believed that there were not enough PUGS in the town.

Amenities increase the attractiveness of PUGS as they add convenience and enjoyment, as well as add economic value (Chiesura, 2003). Amenities such as a jungle gyms or other play facilities increase the use of PUGS and provide the attraction for small children to play (Chiesura). There were 16 PUGS evaluated in the different areas in Grahamstown. Most of the PUGS did not have any amenities at all. Play areas are important for children especially in the township and RDP areas because often the parents cannot afford to provide them with any play facilities. Gardens in these areas are also very small making the need for play facilities for children in these areas a great priority. A problem is presented in the fact that only three PUGS out of 16 had litter bins. This is a problem because without bins the amount of litter in PUGS becomes greater. A few of the green spaces had informal sand paths that were created by foot traffic, besides for the Botanical Garden which had properly constructed paths. Other than Botanical Gardens and Ndlovo Str. none of the PUGS had fences which allowed uncontrolled access. Many respondents discuss that they would like more of the PUGS to have fences to keep out onlookers and domestic animals when they are having their prayer group sessions in PUGS.

There were six PUGS evaluated in the affluent area. Of these six only two had amenities. The Botanical Gardens had the most amenities out of all the PUGS. The condition of the amenities in the Botanical Gardens were good and well-maintained. The sand paths that were present in the Botanical Gardens were formally constructed in a planned layout. Oatlands Park was the only other green space in the affluent area that had any amenities and was one out of two that had paved paths. The two benches that were present in Oatlands Park were broken. The other green spaces such as Gowie Dam and Oatlands North were very natural and no human made features were evident. The PUGS in the township, besides Ndlovo Steet, did not have any amenities. A few had informal sand/foot paths that had been created by foot traffic. Ndlovo Street had a few amenities that were in good condition. It also had a rotating steel gate to control access. There were no amenities found in the PUGS in the RDP area. There were three informal foot paths in the Beaumont/Valley View Street green space and a security light.

The presence of PUGS creates a potential security/crime threat for people who use them and for people that live bordering PUGS or nearby. Residents may be concerned about the security risk associated with PUGS (Chen and Yim, 2006). This was proved in the questionnaires that were conducted; many people stated that the biggest negative associated with PUGS was the potential security threat. Shackleton and Blair (unpublished) found that in two towns near Grahamstown approximately 50 % of people did not use PUGS due to not feeling safe. PUGS provide communal areas for criminal activities to take place, such as drug dealing, ambush spots for muggers, as well as areas for drug consumption and underage drinking (Troy and Grove, 2008). Often the only reason that people did not use any PUGS was because of the security threat. There have not been many security measures that have been implemented to address the security threat issue associated with PUGS. Beaumont/Valley View Street green space was the only PUGS that had a security light. However, this was just by coincidence and was more for the street than the PUG. The Botanical Gardens and Ndlovo Street were the only PUGS that had fences around. The Botanical Gardens was the only PUGS that had any security guard measures implemented. These security guards are employed by Rhodes University.

Litter was observed due to the harmful the negative aesthetic nature as well as an indicator of the upkeep of PUGS in Grahamstown. Litter gives a negative impression of the condition of PUGS, as well as the overall attractiveness (Ozguner and Kendle, 2006).

The great differences in litter cover for the three areas may be attributed to the fact that the RDP area had much less amenities than the other two sites. Many of the respondents in the RDP area also said that the service delivery by the municipality was very poor in that area. Therefore, much of waste was left in the RDP PUGS. The township area had more amenities than that in the RDP and so this has a direct effect on the litter cover. Where the effect of service delivery and amenities such as dustbins and fences can be seen to have the greatest impact was in the affluent area. Due to these factors the PUGS in this area had a litter cover of less than 5 %. The Botanical Gardens is the only PUG that has maintenance every day and so had a very small litter presence. In the affluent area a lot of litter found in the PUGS was due to unemployed people dragging rubbish bags into PUGS to obtain recyclable goods to sell.

Accessibility to PUGS is an important aspect in assessing the quality of PUGS in a city (Bullock, 2006). It was seen that the majority of the people in the township area lived closer to PUGS in comparison to the RDP and affluent areas respectively. On average most residents were within 200 meters of as PUGS which was also found by (Shackleton and Blair, unpublished). Literature shows that there might be a negative relationship between access to PUGS and the level of activity that can be conducted in the PUGS (Hillsdon *et al.*, 2006). This means that if there are a lot more accessible PUGS in an area they are likely to have less to offer. This was found to be true in our study, with areas with the close PUGS (township and RDP) having less amenities, compared to areas where PUGS are further away (affluent) which on average had better amenities.

## 5.2 Economic

The results showed that on average the willingness-to-pay in the affluent area was much higher compared to the other sites. This is supported by findings from Shackleton and Blair (unpublished). This was expected due to the fact that on average the income per household is higher in the affluent area compared to the township and RDP. It was also found that the willingness-to-pay in the RDP was higher than in the township. This may be due to the fact that there are fewer PUGS and smaller PUGS in the RDP area compared to that in the township, thus people were more willing-to-pay to preserve the few PUGS in the RDP as they hold more value to the community. The willingness-to-pay for Grahamstown amounted to R 5,469,634 million per year. This was much higher than to other Eastern Cape towns which amounted to approximately half a million rand per year (Shackleton and Blair, unpublished). This is most likely due to the fact that Grahamstown has a bigger population as well as the fact that on average residence in Grahamstown is wealthier (McConnachie, *et al.*, 2008).

The opposite was found when looking at the results as to whether people are more willing-to-volunteer their services to maintain and upkeep PUGS. The results that were found were expected. People in the affluent site were least willing-to-volunteer their services to the upkeep and maintenance of PUGS. This is due to the fact that people from this area often work longer hours and they have the money to pay and thus would rather pay because time is too valuable for them and they would rather spend their free time with their families. In the township and RDP areas there are a higher proportion of unemployed people who discussed

that they were willing-to-volunteer their services to maintain and upkeep PUGS as they do not work and thus have free time to volunteer. This is supported in recent findings from (Shackleton and Blair, unpublished).

Table 4 shows value given by people's willingness-to-volunteer themselves to community service for the upkeep and maintenance of PUGS is greater than the cash value of people willing-to-pay. This can be explained by the fact that many people in the Township and RDP site did not have the financial resources to pay cash value; however they had a lot more spare time in which they would be more willing-to-volunteer their service to the upkeep and maintenance of PUGS shown by Figure 14. The people in the affluent site had greater financial resources and less spare time in which they could volunteer their service to the upkeep and maintenance of public PUGS (Figure 12). Therefore, people in the affluent area were more willing-to-pay in cash. There were a number of respondents who were not willing-to-pay. They discuss that they pay a large proportion of their income to rates and taxes. They therefore, believe that it is not their responsibility to maintain and upkeep PUGS in Grahamstown, but the responsibility of the municipality and the authorities.

The total costs on PUGS were extrapolated by summing up all the costs involved to manage and maintain all the existing PUGS. These costs included salaries (from specialised managers and supervisors to semi-skilled grounds staff, capital used to maintain and upkeep the PUGS (including equipment and machinery such as vehicles, weed-eaters and lawnmowers etc.) and the cost of infrastructure and the opportunity cost of using the PUGS for a different land-use. These costs are all included in the annual budgets for the PUGS. It must be noted that there are other costs that were not included such as a once off donation of R 10 million for the development of new PUGS and planting of trees in the township. To be relevant for this study the R 10 million would have to be discounted over time. The discounted figure would become very small and thus would not influence the costs very much, and so was left out.

Table 6 shows that the total benefits outweigh the costs of PUGS by R 7,168,801 this is a significant value and relates to a benefit cost ratio of 1: 0.65. This therefore means that the population of Grahamstown values the PUGS significantly more than what is represented by the total capital inputs into the PUGS. This is positive as it shows that the population of Grahamstown value their PUGS and a change in land use would not be accepted by the general public. However this also shows evidence that the municipality should put more

capital and greater measures in place to improve the PUGS in Grahamstown as the public of Grahamstown value these PUGS and have a significant amount of interest and value placed in them.

The results depict that more half the households across the three areas would prefer to live on a property bordering PUGS, due to the fact that people feel that bordering PUGS creates easier access to the PUGS, as well as provides more direct use of benefits associated with PUGS (Nagendra and Gopal, 2010; Tzoulas and James 2010). Many respondents discussed that they liked bordering PUGS so it was easy to take their dogs out for a walk and provided place for children to play especially in the township area. Having PUGS so close benefited residence as it made access and use of PUGS much easier. Most respondents who discusses that they did not want to live bordering PUGS, was because of the risk of crime.

The crime threat is represented in the price of properties. Houses further away from PUGS have a higher value in both the affluent and township area. This may be because in South Africa PUGS are associated with security threats. Troy and Grove (2008) found that in Baltimore on average properties bordering PUGS were of a higher value, except in a few high crime suburbs where the opposite was found. This study therefore reinforces our conclusion that properties bordering PUGS have a lower value due to the crime threat.

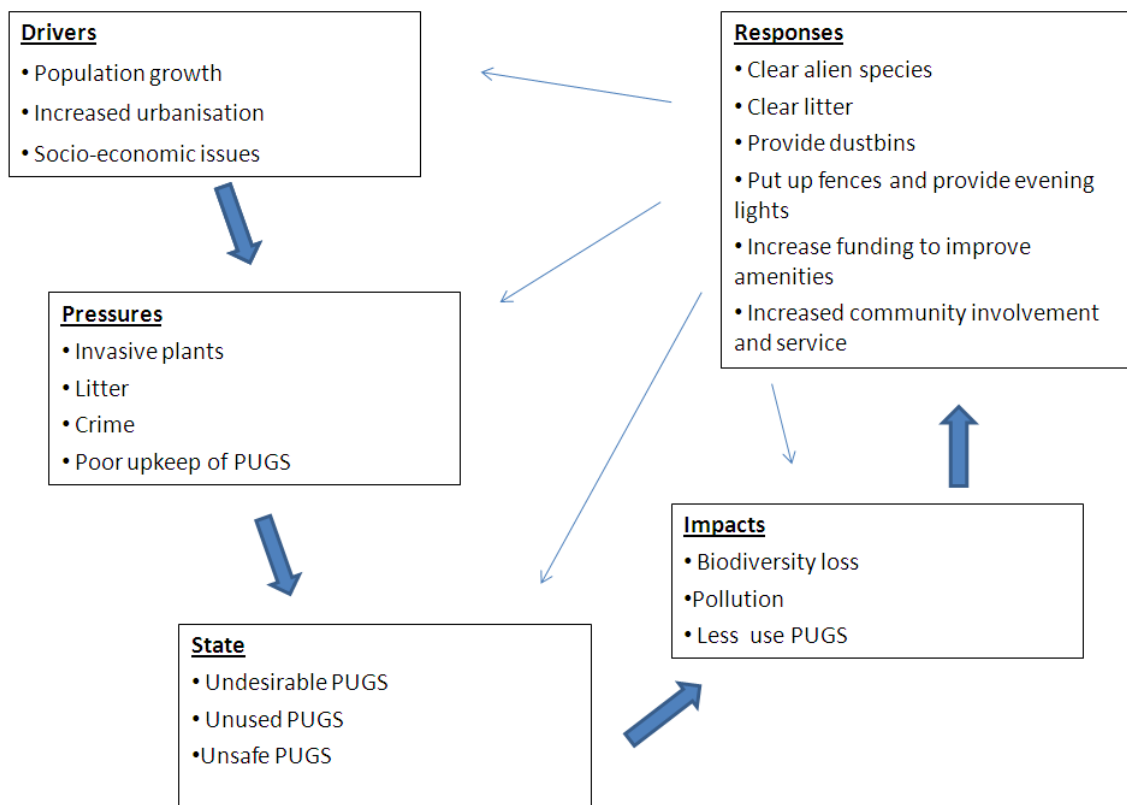
The DPSIR framework was applied to PUGS in Grahamstown. Figure 21 discusses that the main drivers acting on PUGS in Grahamstown are population growth, urbanization, and socio-economic issues in South Africa. Population growth and urbanization lead to the continual increase of cities. This make issues such as proper planning of cities to include the adequate amount of PUGS important. For example the RDP settlement in Grahamstown has no formal PUGS and this was not properly considered when building the new settlement. Socio-economic issues in South Africa such as unemployment, crime and violence also impacts PUGS in Grahamstown. The potential for crime and violence extends its self into PUGS and thus leads to less use due to safety issues.

The pressures found in PUGS in Grahamstown include invasive species, litter, crime and poor upkeep of PUGS (Figure 21). Invasive plants reduce natural biodiversity through competition, which is prominent in some PUGS in Grahamstown (Borokini, 2011). Litter is unsightly and if it is prominent reduces the quality of PUGS (Ozguner and Kendle, 2006). Crime influences the use of PUGS with in Grahamstown making safer ones much more

popular (Troy and Grove, 2008). Many PUGS are not properly maintained with many of the bins and benches being broken, as well as numerous alien species and litter, which affect the use of PUGS.

These drivers and pressures lead to PUGS that are undesirable for users, resulting in less use of PUGS. The impacts are similar to the state and are influenced by the drivers, pressures and responses discussed. Impacts include biodiversity loss through aliens, pollution causes by litter in many areas sewage, as well as poor use of PUGS caused by crime, lack of amenities and upkeep (litter).

The responses include the clearing of alien species and litter. Providing amenities such as dustbins, benches, and fences and increases community involvement and funding to improve PUGS in Grahamstown. These responses will be discussed more thoroughly in the recommendations section below.



**Figure 21: DPSIR framework for PUGS in Grahamstown**

## **6. RECOMMENDATIONS**

Through the above research some key findings have been made where municipality intervention and policy intervention can make a difference in improving Grahamstown's populations' lifestyles and standards of living in terms of PUGS. Through the study it has become evident that the public of Grahamstown value PUGS and find them an important part of daily life. Therefore it is of the utmost importance that the municipality and authorities respond in an active and appropriate manner to better the quality of PUGS in Grahamstown.

In terms of tree species, it can be seen that there are too many invasive in some areas and too few trees in others. Therefore, it would be recommended that alien trees should be removed and the introduction of more indigenous trees should take place. In an interview with Mr Bates, it was discussed that the municipality try's to service and maintain all the PUGS around once a month. This mainly involves cutting grass and clearing litter. However, a new goal should be set out to cut out alien trees during the monthly maintenance of these PUGS. Another goal should be to plant indigenous trees in PUGS in the township and RDP, as many of the PUGS lacked trees. However, these new trees should also be protected from goats, as well as people cutting them for fire wood, by putting small fences around them to ensure survival. It should also become policy that under no circumstances should non-indigenous trees be planted, but evidence suggests that this is no longer an occurring problem as it was seen that all newly planted trees were indigenous.

In order to ensure that things such as urban sprawl do not occur, there should be laws put in place with respect to PUGS. There should be a percentage of green space in a town or city allocated per number of houses. If the town were to grow in size, more open green spaces would have to be secured. In doing so this would ensure sustainability of open green spaces and would reduce the chances of things such as urban sprawl occurring. It is important to introduce more PUGS, as communities rely on PUGS for social networking and social support systems. For example church meetings in many of the Grahamstown PUGS.

In the interviews conducted, respondents highlighted the need for more PUGS in Grahamstown especially in the RDP area. Most of the PUGS that are in Grahamstown are either not in good condition or are unsafe to use. In the township and RDP areas, respondents stated that they preferred human made PUGS to natural PUGS. Through the need for the development of more PUGS in Grahamstown this needs to be taken into consideration.

Human made PUGS are important areas for recreation and sport for people in the township and RDP areas, as it gives the residences something constructive to do, and detracts them from partaking in negative activities and negative behaviour. People in the affluent area prefer natural PUGS, as they feel biodiversity and ecosystem services are more important to their life styles. Therefore, these different opinions need to be taken into consideration when constructing new PUGS in the different areas.

In order to ensure that all the PUGS provide the public with optimum conditions, the amenities would have to be improved. The municipality should first secure these areas with fences, security lights, in doing so it would reduce the chances of the future amenities of being vandalised. It would also be a small step to reducing the crime threat. From there more amenities such as play facilities for children and walk ways may be put in place, ensuring that everyone gets the optimal benefit out of these PUGS. Litter bins also need to be put in place in many of the PUGS, to reduce the amount of litter in the PUGS.

From this one may conclude that an increase in amenities such as dustbins, fences and greater service delivery in areas such as the RDP, would greatly reduce the litter cover and improve the whole condition of the PUGS. One may then also assume that this increase in the state of the area would ensure that the people of the area keep it in that state and more people would use the PUGS as they have become more attractive and the safety has been resolved.

If the PUGS especially in the township and RDP areas were created in accordance to the needs of the communities (with sporting facilities) small sporting clubs could be set up. This would get the youth off the street and encourage more use of PUGS in Grahamstown.

Form the study it was found that the Grahamstown community was willing to provide free of charge volunteer work. Programmes could be set up in each suburb whereby once a week or every second week the public could gather together to maintain the PUGS in Grahamstown. This could include removal of alien species, as well as the collection of litter. It could also include creating nurseries and planting indigenous trees into the PUGS.

The municipality is a key role player in terms of the condition that the PUGS are in, as well as their maintenance. Many of the PUGS were not well maintained and lacked amenities and security measures. This can be related to lack of funds, which is directly related to poor management of financial resources by the municipality. The municipality needs to improve

their handling of financial books and expenses by the correct people to combat this reoccurring problem. It is also important that the municipality correctly manages its funds so that it does not run out of funds half way through a project

Other than the local level management of municipalities, there are no other formal authorities or organisations that are responsible for PUGS. If a National Trust was developed for PUGS it would ensure the sustainability of well-cared for PUGS. It should also concentrate of the minimisation of PUGS being converted into development areas. Alternatively an NGO needs to be created that can raise funds for the improvement of PUGS and ensure they are properly maintained. Monitoring of PUGS also need to be conducted on a continual basis which could be done by an NGO or the possible National Trust.

## **7. CONCLUSION**

Through assessing the overall condition of PUGS in Grahamstown, their location and people's willingness-to-pay for their general upkeep and maintenance we can draw certain conclusions. PUGS are used less by households from the township and RDP areas and this is most likely this is related to the poor condition and lack of PUGS in these areas. Most of the PUGS in Grahamstown lack adequate amenities which need to be improved on. It can also be seen from the findings that a greater percentage of households in these areas would prefer human made green spaces as opposed to natural ones. It was found that properties bordering PUGS are of a lesser value that those further away which is related to the threat of crime. Although there was higher percentage of people willing-to-pay for the upkeep and maintenance of PUGS in the affluent area, households from the township and RDP areas were willing-to-volunteer more of their time. By equating the two we able to see that overall there is a significant proportion of the Grahamstown population who actually place a value on PUGS and would like to see many of them improved. Overall Grahamstown residence place a grate value on PUGS than is being spent on them as shown in the cost/benefit analysis. On the one had is a positive finding as it can be seen that the public value PUGS and on the other it is problematic as it indicates that more money should be spent on PUGS which may improve their condition. Many recommendations were discussed that would be important to help improve the condition and running of PUGS in Grahamstown.

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