An Assessment of Urban Residents' Knowledge and Appreciation of the Intangible Benefits of Trees in two Medium Sized Towns in South Africa

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ABSTRACT

In order to meet the different public needs and requirements of contemporary urban society, a better understanding of public perceptions, appreciation and knowledge of the assorted values derived from urban trees is beneficial for improved urban greening. Thus, this study carried out an assessment of urban residents' knowledge and appreciation of the benefits of trees and the role they play in enhancing the quality of life in urban systems. The study primarily focused on the intangible benefits (also referred to as cultural and regulating services) of urban trees, because most research to date in South Africa on trees and the benefits derived from them is biased towards the provisioning services of trees in rural areas. The significance and contribution of the intangible benefits of trees in urban systems is often underestimated and not seriously taken into account by urban planners, policy makers and other key decision makers.

The study was conducted in three different residential settlement types (formal townships, RDP settlements and informal settlements) in two towns in the Limpopo Province in South Africa, namely Bela-Bela and Tzaneen. Findings revealed that the intangible benefits of trees are seen to play a significant role in improving both residents' quality of life and the environmental conditions in cities, including the preservation of biodiversity. Findings also showed that urban residents had strong spiritual connections with trees and placed considerable cultural and historical importance on specific tree species and individual trees.

Urban residents in both towns had moderate knowledge of the intangible benefits of trees based on the knowledge score that was created for the purposes of this study. Fifty seven percent of the residents had 'reasonable' knowledge of some of the intangible benefits of trees, while 43% had low levels of knowledge. That said, the majority of residents demonstrated high appreciation (98%) of the intangible benefits of trees (especially social and cultural values), with few residents not recognising these, suggesting that knowledge does not necessarily lead to appreciation. Age and level of education were found to influence knowledge of the intangible benefits of trees. A large proportion (86%) of residents who possessed tertiary level qualifications had more knowledge of the intangible benefits of trees as compared to residents with no formal education. Findings also revealed that younger respondents (60%) had more knowledge of the intangible benefits of trees. Factors that influenced appreciation of the intangible benefits of trees included links to crime, peoples' value systems (their pro-environmental and altruistic values) and residential settlement type. Sixty five percent of residents in both towns felt that urban street trees and trees in public spaces attract criminals and promote crime, while 67% of RDP and 96% of informal township residents did not use or appreciate the social

and recreational benefits of trees mainly because of the absence or long distances to public parks.

A Willingness To Pay (WTP) survey revealed that a high proportion of residents in Bela-Bela (86%) were WTP a small annual fee in order to sustain greening initiatives in their communities compared to the residents in Tzaneen (53%). In terms of the planting and retention of trees, it was found that 300 households in both study towns had planted and retained a total of 1 615 trees in spite of the various factors that negatively influenced planting and retention of trees such as residency time and tenure security. The majority (66%) of informal township residents said tenure security was an important factor to consider when making tree planting decisions, while this was not an issue for formal township and RDP residents.

Policy implications and recommendations are presented to help municipalities and urban planners improve and develop effective policies and programmes that will enable implementation of sustainable urban greening programmes.

Key words: Appreciation, knowledge, intangible benefits, cultural and regulating services, urban systems.

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LIST OF ABBREVIATIONS AND ACRONYMS

CV	Contingency Valuation
DAFF	Department of Agriculture Forest and Fisheries
DF	Degrees of Freedom
DWAF	Department of Water Affairs and Forestry
ESB	Environmentally Significant Behaviour
EU	European Union
FAO	Food Agriculture Organisation
Hh	Household
IDP	Integrated Development Plan
IERM	Institute for Environment and Recreation Management
MEA	Millennium Ecosystem Assessment
MS	Microsoft
NEP	New Environmental Paradigm
NGO	Non Governmental Organisation
NRC	National Research Council
NUFU	National Urban Forestry Unit
PASW	Predictive Analytics Software
PEB	Pro-Environmental Behaviours
QRED	Quantec Regional Economic Database
RDP	Reconstruction and Development Programme
SA	South Africa
SANBI	South African National Biodiversity Institute
SANPAD	South Africa Netherlands research Programme on Alternatives in Development
SAWS	South African Weather Service

SPSS	Statistical Software for Social Sciences
SSACS	Statistics South Africa Community Survey
STATSA	Statistics SA
TEV	Total Economic Valuation
TV	Television
UN	United Nation
UNHS	United Nation Human Settlement
USA	United States of America
Vs	Versus
WTP	Willingness to Pay

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CHAPTER ONE

INTRODUCTION AND STUDY OVERVIEW

1.1. SUSTAINABLE URBAN SYSTEMS

Urban sustainability, deals with the "fundamental character of interactions between nature and society within urban systems" (Kates *et al*., 2001). It is further described as "a transdisciplinary effort to come to grips with one of the most perplexing issues of our time: how to achieve a symbiotic relationship between biological and socio-cultural systems so that future options are not foreclosed" (Rapport, 2007). The importance of sustainable urban systems for economic development and social well-being of urban residents cannot be over emphasized. If cities have to be designed with the intentions of being sustainable, they should be planned in such a way that negative impacts on the environment are reduced and their inhabitants should strive to reduce energy requirements, air (carbon dioxide and methane) and water pollution (Rees, 2003). One of the many ways in which cities or towns can be planned to be more sustainable is by integrating trees (Sassen, 2009). Green spaces with trees as major components in urban areas are necessary for the provision of ecosystem services, environmental quality, quality of life, human health and consequently urban sustainability. Urban trees can also curtail environment challenges created in urbanised areas such as noise, air and water pollution (Section 1.2.1). This particular study has taken a keen interest in urban trees and the ecosystem services they provide to make cities more sustainable and livable.

Sustainable development has tenaciously been recommended at international and national level as the foremost approach to lead the present and future development of urban areas (Newman and Jennings, 2008). The United Nations, the European Union, the World Bank and other international organisations have put certain programmes into practice in order to support sustainable growth in urban systems (Adger *et al*., 2005). Related efforts have been implemented by national and local governments in the different parts of the world, including South Africa (Satterthwaite, 2005). Regardless of the improved efforts to promote urban sustainable development, poor progress has been made to reach the desired outcome of sustainable urban systems (Hamza and Zetter, 1998). This delay in sustainable development can be attributed to a variety of different factors. These include socio-economic, geo-political relations and drivers at the local, national, regional, and global level such as lack of employment; inefficiency in urban services delivery; limited housing; dilapidation of existing infrastructure; degradation of the environment; problems in guaranteeing access to natural resources essential to urban life (such as water, food, and construction materials); and a startling growth of

violence related with gang related crimes (Moser, 1998; Section 1.3). These problems are largely worsened by the rapid increase of the population in urbanised areas which is also referred to as urbanisation and is discussed in detail in the following section.

1.2. URBANISATION

Urbanisation has become a popular tendency throughout the world. More than half of the world's total population, "approximately 3.5 billion people", reside in cities (United Nations Human Settlements, 2006). According to United Nations (2008) statistics, "the urban population of the world will be over 60 % of the total by 2030". Urbanisation levels are known to differ to a great extent around different parts of the world. In countries that are more developed, a great deal of urbanisation has already taken place. "In mid 1990 some 73 % of the population of more developed regions were classified as urban, compared with 37 % in less developed countries" (United Nations, 2006). It is in the less developed countries where the population in towns and cities has increased rapidly, but especially since the 1950's (United Nations, 2008). Urban areas in developing countries will be responsible for approximately "90 % of the projected world population increase of 2 700 million people between 1995 and 2030" (United Nations, 2006). In 2030, over half of all Africans will live in towns and cities (United Nations, 2006). This tendency is apparent in South Africa as well as all the other developing countries in the Southern African region. Within each country in the Southern African region, population expansion is much higher in urban settlements than in rural ones largely due to immigration from rural areas. The pace of urbanisation within South Africa has steadily increased since the 1950's. Today "57 % (or 21 million) of all South Africans live in towns and cities" (Williams, 2000). It was predicted that by the year 2010, "73 % (43.7 million) of the population in South Africa will be urban" (Urban debt, 2010). The reality of urbanisation and its adverse effects on the urban environment and quality of life can therefore not be ignored as it will be one of the "strongest social forces" influencing and affecting sustainability in urban areas in the years to come (Kuchelmeister, 1999).

1.3. GROWING ENVIRONMENTAL CONCERNS IN URBAN SYSTEMS

Globally, rapid urbanisation comes along with a variety of challenges. The demand for land and energy resources increases tremendously. Water and waste disposal requirements of the urban populations must also be met (Kuchelmeister, 1999). The environmental problems generated by urban areas are experienced at all levels, from the household to the entire world. These problems may result in compromised human health, economic and other welfare losses and damage of ecosystems (UN Habitat, 2004). Contamination of water and air, occupation of sensitive and degraded lands and

production of harmful wastes are among the major environmental problems; using agricultural land and open spaces for urban development is another problem (World Resource Institute, 1996). Urbanisation can also result in the decrease of areas that are permeable to water, disturb natural drainage patterns, and as a result, cause severe flooding (Kuchelmeister, 1999).

This also holds true for modern-day South Africa, which is undergoing an augmented speed of human-induced environmental changes and concerns as a result of urbanisation (Pelser and Redelinghuys, 2009). Rapid urbanisation in South Africa has also led to an increase in exploitation and overconsumption of natural resources and as a result this has worsened the cycle of poverty, environmental degradation and in the end impacted negatively on human development (Pelser and Redelinghuys, 2009). Economic expansion demands as well as demand for social services and environmental capital, predominantly accessing clean water and land, continues to increase (Setswe, 2010). Challenging realities in terms of increased poverty, unemployment, the rising number of informal settlements, increased demand for access to inadequate resources, air and water pollution, vulnerability to climate change, a declining state of the environment, and erratic delivery of services such as water and sanitation, are all increasing the "exposure and vulnerability" of millions of South Africans to environmental change (Setswe, 2010). Poor people who reside in cities and who are largely dependent on natural resources (such as land, which they use for agricultural purposes to improve their livelihoods) are threatened due to widespread environmental degradation. The growing pursuit for land, shelter and other services puts a lot of pressure and stress on the natural environment as well as urban authorities who find it extremely hard to meet the demand for human and urban development (Pelser, 2004).

1.4. TREES IN URBAN SYSTEMS

In efforts to create cities that are both habitable and sustainable and that avoid some of the challenges and problems outlined above, urban green spaces with trees as key components have been found to be very useful in curbing some of the negative impacts of urbanisation mentioned above (Akinbamijo, 2004). In the recent years, integrative and strategic ideas have been developed and employed throughout the world to encourage and extend the use of natural resources such as trees to provide for numerous demands in urban systems (UN Habitat, 2004). Urban forestry has become an important approach with the ability to meet various urban requirements and at the same time play a crucial role in making towns more ecologically and socially sustainable (Kuchelmeister, 2000).

Trees in urban systems are not only vital for economic, environmental and industrial purposes, but also for spiritual, historical and aesthetic reasons as they maintain human life through direct and

indirect benefits by providing a series of ecosystem services for continued existence and wealth (NUFU, 1998). Urban residents are slowly recognising and acknowledging the significance of urban trees for the range of ecosystem services that they provide and also as key components of the urban landscape and infrastructure (Kuchelmeister, 2000). Psychologists, sociologists and urban residents in general agree on the outlook that the "quality of urban life depends largely on the amount and quality of green spaces within or close to it" (Bonaiuto *et al*., 1999). A large portion of these green spaces is typically occupied by trees and, apart from the aesthetic and social values that they confer, they are also considered to play a fundamental role in the safeguarding of the urban environment (Olembo and Rham, 1987). Trees can protect the urban environment by improving its ecological state. This is mostly accomplished through the removal of pollutants from the atmosphere, reducing soil erosion, floods and extreme evapo-transpiration as well as heat and temperature regulation. These services provided by trees are also referred to as regulating services and they are discussed in detail in the next chapter. Trees and green spaces also form an important part of the natural life support system as they provide habitat for different species of birds and insects and, as a result, biodiversity is enhanced (Tyrväinen *et al*., 2005; Konijnendijk, 2003).

As significant as environmental challenges may seem, they are often not given political priority because basic concerns such as the provision of food, accommodation, hygiene and employment which have top priority are yet to be tackled, especially in a developing country such as South Africa (Setswe, 2010). Urban forestry and greening programmes will consequently be given political priority if they can be linked in such a way that some of the key urban requirements are addressed (Konijnendijk *et al*., 2004). Experiences in the past have revealed that urban trees are more than just additional urban infrastructure and can help maintain and enhance livelihoods through the consumptive benefits they provide including fuel wood, food and fodder, etc (Kuchelmeister, 1999). These products, if sold "provide direct cash benefits and if used within the household they provide indirect cash benefits by freeing cash income for other uses" (Kuchelmeister, 1999).

With this in mind, the study aims to understand the important role of trees in the urban environment and the various cultural and regulating ecosystem services or intangible benefits that they provide. This study forms part of a collaborative research programme funded by the South Africa-Netherlands Research Programme on Alternatives in Development (SANPAD), to determine the contribution of trees to local livelihoods in urban areas. There are three sub-studies including this study. The other two focus on the role of governance of urban trees to improve livelihoods and the provisioning services from these trees used by urban households, while this study places its focus on knowledge and appreciation of the intangible benefits of trees. The study concentrated on the intangible benefits

of trees because much of the literature and publicity in South and Southern Africa regarding the role of trees in livelihoods and human well-being is biased towards the tangible benefits of trees in rural environments. Yet, the intangible benefits of trees are equally important for a sustainable and healthy environment, as well as improvement of the quality of urban life (Baker, 1997; chapter 2, section 1). Studies have shown that the intangible benefits of trees are often overlooked and less appreciated by the general public, although there are some exceptions, such as with the ecological benefits of trees. This is partly due to the global warming crisis which has turned the world focus to the ecological values of trees as carbon sequesters (Lo Yu-hong, 2009). The contribution of trees to biotic and abiotic aspects of urban life has also been well documented, but at the same time "human dimensions" and the social and cultural connections between urban residents and trees are often not measured, underestimated or not seriously taken into account (Koch and Kennedy, 1991; Driver *et al*., 1979). It was what this study set out to do. In addition to assessing urban residents' understanding and appreciation of the the intangible benefits of trees, this study sought to explore the different factors that might affect this, including; age, education, settlement type, perceived crime and pro-environmental and altruistic values. This was done because understanding perceptions, knowledge and appreciation of the numerous values derived from trees is critical and necessary to meeting different public needs (Nowak *et al*., 2001). Also, having a "thorough understanding and integration of the public views and needs is particularly important for improving provision and exploitation of the full use of urban trees and green spaces" (O'Brien, 2005). Therefore, this study provides useful information for urban planners and policy makers about planning and management of urban trees and green spaces by soliciting public views. The study also contributes to literature by availing information on the various intangible benefits of urban trees and their vast contribution to human well-being in both study towns.

1.5. AIM AND OBJECTIVES

This particular study aims to understand urban residents' knowledge and appreciation of the intangible benefits of trees in private and public spaces in different urban settings and the various factors influencing these perceptions.

1.5.1. Specific objectives

This study addresses three specific objectives which help to achieve the overall aim. These are:

- To document urban residents' knowledge of the social, cultural, recreational and ecological benefits of trees and identify the values and beliefs that are associated with specific tree species.

- To explore urban residents' attitudes and appreciation of the intangible benefits of urban trees and understand how different factors influence appreciation of these benefits.
- To examine the factors (social, institutional, practical and biophysical) that influence urban residents' retention and planting of trees on their private space.

1.5.2. Hypotheses

Based on the findings and trends within literature related to the interactions between people and nature within urban socio-ecological systems, the following hypotheses were formulated to help explain urban residents' perceptions regarding trees in their environment:

- Knowledge of the intangible benefits of trees increases with age and level of education.
- Appreciation of the intangible benefits of trees is influenced by people's altruistic and pro-environmental values, settlement type as related to tenure security and the disservices of trees.
- Tenure security and residency time influence urban residents' decision to plant and preserve trees.

1.6. DESCRIPTION OF THESIS AND LAYOUT OF CHAPTERS

The research process followed a study design that involved collecting quantitative survey data for three hundred (300) households in the towns of Bela-Bela and Tzaneen, Limpopo Province, South Africa. This was then followed by the application of life stories, also referred to as in-depth interviews, as a way to further explore urban residents' knowledge and appreciation of the intangible benefits of trees.

This thesis is structured into seven chapters as follows: the first chapter introduces the research background, themes, research problem and significance of the study. Research objectives and hypotheses are presented to guide the research design and analysis. The second chapter reviews the literature on the various ecosystem services provided by urban trees, focussing on the intangible benefits. This chapter also discusses the different factors underlying and influencing appreciation of the intangible benefits of urban trees. The third chapter provides research methods and also outlines the criteria for selecting study areas. This chapter also gives details of the questionnaire and in-depth interview design and discusses the stages of data collection and analysis for both the household survey and in-depth interviews.

The fourth, fifth and sixth chapters of this thesis present the results and discussion of the first, second

and third objectives, respectively. Each chapter has an introduction, short methods section and a detailed section elaborating results and discussion. The fourth chapter present results and discusses knowledge of the intangible benefits of urban trees and the different factors influencing it and the cultural/spiritual values placed on specific tree species. The fifth results chapter covers results and discussion of urban residents' pro-environmental and altruistic values, appreciation of the intangible benefits of trees and residents' WTP towards greening programmes in their communities. The last results chapter presents results and discussion of residents' planting and retention of trees and the various factors influencing planting and retention of trees in urban areas.

The seventh and final chapter synthesises the findings and presents a general discussion of study findings, policy implications, recommendations and the final conclusions.

CHAPTER TWO

THEORETICAL, CONCEPTUAL AND POLICY CONTEXT FOR THE STUDY

2.1. INTRODUCTION: URBAN TREES AND ECOSYSTEM SERVICES

As discussed in section 1.4, trees in the urban environment provide a range of benefits, also known as ecosystem services that contribute to both human and environmental health and well-being. The concept of ecosystem services provides a useful way to think about the various benefits provided by trees. Recent studies have stressed the need to differentiate goods, services and ecological functions including ecological structures and processes, to emphasise the mechanisms that underpin the links between natural capital and human well-being (Millennium Ecosystem Assessment (MEA), 2005).

Ecosystem services refer to the "conditions and processes through which natural ecosystems, and the species which make them up, sustain and fulfil human life" (Daily, 1997). They sustain biodiversity and the manufacture of ecosystem goods, such as timber, seafood, biomass fuels, forage, natural fibre, and many pharmaceuticals, industrial products, and their forerunners. Apart from the production of goods, ecosystem services also comprise of the "actual life-support functions of ecosystems, such as cleansing, recycling, and renewal" (Daily, 1997). Furthermore, they can bestow numerous "intangible aesthetic and cultural benefits" as well (Daily, 1997). Maher and Thackway (2007) further refine this definition to "describe the services as recognised and defined by people who are beneficiaries of natural assets which include soil, water, atmosphere and biota (flora and fauna)". Effectively the ecosystem *services* are the *benefits people* obtain from the natural environment.

As mentioned in chapter one, this study exclusively focuses on the intangible benefits (cultural and regulating services) of urban trees which are often less obvious to urban residents. The following section discusses two conceptual frameworks that were useful for this study as they provided a means to classify and categorise the various intangible benefits of trees. This is followed by a section that details the economic benefits provided by urban trees.

2.2. CONCEPTUAL FRAMEWORKS FOR CATEGORISING AND DEFINING DIFFERENT TYPES OF ECOSYSTEM SERVICES

The notion of ecosystem services is increasingly supported as a useful means for documenting the values that humans place on ecosystems and assessing the benefits derived from natural resources

(Costanza *et al*., 1997; De Groot *et al*., 2002; MEA, 2005). Valuation and classification of ecosystem services has become an important trend, and it is particularly important in the case of environmental benefits where values are often difficult to describe in economic terms and rarely well-explained in natural resource decisions.

Wallace (2007) states that if ecosystem services are to provide a functional framework for natural resource resolutions, they need to be categorised in a manner that leaves room for "comparison and trade-offs" amid the appropriate set of possible benefits. In the language of the Millennium Ecosystem Assessment (2005), this means that the entire range of benefits representing human welfare from ecosystems ought to be demonstrated in any effective typology of ecosystem services. Wallace (2008) suggests that "in order for the concept of ecosystem services to make a large and meaningful contribution to conservation and human welfare, it needs to be clearly defined and put into a framework so that it is operational for societal management decisions". Wallace (2008) further dwells on the fact that there is a need to incorporate numerous areas of study from "biology and philosophy to economics", and the need to demarcate between ends and means to operationalise ecosystem service research. Wallace (2007) also points out that "clearly defining and organising the concept of ecosystem services is not just a semantic decision, but it is integral to any process seeking to clearly illuminate tradeoffs in natural resource management and policy decisions".

Ecosystem services can be categorised or classified in a variety of ways (NRC 2004). Numerous informative publications have aimed at defining and categorising ecosystem services (MEA, 2005). However, no single method has been agreed upon for classifying ecosystem services (Wallace, 2007; Boyd and Banzhaf, 2007). This study focussed on two of the most popular frameworks, the Millennium Ecosystem Assessment (MA) framework and the Total Economic Valuation (TEV) framework. This is because these two frameworks provide a very useful way of seeing and classifying the various intangible benefits of trees for this particular study.

2.2.1. Millennium Ecosystem Assessment (MA) Framework

The conceptual framework for the MA puts the welfare of humans as the main focus for assessment, and at the same time acknowledges that biodiversity and ecosystems have inherent worth and that humans make choices to do with ecosystems on the basis of consideration of well-being and inherent worth (MEA, 2005). The MA conceptual framework supposes that a lively interface is present between humans and other components of ecosystems (MEA, 2005). The assessment concerns itself with the variety of ecosystems ranging from those that are moderately intact, such as natural woodlands, to sceneries with diverse appearances that have been exploited by humans, and

ecosystems rigorously controlled and transformed by their inhabitants, for instance farmland and cities (MEA, 2005).

The MA framework (2005) identifies four broad categories of service including: provisioning, regulating, cultural and supporting services. Figure 2.1 below reproduces the MA framework. The provisioning services include food, water, wood and fibre. These services are physical outputs and are what are known as ecosystem goods. This study, however, is particularly interested in the regulating and cultural services, which are also known as the intangible benefits provided by trees and ecosystems. Examples of the regulating services of trees include regulation of floods, drought, land degradation and pollution. The cultural services of trees include recreational, spiritual, religious and other non-material benefits. These benefits (regulating and cultural services) constitute the major part of this study. The fourth category in the MA framework is supporting services which include nutrient cycling, soil formation and primary production (MEA, 2005). Figure 2.1 depicts the strength of linkages between categories of ecosystem services and components of human well-being that are commonly encountered and includes indications of the extent to which it is possible for socio-economic factors to mediate the linkage.

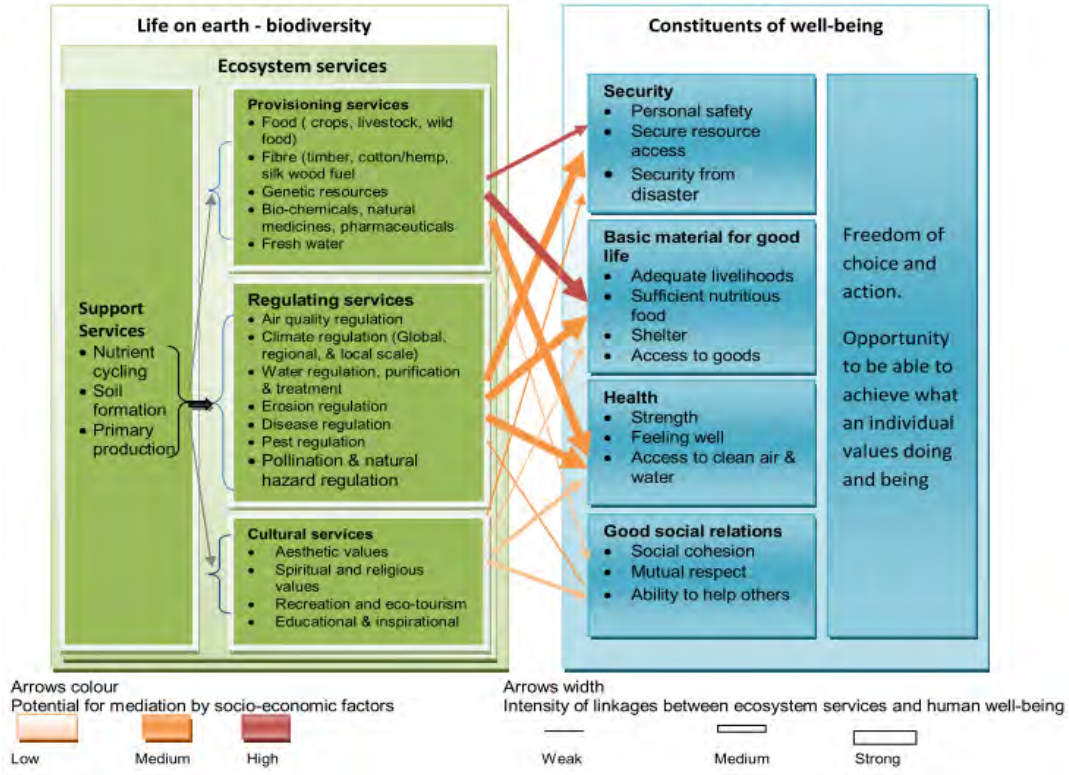


Figure 2.1: The MA framework (2005), linkages between ecosystem services and human well-being.

2.2.2. Total Economic Valuation (TEV) Framework

The notion of total economic value (TEV) has been used extensively for identifying the multiple values of ecosystems (Pearce and Warford, 1993). This particular framework is specifically used to identify the economic or monetary value of ecosystems. The framework classically separates TEV into two classes: use values and non-use values (Figure 2). According to Pearce (1993) "use values refer to the value of ecosystem services that are used by humans for consumption or production purposes. It includes tangible and intangible services of ecosystems that are either currently used directly or indirectly or that have a potential to provide future use values". Therefore, TEV splits use values into direct, indirect and option values. The direct use values are again separated into two classes; consumptive and non-consumptive. However, this study is only interested in the non-consumptive uses, indirect use values and non-use values because they constitute the intangible services of ecosystems. The direct use values on the other hand are the tangible benefits or goods from ecosystems and these are normally measurable by the market e.g. fruits, timber and fibre. The direct/indirect use values and non-use values are discussed in detailed in the following sections.

Direct use values

Consumptive uses involves utilisation of ecosystem goods, such as "harvesting of food products, timber for fuel wood or building, medicinal products, and hunting of wild animals from ecosystems that managed as well as those that are natural" (Daily, 1997). Whereas non-consumptive uses of ecosystem services refers to the less tangible benefits and uses including; "enjoying recreational and cultural amenities such as wildlife and bird-watching, water sports, and spiritual and social utilities that do not require a harvesting of products" (Pearce and Warford, 1993). This category of benefits corresponds broadly to the MA description of provisioning and cultural services (Figure 2.1).

Indirect use values

Indirect use values are linked with the processes of ecosystems which sustain human activities; this entails numerous ecosystem services that are utilised as inputs during the production process of final goods and services to people such as "water, soil nutrients, and pollination and biological control services for food production". Other ecosystem services confer obliquely to the gratification of other final use services, such as "water purification, waste assimilation, and other regulation services leading to clean air and water supplies and thus reduced health risks" (Pearce, 1993). This category of benefits corresponds broadly to the MA notion of regulating and supporting services.

Non-use values

Non-use values, also known as "passive use values", are values that are not related with the very use, or even the alternative to make use of goods or services (Pearce, 1993). They are equivalent to an "insurance premium" that people are prepared to expend to guarantee use of an ecosystem service or product in the future, regardless of the fact that they may not benefit from an ecosystem service at that particular time (Boxall *et al*., 1996). Non-use values are divided into three classes which include the following; existence, bequest and altruistic value. Existence value is value that is associated with the fulfillment that an individual gets by knowing that species and ecosystems are preserved (Pearce, 1993). Whereas, bequest value is value that is linked with merely knowing that, the future generation will be benefiting from an ecosystem and biodiversity (inter-generational equity concerns) (Pearce, 1993). Altruistic value is the value attached by people to the fact that others are currently benefiting from the services provided by ecosystems (intra-generational equity concerns) (Bateman and Turner, 1993). Quasi option value is an interconnected 'sort of' value and it stands for the value of evading permanent choices awaiting new information which makes known whether certain ecosystem services have a value that is presently unidentified (Cavatassi, 2004). This category of benefits includes provisioning, regulating, and cultural services to the extent that they are not used now but may be used in the future.

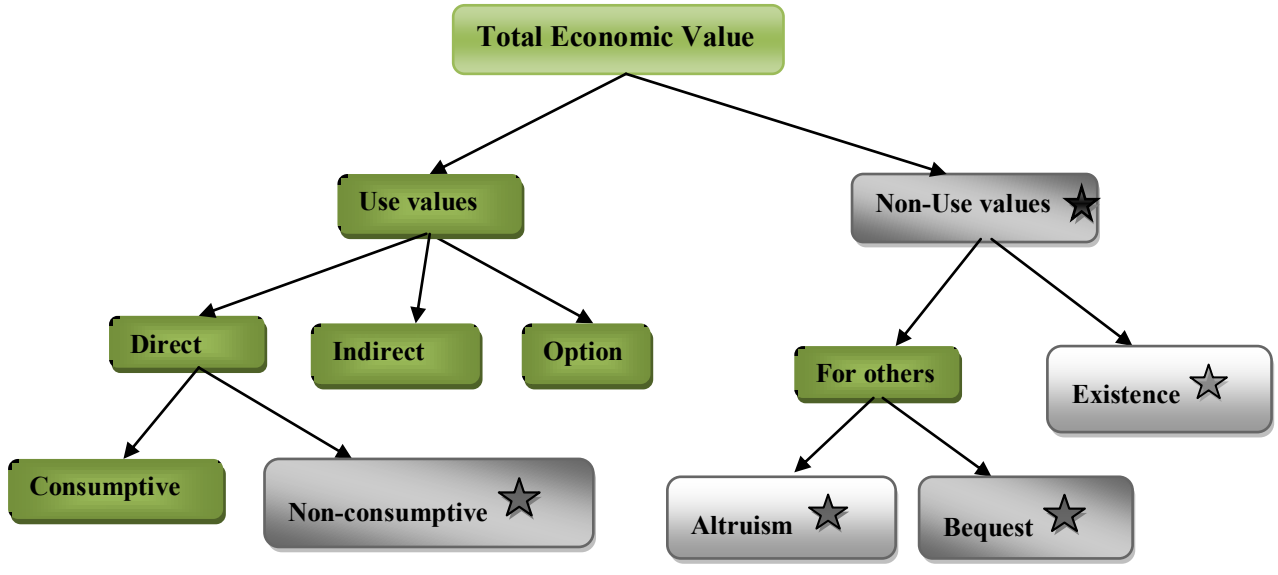


Figure 2.2: Total Economic Value (TEV) (Pearce et al., 2006) ★ *indicates those of interest for this study*

2.2.3. Merging the MA and TEV frameworks for this study

For the purposes of this study, a framework has been designed to demonstrate the various intangible benefits and values of trees that are discussed in detail in the next sections. This framework has been designed based on the TEV and the MA frameworks (Figure 2.3). The framework highlights the similarities and convergences between MA and TEV frameworks. The cultural services of the MA framework are the same as the non-consumptive uses of the TEV framework. While regulating services (MA) are the same as indirect services of the TEV framework. This framework provides the study with a useful way to classify and think about the various intangible benefits of trees. The non-use values (TEV) are also important to this study because the study considers how people's basic values influence their concern for the environment and future generations (Section 2.8). The bequest and altruism values under the non-use values form part of the core or basic values of people and as such they are important and useful for the study. The use of the term 'intangible benefits of trees' in the subsequent chapters encompasses all the components illustrated in figure 2.3

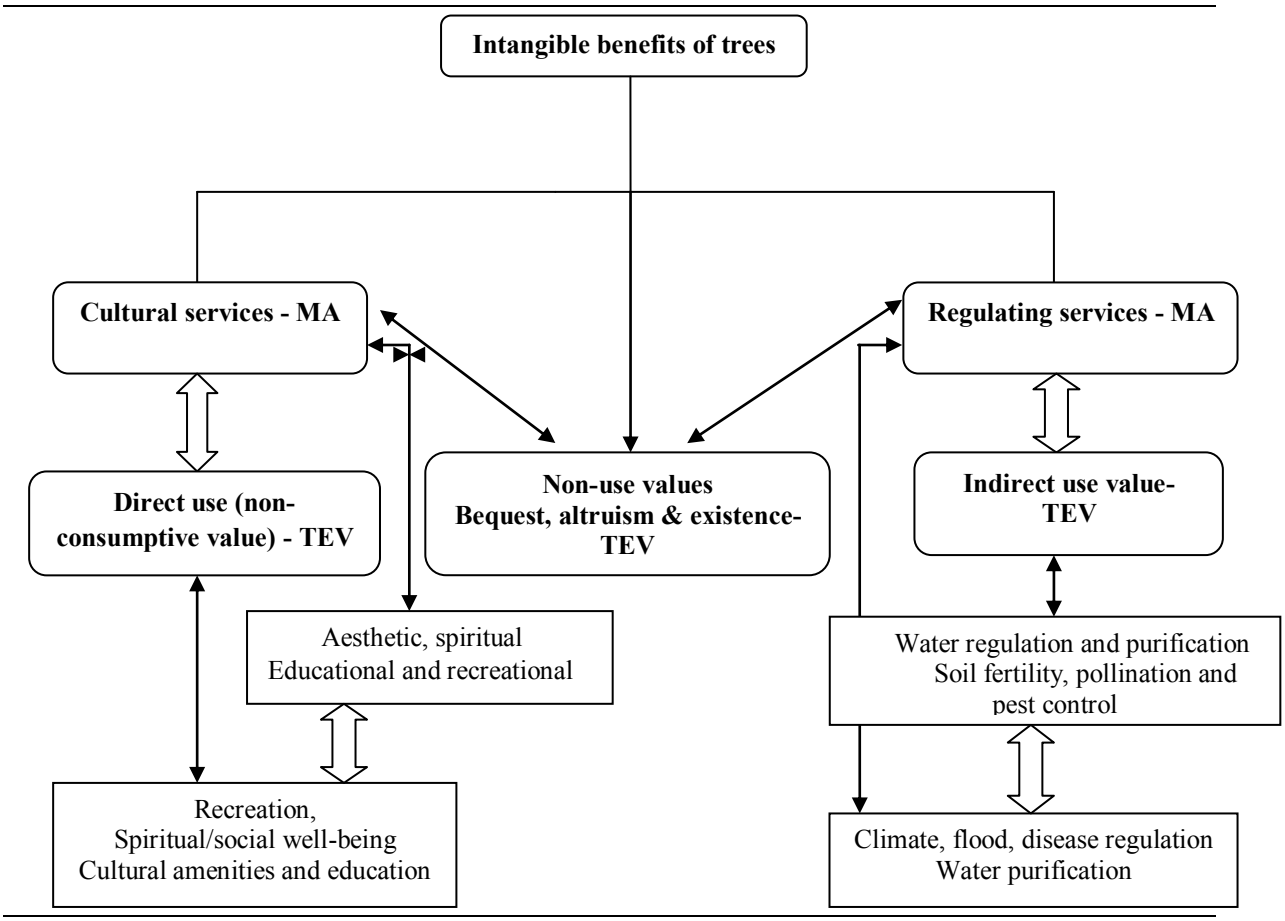


Figure 2.3: A framework derived from MA and TEV frameworks, illustrating the classification of the various intangible benefits of trees

2.3. REVIEW OF ECOSYSTEM SERVICES FROM TREES IN URBAN SYSTEMS

2.3.1. Ecosystem services delivered by urban trees

Urban trees are essential components of the urban ecosystem and are vital for environmental quality, quality of life and sustainable urban development (Chen and Jim, 2006). Urban trees play key roles in improving environmental circumstances in cities and preservation of biodiversity. Environmental benefits are not only associated with wooded or forest areas. Minor clusters of trees, streets trees and remote trees can likewise improve the surrounding environmental state in cities. "Greenbelts and greenways" can also act as natural passageways, linking a town to the neighbouring bioregion (Chen and Jim, 2006). The intensity of biodiversity in urban green areas is frequently astoundingly high, signifying nature near to where people live (Konijnendijk *et al*., 2004).

Numerous trees growing in parks, streets, gardens, and other places supply the various ecosystem services. Urban residents depend on several of these services from their urban ecosystem for good health, pleasure and the ameliorating effects on the urban environment. These belong to two main categories: cultural services or indirect use values and regulating services or non-consumptive uses as mentioned in the previous sections (Figure 2.3).

Regulating services (indirect use values)

Regulating services or indirect use values of urban trees refer to "habitat, biological or system properties or processes of ecosystems" (Daily, 1997). These services assist in the reduction of the destructive features of an urban environment such as noise and air pollution and carry out important hydrological processes. Most of these ecosystem services are not apparent or even acknowledged by residents in urban areas (Robinson *et al*., 2009). These services are discussed in detail in the following sections.

Carbon dioxide sequestration: With carbon fixing capability, trees are able to sequester carbon dioxide from the earth's atmosphere and uphold the earth's heat stability (Lal and Augustin, 2012). "Concerns globally on the result of increasing levels of carbon dioxide on the greenhouse effect remind the human race about the fundamental role of trees in curbing the adverse effects on the environment" (Escobedo *et al*. 2010).

Urban hydrology: The capacity of trees in the urban environment to regulate hydrological processes has been well documented (Pauleit and Duhme, 2000). The function of urban trees in the management of watersheds has become more and more important in developed as well as developing countries

(Konijnendijk *et al*., 2004). If trees are planted along watersheds they can protect catchment water balance and stream flow (Whitford *et al*., 2001). A lot of cities have planted and preserved trees to decrease runoff water, cleanse drinking water and process wastewater (El Lakany, 1999). "Trees in the watershed interrupt extreme rainfall and control river flow by steadily discharging rain water into the streams and rivers thus preventing flooding and erosion" (Pauleit and Duhme, 2000). Trees also protect the watershed from extreme evapo-transpiration.

Habitat for wildlife: If appropriately designed urban green spaces and trees can provide homes for a range of animal species and improve biodiversity at the same time (Milligan-Raedeke and Raedeke, 1995). Such kinds of areas sustain diverse species by providing them with food and a place to live which are otherwise not accessible in solid concrete blocks in cities. For a lot of people, realising the existence and variety of wildlife species has inherent value and participation in wildlife neighbourhood programmes can enhance and improve their understanding of nature (Dunster, 1998).

Temperature regulation: Trees facilitate in the reduction of temperature by giving shade and by capturing and absorbing solar energy, particularly in areas with high temperatures, where there is heat and sunlight throughout the year (Seth, 2004). Urbanised areas that are highly populated are susceptible to heat island effects since the construction materials absorb solar waves and release long-wave radiation and the high energy use leads to production of waste heat (Miller, 1997). Nearby air temperature can be lowered by the vegetation in urban areas through shading and evapo-transpirational cooling (Seth, 2004). This is of explicit importance to areas in the central city where the density of the tall buildings results in vigorous absorption of heat.

Trees also function as natural air conditioners by evaporating water from their leaves through the process of transpiration. "A single large, well-watered city tree can transpire about 380 litres of water in one day, thus producing the cooling effect of five average room air conditioners running 20 hours a day" (Schubert, 1979). Trees thus improve the microclimate by controlling and stabilising the climate of the region and of the world as a whole. The results from extensive studies in Göteborg, Sweden clearly show the climatic impact of urban trees (Eliasson, 2000). Air temperatures were found to be significantly lower inside parks as compared to the surrounding built areas, but temperatures were also reduced in a transition zone outside the parks due to the presence of the trees in the parks (Eliasson, 2000).

Urban trees are now being widely considered as a way to reduce energy consumption. In the last years, numerous studies have demonstrated the effectiveness of urban trees for changing the temperature in the interior parts of the cities, allowing in some cases a considerable reduction in the

use of energy by different cooling and heating systems (McPherson, 1991; Dwyer *et al.*, 1992; Peck and Callaghan, 1999).

Windbreaks: Urban trees can function as wind breaks by lessening the strength of the winds, if they are correctly planted and managed. Ecologically they also perform as "shelter belts", hence they help in ensuring that soils are protected against erosion (Seth, 2004). The integration of trees in residential areas and within cities decreases wind speed, particularly during winter (Laverne and Lewis, 1995). In West Africa strong winds have an effect on urban infrastructure and other municipal amenities and as a result, trees have been planted to act as shields against the winds (Fuwape, 2010). The trees proved to reduce wind speed thus shielding urban structures from getting damaged. In northern Nigeria, Burkina Faso and Gambia, *Eucalyptus* species are mixed together with *Acacia anacardium* and *Azadirachta indica* to act as efficient windshields (Fuwape, 2010).

Noise abatement: An additional important ecosystem service provided by urban trees is their capacity to lessen the level of noise in cities. The role of trees in improving the negative impact of extreme noise is multifaceted (Woolley, 2003). The purpose of trees goes beyond the "actual shielding of the noise as the rustling sound of leaves and melodies from birds act as a camouflage to change people's insight about the sources of noises that are not wanted" (Seth, 2004). Woolley (2003) stated that leaves and stems disperse sound and the earth absorbs it. Cook (1978) later wrote that trees are important in providing a shield to abet in controlling noise. Reethof and McDaniel, (1978) agreed adding that "a row of trees alongside bushes might end in a 3-5 decibel noise reduction". Bolund and Hunhammer (1999) stated that "natural evergreen vegetation is well-known for reducing noise and that even oaks and maples can reduce noise levels too". The presence of trees and shrubs act as a shield between urban residents and noise source and makes them less aware of the exact source of noise.

Soil erosion: Planting trees on bare soils and ravaged land, alongside roads, railways, paths, abandoned areas and watersheds shield soils from being eroded as a result of strong winds and water by tightly binding it with roots and by redirecting excess water (Seth, 2004). The sides of the road especially if the roads are not paved, railway tracks and watersheds can therefore be protected (Schueler, 2000). A study conducted by Fuwape (2010) in Enugu State in Nigeria illustrates that trees planted in areas that are likely to be eroded in Imo state have improved water infiltrating during the rainy season and reduced occurrences of water overflow and soil erosion.

Cultural services (non-consumptive uses)

Cultural services or non-consumptive uses refer to non-material benefits for people. Researchers and

policy makers occasionally neglect the importance of cultural services of trees. This is because it is hard to put a monetary value on these services or even to quantify them, but they are essential for human well-being. There are a variety of socio-cultural services which can be derived from urban trees and these are broadly categorised into five areas. This type of classification of socio-cultural tree services has been adopted from Stewart *et al*.'s (no date) briefing paper.

1. Recreation, physical health and mental well-being
2. Social interaction, inclusion and cohesion
3. Education and learning
4. Aesthetics and quality of place
5. Spiritual, cultural and historical meanings

Recreation, physical health and mental well-being: Trees and urban green spaces are key components in urban systems and they provide several opportunities for recreation activities, which range from the strenuous kind of use of services such as mountain climbing, mountain biking to less exhausting types of use, such as gathering with family for a picnic (Arnberger *et al.*, 2010). Urban trees to a great extent are known to increase outdoor amusement. The recreational opportunities offered by urban trees and other green spaces contribute tremendously to "people's quality of life, their health and overall well-being" (Arnberger and Eder, 2007). Public parks can function as places where people can meet for social gatherings, but at the same time can be a place for seclusion and solitude. Parks are also places for day-to-day regular activities such as exercising, strolling and dog walking.

By beautifying the urban environment and promoting recreational activities urban trees are known to improve public health and quality of life as trees in urban systems may entice residents with inactive lifestyles to become more active during their pastime activities (Grahn and Stigsdotter, 2003). Recreational activities such as walking, jogging and cycling have a positive outcome on human health. Research reveals that, the more the trees and green spaces within the urban environment, the more often residents are inclined to make use and be part of natural environments (Grahn and Stigsdotter, 2003).

Research related to studies conducted in the United States of America by Ulrich *et al*. (1991) has given birth to very similar results in Sweden (Hartig *et al*., 1996), where "visual interaction with the natural scenery resulted in the reduction of stress levels". In both studies "stress relief was calculated by monitoring muscle tension, blood pressure and electrical brain activity". It was found that stress levels reduced considerably within few minutes of exposure to a green environment (Ulrich *et al.*, 1991). Furthermore, experiencing the calming effect of the natural environment after a nerve-racking

or traumatic incident creates healthier "physiological changes" resulting in relaxation in stressed individuals and quick recovery, while performing activities that require deep concentration (Parsons *et al.*, 1998). Research has also revealed that urban green areas have the same stress reducing effect on people on a daily basis (Parsons *et al.*, 1998).

Additional evidence is supportive of the fact that trees and the natural environment affect hospital patients positively (Ulrich, 1984). Studies were conducted on patients who were receiving "post operation care" in a Pennsylvania hospital. Half of the patients had a view of the natural environment consisting of trees while the other half only had a view of a brick wall. Results indicated that the health of patients with a view to natural environments improved faster and they got better health reports as compared to the patients who viewed the brick wall (Ulrich *et al.*, 1991). Kaplan and Kaplan (1989) obtained similar results, where desk workers with a view of nature were reported to be healthier and "experienced 23% less time off sick" than those who did not have a view of nature from their desk. Desk workers with a view of nature were found to be more content with their type of job (Wolf, 1998).

Social interaction, inclusion and cohesion: Community participation in urban forestry programmes can help build bonds in neighbourhoods by according residents with a chance to work collectively in order to improve their environment (NUFU, 1998). Studies revealed that there is a connection between the length of time that is spent in a public park and the existence of trees as well as how they are positioned and how many there are (Coley *et al.*, 1997; Depooter, 1997). Consequently trees are very essential in drawing people to the public parks and green spaces and forming "social ties" among urban residents (Depooter, 1997). Chances for social interactions as a result of participating in community forestry programmes have been evaluated in research carried out by Lewis (1996) and Berman (1997). Their research confirmed that residents in residential areas, where people jointly work as a group in "tree rehabilitation projects", started to develop a sense of uniqueness and harmony in their neighbourhoods. Kuo *et al.* (1998) found that, in neighbourhoods that had plenty of trees and green spaces, the bond between park visitors were stronger, as compared with residents who went to public parks and green spaces that had fewer trees and other plants.

Research also reveals that reduced crime rates have been reported in urban public houses that are well treed. Sullivan and Kuo (1996) proposed that trees and urban green spaces provide an avenue for people to gather and get more acquainted with each other. Their research indicates that relationships culminated into a system of support. The University of Illinois conducted a similar study and it was found that treed urban systems are linked directly with decreased crime incidences, less discourtesy,

and less sadistic and hostile conduct (Georgia Urban Forest Council, 2001). In neighbourhoods that are located inside the city, it was reported that the greener the surrounding environment was, the less the rate of criminal activities (Sullivan and Kuo, 2001). Citizens attested to the fact that there were less brutal and property offences in well treed neighbourhoods as compared to those that were without trees (Sullivan and Kuo, 2001). However, it has been reported that urban trees in certain neighbourhoods are linked with increased crime levels (Section, 2.7.1).

Education and learning: Urban trees have become more and more useful in ecological and environmental education. Trees within towns make suitable places for education and innovation (Nowak and Dwyer, 2007). Trees in cities, public green spaces and neighbourhoods act as a home for animals (as discussed in habitat for wildlife subsection under the regulating services) and thus function as perfect places to admire nature, learn about biodiversity, and participate in various learning activities concerning the environment (Westphal, 2003). Numerous towns in both developed and developing nations possess "botanical gardens, zoos, nature trails and visitor information centres" that can improve public knowledge about different plants and animals (Tyrväinen *et al*., 2003). Urban trees and forests that are within reach offer very important services for both official and unofficial learning (Nowak and Dwyer, 2007). Therefore, not only are urban trees and green spaces a source of leisure and enjoyment but they also educate the public at the same time.

The presence and accessibility of urban trees and green spaces is very vital for urban children as well as youths, because they will not be deprived through deficiency and lack of access to the natural environment (O'Brien and Murray, 2007). Trees and urban green spaces also provide a setting for children to enjoy the outdoor recreational activities which form a crucial part of their growth (O'Brien and Murray, 2007).

Aesthetics and quality of place: Trees, green spaces, wooded areas and gardens play an important role in making homes, neighbourhoods and towns beautiful and in enhancing the quality of life by adding colour, alleviating the bland appearance of concrete structures, blocking ugly sights and contributing to the worth of the environment (Westphal, 2003). Urban trees (particularly the ones with big crowns) and forests can intervene with the harmful effects of trade and industrial land on local communities and improve the general awareness of the visual distinction of urban surroundings (Ellis *et al*., 2006). Additionally, trees in urban systems can also help in forming a sense of uniqueness for specific places and they can also operate as important indicators of certain periods in history for people, which contribute to the way they feel about specific places, as well as being proud of their neighbourhood (Bonaiuto *et al*., 1999). This is especially true in South Africa, where in some places certain trees

have taken on symbolic meanings and as such have even become national monuments (SANBI, 2012). For instance, the abundant oak trees in the streets are seen as a symbol of the city in Stellenbosch, South Africa, and thus have been proclaimed national monuments. Place attachment can encourage the social and political involvement of local residents in the preservation of the physical and social features of their urban neighbourhood such as woodlands and specific trees.

Cultural, spiritual and historical meaning of trees: Trees are of immense spiritual, cultural and historical importance to the majority of people throughout history (Dwyer *et al*., 1991). "The multiplicity of cultural/spiritual values and figurative use attributed to trees and forests are as plentiful and varied as the neighbourhoods and traditions in different states" (Woolley, 2003). Physically and spiritually trees have given deep meaning to the environment in neighbourhoods in various countries worldwide since time immemorial. Single or a cluster of trees can be important to urban residents or neighbourhoods mainly because of their size and splendour, uniqueness, spiritual, historical or environmental value or even a connection with an extraordinary person or occurrence (Dwyer *et al*., 1991). Urban parks that are large in size manifest as the centre of attention in neighbourhoods of various towns as they provide places for local celebrations, artistic activities and municipal/public festivities (Woolley, 2003). All over the globe important trees have played crucial functions in trade, spiritual and cultural rituals and formation of folklore (Hageneder, 2005). Physically and impalpably, trees are present in every part of society: speech, olden times, skilfulness, belief, medicines, political views, and even the community organisation itself (Hageneder, 2005). Most urban residents have strong connections to specific trees and woodlands. These connections can be as a result of religious/spiritual association or linking people to past events and activities (Schroeder, 1991). Attachments involving humans and trees are linked with "traditions, symbolism, and the need to get involved at the local level to sustain or enhance ecosystems for current and potential uses" (Dwyer *et al*., 1991).

Trees are linked with metaphorical connotations associated with native individuals. Certain communities and "cultural systems", consider trees as symbols of spiritual and cultural customs signifying a religious bond with the holy and ancient times (Dwyer *et al*., 1991). Anthropologists have acknowledged that characterisation of trees as spiritual and cultural symbols in ceremonies and as a "god-like supernatural entity" ensure the stability of local societies in developing nations such as Africa and India (Rival, 1998). In India, for example, a number of different kinds of trees are believed to bring good luck and thus are planted and preserved by many people (Randhawa, 1961). Indigenous trees in India also hold a unique place in folk songs (Rival, 1998). India poets like Valmiki and Kalidasa have written many songs in admiration of trees and even "folktales" have distinguished the

magnitude and splendour of trees (Randhawa, 1961).

Trees are also known to act as symbols for values and philosophies within people's lives (Dwyer *et al*., 1991). In Arusha Tanzania, *Ficus sycomorus* is assumed to convey good fortune and passersby normally put pieces of grass or flowers at the bottom of a tree as a gift and in exchange they request their idols to sanctify them and bring upon them fortune and riches (Hines and Eckman, 1993). Another important tree is *Trichilia emetica* which serves as a place where travelers catch rest during the course of a long journey and before commencing with their journey they pray for good health and fortune from the gods (Hines and Eckman, 1993).

Specific tree species are often thought of as holy and having extraordinary control that can assist in solving different problems, such as infertility problems, diseases, or exorcising demons (Rival, 1998). *Ficus sycomorus* is considered as sacred by a number of people in Dodoma, Tanzania and it is well known as a source of water (Westman, 1990). *Euphorbia candelabrum* is used to chase away wizards from communities, and residents place leaves and branches on the wizard's front door so as to send a message to others and also to warn the wizard to leave the community (Westman, 1990). Trees also play a crucial role in different religions around the globe. Notably, the Buddha sat under a consecrated fig tree (*Ficus religiosa*) reflecting until he reached a point where he attained enlightenment (Rival, 1998). Hindus and Jains also consider the fig tree to have enormous spiritual and religious meaning thus the tree is referred to as the sacred fig (*Ficus religiosa*) (Parkash, 1991).

2.3.2. Economic benefits of trees in cities

The initial impression that a town normally gives to its visitors is the number of trees as well as the state in which they are. Urban trees in towns create an impression of the town's superiority and character (Coder, 1996). The financial status of cities is also boosted by urban trees which draw visitors and businesses in addition to increasing property value within the towns (Bowman *et al*., 2009).

Property value improvement

Urban trees give life and "economic stability" to cities by increasing the price of properties and consequently the value of the entire neighbourhood (Price, 2003). A number of studies have explored the influence that trees have on particular prices of residential properties. In California, United States of America houses with the same features (square footage, number of rooms and location) were valuated and in one neighbourhood an increase of 6% in sale price was found to be linked with the existence of trees and no increase in price was observed for houses that had no trees (Rodriguez and

Sirmans, 1994).

The majority of people prefer to live in neighbourhoods with trees as they are more appealing and beautiful as compared to those without. The increased demand to stay in treed neighbourhoods has boosted the value of properties with trees in contrast to the ones that are without trees and plants (Morancho, 2003). In Atlanta Georgia, a review was done on sales of particular family homes and results showed that the "well landscaped houses with trees increased by 3.4 to 4.5% the value of real estate" (Luttik, 2000). Another study, conducted in the city of Salo in the northwest of Helsinki, Finland, showed that the price of homes with a view of trees and other vegetation increased by 4.9% (Tyrvainen and Miettinen, 2000). Developers of real estate believe that properties with trees are normally sold 7% quicker than those without trees and other vegetation (Seth, 2004).

Promoting businesses and enhancing the town's image

Studies have also revealed that customers doing their shopping in well treed business centres tend to pay more for parking as well as 12% more for goods and services (Wolf, 1998). Customers have been observed to spend more time and shop for longer periods of time in stores that are located near streets that are lined with trees (Wolf, 2004). This, therefore, goes to show that urban trees and green spaces help to enhance neighbourhoods and cities by attracting businesses and tourists. This can provide an incentive for most people to plant trees that then also yield the numerous benefits already discussed.

2.4. DISSERVICES OF URBAN TREES

While trees provide urban residents and the environment with numerous services and benefits, it is worth mentioning that trees also have a number of problems or annoyances that they pose to urban residents and the public. Research on the harmful effects of urban ecosystems has been placed under the theoretical umbrella of 'ecosystem disservices' (Balmford and Bond, 2005). Ecological/ecosystem disservices are characteristically implied as "disturbed or missing services as consequences of loss of biodiversity" (Chapin *et al*., 2000) or as "negative effects of ecosystem change" (Balmford and Bond, 2005). Also according to Zhang *et al*. (2007) ecosystem disservices are understood as "functions of ecosystems that are perceived as negative for human well-being". These disservices are also referred to as social nuisances.

The fact that urban trees are used by many different people in different ways, certain ecosystem services will not be equally important or useful to all urban residents and communities. The actual use of a tree for a single reason by a certain person may be perceived as a problem by another (Agbenyega *et al*., 2009). For instance, tall, attractive and leafy trees can be appreciated for shade and aesthetics

by most people walking along the streets, but the same trees may cause displeasure to some passersby or to the residents of close-by houses because of allergies, leaf litter or obstructed views (Jari *et al*., 2008). This indicates that the levels of disservices from urban trees often accrue differently to various individuals or communities (Agbenyega *et al*., 2009). In this study, especially in the in-depth interviews, respondents were given an opportunity to highlight the various benefits as well as the disservices of urban trees. The following sub sections give details of the various disservices associated with urban trees.

2.4.1. Security and safety hazards/health issues

Trees within neighbourhoods and parks are sometimes perceived as unpleasant and dangerous by some people especially women (Koskela and Pain, 2000). Fear of violent behaviour and crime is often connected to places that are highly populated with trees (Section 2.3.2). Therefore, trees in urban areas can be considered as a disservice to some people as they feel trees provide places for criminals to hide especially in the night time, thus making places such as parks with high biodiversity feel even more unsafe for such people.

Another disservice of urban trees to people, are the threats they pose to human safety and health. Trees that are poorly planted can pose as a threat or hazard to the urban population, either directly (through falling branches or the toppling of the entire tree) or indirectly (branches catching in overhead power lines). According to Onganga (1992), in Kenya, it was reported that trees were blocking highways and falling on roofs of houses in urban areas. Trees can also cause allergic reactions or intoxication and therefore posing a threat to human health. For example, a high concentration of Mugwort (*Artemisia vulgaris*) pollen causes severe health problems for individuals with respiratory conditions such as asthma (Ogren, 2000). Also certain animal species utilising trees may be vectors of diseases (e.g. avian influenza, rabies) (Jari *et al*., 2008).

2.4.2. Structural damage

Urban trees have been reported to cause structural damage to buildings, especially at the base of buildings due to their roots, and also through the falling of the entire tree or branches (Jari *et al*., 2008). The roots of trees frequently cause roads and pavements to crack up and occasionally water pipelines in the case of street trees (Biddle, 1987). Trees around the yard can also cause damage to the base of the house and as a result the walls might crack as the roots go deeper into the ground. Trees can also cause tremendous damage to the entire building especially in cases where the whole tree falls onto a building and at times can cause death or severe injuries if there are people within the building (Jari *et al*., 2008).

2.4.3. Decreased aesthetics

Some areas in towns that are not properly managed are frequently considered as unattractive and unsightly (e.g. parks that look unkempt with weeds and dense vegetation). Also certain noises, odours and behaviour of plants and animals can annoy people. For example, a debate came forward in Helsinki, Finland, because of a nasty smell similar to vomit which was coming from the linden trees in a very popular avenue in the town centre (City of Helsinki, 2007). A study conducted by the city of Helsinki Environment Centre reported that the source of the smell was excreta from the aphids living in the linden trees (City of Helsinki, 2007). Excreta from dogs and birds is perceived to be an aesthetic and hygiene problem by some individuals (Nowak and Dwyer, 2000). Also animals such as foxes and birds searching for food from garbage bins at public parks can create a mess and make the surroundings unappealing (Jari *et al*., 2008). Leaf litter is also considered as a disservice and aesthetic problem by some urban residents who feel inconvenienced by seasonal clean up routines (Zhang *et al*., 2007).

2.4.4. Blocking view and sunlight

Trees have been reported to decrease visibility and they are also held responsible for blocking signs, storefronts, and window displays from both pedestrian and automobile traffic (Zhang *et al*., 2007). Urban trees are also blamed for blocking sunlight and views. When trees block or decrease the amount of sunlight (especially in places where solar panels are used), they are perceived as a nuisance and disservice (Nowak and Dwyer, 2000).

2.4.5. Maintenance costs

Urban greening programmes done on a large scale beyond small backyard gardens can cost huge sums of money to put into practice (Bolund, 1999). This is predominantly true in a case of setting up a new park. Also, a large number of tree seedlings require intensive aftercare especially in the first year of establishment. Consequently, maintenance costs are normally high particularly if irrigation is required (Kane, 2009). Other maintenance costs come about when the park is already established, such as removing unwanted or alien species, birds forming nests in wrong places, weeding, pruning branches, removal of fallen debris and pest control (Kane, 2009). Tree planting initiatives that are poorly run can also prove to be very expensive, if the death of seedlings is high as a result of insufficient or misdirected support (Bolund, 1999).

2.5. *APPRECIATION OF INTANGIBLE BENEFITS OF TREES*

One of the interests for this study was to understand how different urban residents perceived and

appreciated the intangible benefits of urban trees. Appreciation can be defined as the "recognition and enjoyment of the good qualities of someone or something" (Webster Dictionary, 2002). Appreciation is also understanding and acknowledging the value of something or someone. So appreciation in the context of this particular study refers to the various intangible benefits of trees and acknowledging the value of these benefits. In order for someone to be considered as having understood something, they need to show familiarity and knowledge of that particular thing (Johnston, 1985). This is why the first phase of this study sought to understand how knowledgeable the respondents were (level of awareness) as far as the intangible benefits of trees were concerned. For the purposes of this study, respondents needed to show that they are familiar with the various benefits in order to determine their appreciation of the intangible benefits of trees. The definition of appreciation also includes enjoyment of the good qualities of someone or something. Good qualities in the context of this study refer to the various benefits and services provided by trees and people making use of the benefits of trees was an indication of enjoyment and appreciation of the benefits. For example, visiting parks or just sitting under a tree enjoying the shade and fresh breeze from the tree.

Appreciation of the intangible benefits of trees is said to be influenced by a number of factors. These factors are somehow linked and overlap with each other thus bringing in the issue of complexity which involves multiple factors and relationships that are directly or indirectly linked to each other. For example religious, cultural and spiritual beliefs influence appreciation but at the same time can influence people's pro-environmental values and beliefs which are also factors directly influencing appreciation of the intangible tree benefits. Appreciation of urban trees can vary considerably among among different ethnic groups of people (Fraser and Kenney 2000). Some people might perceive the cultural and social aspect of urban trees to be more important than the ecological aspects, thus being more appreciative of the social and cultural benefits of trees. Other people may recognise and appreciate the positive services provided by trees and consider them as outweighing the disservices (Lo Yu-hong, 2009). Research regarding which factor or factors influence appreciation of intangible benefits of trees is limited and little is known about this (Fraser and Kenney 2000). Some of these factors are discussed in the sections below.

2.5.1. Religious, cultural and spiritual beliefs

Schroeder (1988) observes that trees have been used by many cultures and religions to signify health, wisdom, and clarification since time immemorial. Several writers have made the analogy between the individual, cultural, spiritual and social characteristics of trees and people (Section 2.3.2). Like humans, individual trees have their own unique form, character, and peculiarity (Gobster and Chenoweth, 1989). The great diversity of tree species and varieties reflects our own ethnic and

cultural diversity in its differences in appearance, customs, and traditions (Rolston, 1988).

The extent to which the people understand and recognize the cultural and spiritual benefits and values of urban trees is dictated by cultural norms or religious values which undoubtedly vary in different countries (Onganga, 1992). For example, one Kenyan writer has commented that, "Many traditional and spiritual beliefs do not hold strong in urban settings with mixed populations". This is due to the fact that "Kenyans maintain their rural homes as links to their traditions and cultures and do not take these values to urban centres where they keep only temporary homes" (Onganga, 1992). However, as noted in Section 2.3.2 trees in urban systems can be of great cultural/spiritual significance, and cultural or spiritual beliefs may strongly influence the value that urban residents attach to trees. These cultural and spiritual beliefs according to research are often linked to age. Research shows that older people have a rich understanding of the cultural and spiritual beliefs attached to trees and thus have a higher appreciation of trees, unlike the younger generation who have somehow shifted away from their culture as a result of western culture which they have adopted (Onganga, 1992). Schroeder (1988) further observes that trees stand as a figurative connection between the human and divine in many religious and cultural traditions, and are the means by which humans come into contact with their deepest spiritual values. If trees stand as symbolic links in people's cultural and religious traditions, it goes to show people understand and acknowledge the importance and value trees and this ultimately shows their appreciation of trees.

Appreciation of trees based on one's spiritual and religious beliefs has existed from the very beginning. For example, Christian religious belief is sometimes identified with the tree of life and knowledge that was found in the Garden of Eden (Chenoweth and Gobster, 1989). The same has been observed in Hinduism, where the Hinduism symbol represents the "awakening of divine consciousness as a serpent ascending a tree, and Buddha is reported to have achieved enlightenment while sitting under the wisdom tree" (Chenoweth and Gobster, 1989).

2.5.2. Environmental education and experiences with nature

Environmental education is recognised as one amid numerous important "preconditions for the development of competence leading to action and behavioural adjustments in relation to appreciation of the natural environment" (Kaplan and Kaplan, 1989). Environmental education is also known to provide a vital foundation of knowledge and assistance to both children and adults in making sense of the earth (Kaplan and Kaplan, 1989). In order to develop an appreciation of trees and nature, there is a need for humans to experience and discover the natural environment and have a personal bond with their natural surroundings such as trees, parks, woodland and forests (Bullock, 1994).

Nature has been found to have a profound impact on people but especially children (Jaus, 1984). Most children come to recognise and acknowledge the splendour, wonder, and familiar experiences provided by the natural world, irrespective of the area in which reside (Johnson and Monear, 1994). Research shows that environmental education has a huge impact on the younger generation and as such it has been incorporated in their curriculum at school (Johnson and Monear, 1994). This essentially means that younger people are more aware and appreciative of the benefits and importance of urban trees as compared to older folk (Jaus, 1984).

Environmental education plays a vital role not only in the classroom but also in our lives (Section 2.3.2). "One long look into the night sky puts our lives into perspective; psychologically, physically and spiritually" (Henninger, 1994). Research done by Bullock (1994) indicates that environmental education and outdoor experiences, assist children to have admiration and a high opinion for living things, arouse their interest, and provide them with important life experiences that may have a positive impact on their adult relations with nature and subsequently impact their appreciation of nature. Bullock (1994) further states that in order for children to build up an appreciation and care for nature, they require frequent meaningful encounters with nature. This is particularly true in urban settings where there may be countless obstacles between children and their natural environment.

Further research by Jaus (1984) shows that experiences with nature encourages a positive outlook towards the environment in both children and adults and consequently influences appreciation of their natural surroundings including trees. Experiences with nature may include outdoor recreational activities as well as participating in tree planting programmes and both of these activities are known to play major roles in shaping one's perception of urban trees and nature as a whole. It is widely understood that people who take part in tree planting initiatives develop a profound sense of ownership and appreciation for the trees because they have invested their time and energy and, therefore, have a strong motivation to maintain the plants and ensure their survival (Moskell *et al*., 2010).

2.5.3. Urban ecosystem disservices

Urban ecosystem disservices have been reported to hinder people's enjoyment of the other services provided by the ecosystem. The various kinds of disservices produced by ecosystems include; allergic reactions, obscuring views and sunlight, posing health and security risks and damaging structures (Section 2.7). These disservices of urban trees can turn pleasant surroundings into detested ones and this greatly affects appreciation of the services provided by urban trees for some people. However, the division between ecosystem services (benefits of trees) and disservices (disadvantages of trees) is not

a clear one because the assessment of disservices is multifaceted (Zhang *et al*., 1998). An ecosystem function can be appreciated as a service or disservice depending on the person making the assessment and the situation (Burgess *et al*., 1998). Some of the disservices recognized here may be perceived as extraneous, or of insignificant value, if weighed against the ecosystem services that are making sure that certain basic needs such as eating, drinking and breathing are fulfilled (Balmford and Bond, 2005).

Disservices of ecosystems have been known to affect use and values of trees and green spaces. For instance, those that feel trees and vegetation (in urban areas) act as a shield for criminals will not appreciate having trees or dense vegetation in their environment as they fear for their safety and, for this reason, many towns have continued removing thick shrubs and trees from along the streets and parks (Talbot and Kaplan, 1984). Also people with pollen allergies will not want to keep or plant trees causing or aggravating their state and as a result, they are forced to clear some of the trees causing their allergies. Research done by Jari (2008) shows that people who are less pro-environmental and affected by the disservices of trees are less likely to appreciate trees and more likely to want to get rid of the trees providing those disservices. But, on the other hand, if the same people hold pro-environmental values, they may see the services and benefits outweighing the disservices and end up preserving the trees.

2.5.4. Pro-environmental and altruistic values

Human values can be defined as "desirable, trans-situational goals, varying in importance that serves as guiding principles in people's lives" (Schwartz, 2005). People hold many values with varying levels of meanings. A particular value may be very important to one person, but unimportant to another. Research shows that people's values are linked to their background and the way they see things, be it political, religious or to do with other matters and consequently affects their character and actions (Schwartz, 2005). This research is supported by studies done in environmental psychology, where it was found that values, beliefs and attitudes have a direct impact on environmentally significant behaviour (Kaiser *et al*., 1999). This goes to show why a person's environmental orientation or attitude is always determined by examining the beliefs and values that they hold toward the environment (Kaiser *et al*., 1999).

Environmentally significant behaviour (ESB) is "any behaviour which has an impact on the availability of natural resources, energy, or alters the function or structure of environmental ecosystems" (Stern, 2000). Several studies have shown that the ESB theory can be useful in differentiating the multiplicity of people's behaviours and the different aspects which influence our

upbringing (Bamberg and Möser, 2007). Sterns (2005) suggests that by understanding environmentally significant behaviours we can separate those which are pro-environmental and those which are not. Pro-environmental behaviours (PEB) can be defined as "human behaviour which seeks to minimise its negative impact on the surrounding environment" (Bamberg and Möser, 2007). Examples of PEB include "reducing the use of motor vehicles, reducing energy consumption, walking, riding a bicycle, minimising waste, composting, and numerous other environmental friendly activities" (Kollmuss and Agyeman, 2002). Factors such as value orientation, environmental beliefs, and norms have been revealed to have an effect on specific PEB such as "recycling, choice of travel mode and general pro-environmental behaviour" (Grendstad and Wollebaek, 1998; Hopper and McCarl-Nielsen, 1991 and Garvill, 1999). This study has taken a keen interest in PEB because research has found that people who are have PEB have a higher inclination towards nature and are more concerned about their natural environment. Also, such people tend to plant/retain trees in their own space and volunteer for community tree planting projects and consequently have a higher appreciation of ecosystem services.

Environmental values have also been recognised as influential forecasters of PEBs (Kaiser *et al*., 1999). Nordlund and Garvill (2001) have been examining general values and their relationship with PEB. Using Schwartz's general value items, they came up with two value types in the organisation of general values. The two value types can be depicted in two opposite categories: self-transcendence and self-enhancement. Self-transcendence merges the value types of "universalism and benevolence, whereas self-enhancement combines the value types of power and achievement" (Schwartz, 2005). Self-transcendence embraces shared interests, as opposed to self-enhancement, which comprise of individual interests (Schwartz, 2005). Several studies have shown that there is a direct connection between general values and PEB. This is evidenced by studies conducted by Karp (1996), which found that individuals who give precedence to collective or self-transcendent values are more eager to take on diverse forms of altruistic, cooperative, or pro-environmental behaviour than individuals who give precedence to self-enhancement values. Self-transcendence influences pro-environmental behaviour positively, whereas self-enhancement tends to influence pro-environmental behaviour negatively.

Nordlund and Garvill (2002) designed a model that emphasises the association between general values and PEB analogous to Stern's model (2000). Stern's model was an annex of Schwartz's (1977) norm-activation theory, which initially was a description of altruistic behaviour but has been extended to pro- environmental behaviour (Guagnano *et al*., 1995). According to Nordlund and Garvill's (2002) proposed model (Figure 2.4), general values influence environmental values. This can be

explained with the help of norm-activation theory. According to the norm-activation theory, "an important antecedent to pro-environmental behaviour is the activation of a personal moral norm" (Schwartz, 1977). This activation occurs "when a person sees environmental conditions that threaten something that they value (nature, well-being of a fellow human or one's own well-being); that is, the individual is aware of environmental problems" (Schwartz, 1977). The personal norm, experienced as an ethical responsibility to take action in order to guard that which is endangered, comes from the person's pertinent general values which in turn incite their environmental values to react (Guagnano *et al*., 1995). Thus, a person's general and environmental value orientations are expected to have an effect on their personal norm. Self-transcendence and eco-centrism are expected to influence the personal norm positively, whereas self-enhancement and anthropocentrism are expected to influence the personal norm negatively (Guagnano *et al*., 1995) (Figure 2.4).

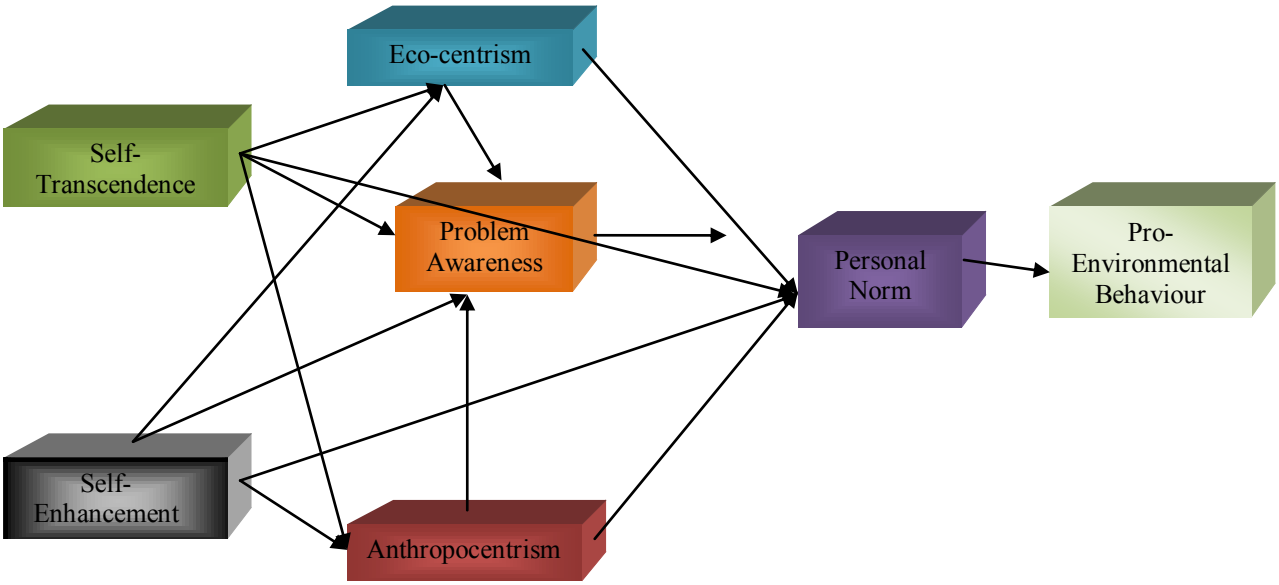


Figure 2.4: Value structure influence on Pro-environmental Behaviour *(Nordlund and Garvill, 2002)- [Path Diagram Showing Proposed Model of the Influence from General and Environmental Value Orientations, Problem Awareness, and Personal Norm on Pro-environmental Behaviour]*

2.6. URBAN FORESTRY AND TREE PLANTING IN SOUTH AFRICAN

2.6.1. Urban greening programmes in South Africa

The concept of urban forestry is quiet new in South Africa as well as other developing countries in Southern Africa. In South Africa, the term urban forestry is not often used but descriptors such as

urban greening or tree planting programmes are frequently used (Shackleton, 2006). Literature on urban forestry in South Africa shows that information is both limited and scattered, but on the other hand, urban forestry and greening programmes are numerous and diverse (Shackleton, 2006). This indicates that there is clearly a need to improve documentation of experiences, gather and synthesise available information, and conduct research to scrutinise important matters on urban greening programmes in greater intensity.

As earlier mentioned, urban greening programmes in South Africa are numerous and occur in different parts of the country. At the national level, the most popular greening initiative is Arbor week, which brings together government, businesses, the non-government sectors and communities to participate in various greening activities (Guthrie and Shackleton, 2006). Arbor Day or Week, provides stakeholders with the opportunity to raise awareness of the various urban greening initiatives and also highlight the essential role trees play in sustainable development and the livelihoods of people and their environment (DAFF, 2004). During Arbor Day/Week, most effort is directed towards institutions such as schools and community groups and the young people are encouraged to participate in tree planting activities and related environmental programmes. But, Guthrie and Shackleton (2006) report that there has been inadequate assessment of the success of Arbor Day or Week, regarding activities both at the schools, or the broader distribution in neighbouring communities and suburbs. Also at the national level is South Africa's Plant a Million Trees Campaign, which is a project that was launched in 2007 by former President Thabo Mbeki and Water Affairs and Forestry Minister Lindiwe Hendricks as part of a UN programme to encourage all countries to plant more than a billion trees a year. DAFF in collaboration with the Institute for Environment and Recreation Management (IERM) has a competition for municipalities called National Arbor city award which was reintroduced in 2002 (DAFF, 2004). The main aim of this award is to recognise and provide incentives for towns and cities for their greening efforts with the special focus on previously disadvantaged areas such as townships and informal settlements.

At the local level, greening initiatives are run by municipalities who assign some budget for the development and protection of parks, and have some tree planting activities in well frequented public spaces, such as along sidewalks or down the main street (DAFF, 2010). Local municipalities also focus on promoting awareness and to some extent assist in the allocation of trees as well as setting up and supervision of areas of natural forest/woodlands within the urban cities (DAFF, 2010). However, these local municipalities lack funds and knowledge for suitable planning and therefore the allocation of trees, and the aftercare, is unguided and not backed up by any research programme. Furthermore, these activities do not recognise the economic and social dimensions of tree planting (Shackleton,

2006).

Non Governmental Organisations (NGOs) have also played a huge role in promoting greening programmes within the country. Food and Trees for Africa is an NGO that encourages environmentally sustainable practices that empower communities while also playing an important role in reducing carbon emissions by planting trees (Food and Trees for Africa, 2012). This organisation runs a number of programmes including "Trees for All, Trees for Homes, Bamboo for Africa" etc. Trees for All is a programme which basically involves planting trees to assist in climate change mitigation. The programme also involves planting trees in poor communities living in barren, dusty townships across South Africa. Trees for Homes is another programme run by this organisation and it is a public greening initiative which contributes to making settlements sustainable and improving quality of life (Food and Trees for Africa, 2012). The programme involves providing low income communities with fruit or indigenous trees to plant at their homes, as well as providing training, short term employment and environmental awareness (Food and Trees for Africa, 2012). There are also smaller NGOs that promote greening initiatives in the country such as Themba Trees, which facilitate the distribution and planting of trees in schools and municipalities in order to improve the environment and well-being of individuals (Themba Trees, 2011).

While it is clear that there are numerous urban greening programmes in South Africa, it is also obvious that they get very little notice on the political agenda regardless of their importance and contribution to society (Park, 2000). Also tree planting and urban greening programmes in South Africa remain inconsistent with scanty information (Shackleton, 2006). This is because very little research has been done regarding tree planting and maintenance in urban areas (Shackleton, 2006). Thus, it is necessary for researchers to offer the much needed facts, knowledge and directions to guide the growth of lively and feasible urban forestry approaches and policies, which will capture the interest of decision makers as well as the municipal planners (Shackleton, 2006).

2.6.2. Distribution of trees and urban green spaces in South African towns

The distribution of trees and public green spaces in South African towns is largely influenced by various attributes such as location, wealth, ethinicity and education of residents (McConnachie and Shackleton, 2010), which was, in turn, hugely influenced by the apartheid regime and racially segregated planning. Under the apartheid regime, ownership of land and residency was racially based (McConnachie and Shackleton, 2010). The apartheid government tried to restrict the number of black South Africans living outside their homeland. The few blacks that were allowed to live in urban areas were confined to "racially defined residential areas", which are also known as 'townships'

(Wilkinson, 1998). The townships lacked proper services, with the majority of buildings being informal, poorly endowed with public green spaces and widespread poverty (McConnachie and Shackleton, 2010). On the other hand, white people lived in suburbs similar to those in developed countries. These suburbs were properly planned and well preserved with adequate green spaces and infrastructure as well as treed streets and large gardens. Since the democratic transition in 1994, the new government has tried to address the disparities created under apartheid (Wilkinson, 1998). Major investments are continually being made in township areas, informal urban areas as well as homelands. Currently, the present government has a housing programme known as Reconstruction and Development Programme (RDP). This programme aims at providing large numbers of houses for poor and homeless, mainly urban, people at a low cost (Gilbert, 2004). These low cost houses are referred to as 'RDP' houses and they have very few trees and green spaces as they are high density and the areas on which they are built are usually bulldozed of all vegetation. The RDP houses are mostly occupied by underprivileged black South Africans. Due to increased urbanisation, RDP houses have not been adequate to accommodate all the poor people. As a result, the people that are not accommodated in the RDP houses find themselves setting up high density small houses largely made of iron sheets known as informal settlements. Informal settlements normally have more trees as compared to RDP settlements but no public green spaces at all as there is no formal planning and a high proportion of these trees have been reported to be invasive (McConnachie and Shackleton, 2010).

As a result of these historical and planning reasons, urban green spaces and trees are not uniformly distributed within towns. Some residential areas are excessively well endowed with public green space, while others have considerably less. This particular study provides a comparison of old townships which were neglected by the government of that time, with new RDP surburbs and informal settlements.

Differences were expected in the way residents in these settlements perceive and appreciate the various benefits that can be obtained from trees. Residents were also were suspected to have different levels of knowledge concerning the benefits of urban trees. This is because the settlement types had variations in tree composition and abundance as well as availability of trees and public green spaces.

CHAPTER THREE

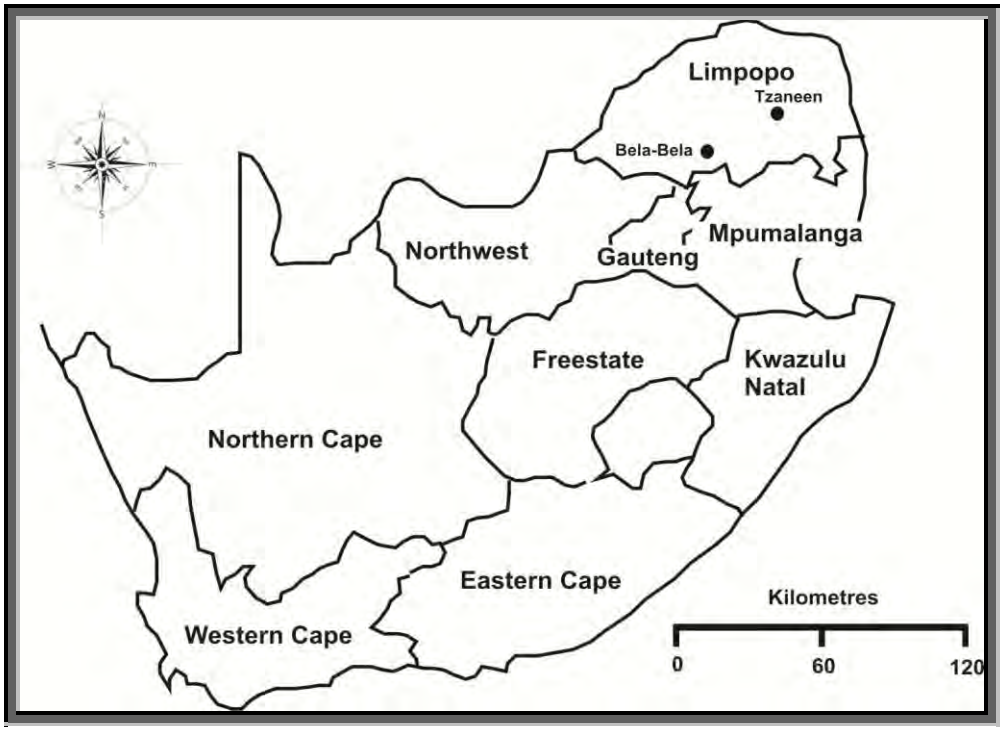
STUDY AREAS AND METHODS

3.1. INTRODUCTION

This chapter provides a general introduction to the study areas and the methods used. The two study towns are described in terms of their socio-economic status and biophysical environment. This is followed by an overview of the study design and methods used.

The study took place in South Africa in two towns namely: Bela-Bela and Tzaneen within the Limpopo Province (Figure 3.1). These towns were chosen by a panel of academics who are involved in the SANPAD research project. It was generally felt that these towns had a good representation of informal settlements, formal townships and RDP settlements which were part of the criteria for selection of study sites. RDP stands for Reconstruction and Development Programme. RDP is an extremely cost-effective and simple method used by the South African government to build low cost housing for the poor and under privileged. These low cost houses are referred to as RDP houses. Informal settlements refer to underdeveloped settlements without title while formal townships are more developed and they also have title (VEDA Associates, 2009). The study singled out these three different settlement types, because each is characterised by different socio-economic, ecological, infrastructural and institutional conditions that could influence residents' relationship with trees and their natural environment. Each one of these settlements has different histories based on race and wealth (Section 2.6.1).

These three different settlements consequently offer an exciting opportunity to examine the differences in knowledge, appreciation and value attached to trees on both private and public spaces in the different areas. Comparisons are made between older townships (which were neglected by the government of that time) and the new RDP houses (which are often bulldozed of all trees and other vegetation, hence poorly endowed with public and private green space and have few trees) with informal settlements (under-developed, high density houses). Differences are expected in how residents in these different settlements perceive trees and green spaces and the values they attach to them, because of the variation in tree composition and abundance that is found in these different settlements.



3.1: Map showing the location of the two study towns in Limpopo Province

3.2. DESCRIPTION OF THE STUDY TOWNS

3.2.1. Bela-Bela

Location

Bela-Bela is geographically situated in the western part of the Limpopo Province and falls within the Waterberg District Municipality (24°53' south 28°17' east) with a population of 32 146 (SSACS, 2007). It lies off the N1 highway between Pretoria and Polokwane and it is 144 km from Polokwane, 170 km from Johannesburg and 100 km from Pretoria. The town shares common borders with the Mpumalanga Province to the south-east, Gauteng to the south and North-West Province to the south-west. The total area of the town is approximately 27.55 km^2.

Biophysical environment

In terms of vegetation, the Waterberg District lies in the savanna biome and is covered with bush veld habitats consisting of open to dense, low thorn savanna dominated by acacia species or shrubby grassland with a very low shrub layer which occurs on flat to slightly undulating plains (Mucina and Rutherford, 2006). The kinds of trees that are found in this region include small trees and tall shrubs such as *Acacia karroo, Acacia tortilis* and *Euclea undulate* (Mucina and Rutherford, 2006). Protected

indigenous trees include *Sclerocarya birrea* and *Adansonia digitata* (Mucina and Rutherford, 2006). The very scattered alien plants over wide areas include *Cereus jamacaru*, *Lantana camara*, *Melia azedarach* and *Sesbania punicea*. Although there many species of plants in Waterberg District, the one which deserves special mention is the special indigenous cycad, *Encephalartos dyerianus*. This cycad is very expensive mainly because human medicine is derived from it (Bela-Bela Local Municipality IDP, 2008/2009).

The altitude of Bela-Bela ranges from 700 to 1000 m above sea level (Bela-Bela Local Municipality IDP draft, 2012/13). The soils in this region are red-yellow apedal, freely drained with high base status and self mulching, black, vertic clays (Mucina and Rutherford, 2006). The vertic soils, with a fluctuating water table, experience prolonged periods of swelling and shrinking during wet and dry periods (Mucina and Rutherford, 2006). The geology of the area consists of rocks that are part of the volcano-sedimentary Karoo Supergroup. Most abundant in the area are the mafic volcanic soils of the Letaba formation, then the mudstones of the Irrigasie formation and sandstone units of the Ecca group (Mucina and Rutherford, 2006).

Climate

Bela-Bela normally receives an average of 481 mm of rain per year, with most rainfall occurring in summer (Mucina and Rutherford, 2006). It receives the lowest rainfall (0 mm) in June and the highest (95 mm) in January (South African Weather Service, 2011). Average midday temperatures range from 19.9˚C in June to 28.8˚C in January (Mucina and Rutherford, 2006).

Socio-economic environment

Bela-Bela is a medium sized town whose population (32 146) has been growing steadily over the past years due to immigration of people from Gauteng (Bela-Bela Local Municipality IDP, 2007/08). The town comprises of formal townships and informal settlements, RDP settlements and the suburbs, with the formal settlements having the highest number of households of approximately 61% of the total housing stock (STATSA census, 2001). STATSA (2001) census reports that approximately 62% of the households in Bela-Bela earn less than R1 600 per month (which is less than the minimum subsistence income) and struggle for survival with the dependents to care for. This is partly attributed to the fact that some people (4 778) have had limited schooling (formal education), and as a result they are likely to be left out of mainstream employment because of this limitation (Bela-Bela Local Municipality IDP, 2007/08).

The major economic activities in Bela-Bela include trade, catering and accommodation, which

contribute 28% to the employment sector (Bela-Bela Local Municipality IDP draft, 2012/13). This sector also includes, a number of tourist destinations and a variety of natural resources which have created opportunities for the local people and encouraged entrepreneurship and economic development (Bela-Bela Local Municipality IDP draft, 2012/13). The area in which the town is situated is also home to a world renowned biosphere reserve. The reserve is one of the biggest conservation areas in the country sitting on an area of 414 000 ha and includes various indigenous fauna and flora, hosting large populations of big game and important prehistoric and historic sites (Bela-Bela Local Municipality IDP, 2010/11). Furthermore, all the municipalities in the District are tourist attractions that attract many tourists from all parts of the world (Bela-Bela Local Municipality IDP, 2010/11). This was evident in 2001, when the United Nations education, Scientific and Cultural organisation awarded the Waterberg savanna biosphere reserve, international status as the first savanna biosphere reserve in Southern Africa (Bela-Bela Local Municipality IDP, 2010/11). Additionally, the natural hot springs found within the town act as a tourist attraction as well as the rich historical and cultural heritage resources that have potential for tourism.

The other major employment sectors within Bela-Bela include construction and finance, insurance, real estate and business services (Bela-Bela Local Municipality IDP draft, 2012/13). The construction sector employs around 18% of the labour force of the District whereas finance, insurance, real estate and business services contribute 10% (Quantec Regional Economic Database, 2011). The Mining sector has also created employment opportunities within the town. The District is one of the major mining regions within South Africa of which platinum, iron ore, coal and diamonds are mined (Bela-Bela Local Municipality IDP, 2010/2011).

3.2.2. Tzaneen

Location

Tzaneen is a medium sized town situated in Mopani District of the Limpopo Province in South Africa with a total population of 16 954 (SSACS, 2007). Its geographical coordinates are 23˚50' south, 30˚10' east. It is part of the Greater Tzaneen Local Municipality within the Mopani District Municipality area of jurisdiction.

Biophysical environment

Tzaneen is the second largest town in the Mopani District and that lies at the foot of the Wolkberg Mountains in the northern reaches of the Drakensberg range (Mucina and Rutherford, 2006). "The vegetation type is deciduous, tall open bush veld with a well developed, tall grass layer occurring on

low to high mountains with undulating plains mainly at the base of, and on the lower middle slopes of the north-eastern escarpment" (Mucina and Rutherford, 2006). The kinds of trees that are found in the Tzaneen area include: *Pterocarpus angolensis, Sclerocarya birrea, Acacia polyacantha. Albizia versicolor, Ficus sansibarica, Parinari curatellifolia, Piliostigma thonningii, Trichilia emetic and Acacia davyi.* The scattered alien plants include; *Solanum mauritianum, Melia azedarach* and *Caesalpinia decapetala*. The subtropical climate is also conducive for the spread of *Chromolaena odorata, Lantana camara* and *Psidium guajava* (Mucina and Rutherford, 2006).

Tzaneen's altitude ranges from 600 to 1000 m above sea level and higher in some places (Mucina and Rutherford, 2006). The geology of the region comprises of potassium poor gneisses of the Goudplaats gneiss and an Archaean granite dyke. Shale and quartzite of the Wolkberg group are present, but not common. The soils are Mispah, Glenrosa or Hutton forms, shallow to deep, sandy or gravelly and well drained (Mucina and Rutherford, 2006).

Climate

Tzaneen is much wetter than Bela-Bela, normally receiving about 881 mm of rain per year, with most rainfall occurring mainly during midsummer (South African Weather Service, 2011). It receives the lowest rainfall (5 mm) in July and the highest (182 mm) in January (South African Weather Service, 2011). Frost is infrequent, but occasional at higher altitudes. The weather condition in Tzaneen is mostly sunshine with long summer days and pleasant winters. Summer months from September to March have an average temperature of 28˚ C, and winter months from April to August have an average temperature of around 15˚ C (South African Weather Service, 2011).

Socio-economic environment

According to the census (STATSA, 2003), Ward 18 of the Greater Tzaneen local Municipality which includes the greater part of the study area, has a population of approximately 7 985 people. The population increased by 6.5 % since the last census of 1996 (Spatial Development Framework, 2003). The settlement types within the study area are predominantly formal (59.4 %), followed by 32% informal homes and the rest of the settlements being RDP houses (STATSA, 2003). The unemployment rate calculated from the total labour force for this Ward is 29 % and approximately 70 % of household incomes are below the minimum living levels (i.e. they earn less than R1 600 per month) (Greater Tzaneen Local Municipality IDP, 2010/11).

The tourism industry in Tzaneen plays an important role in the economic growth of the District. The town is also situated close to a number of game reserves and the town often serves as a thoroughfare

for tourists on their way to other tourist destinations in the Province (Greater Tzaneen Local Municipality IDP, 2011/12). The well-known Kruger National Park, for instance, is situated approximately 100 km away.

There are many tourist attractions in the small town of Tzaneen, including: the Tzaneen Dam, Magoebaskloof, Haenertsburg, and the Pekoe View tea estate (Greater Tzaneen Local Municipality IDP, 2011/12). Tzaneen also has abundant vegetation, plantations, mountains and one of the biggest baobab trees in the world at the Sunland nursery between Duiwelskloof and Ga-kgpane (Davison, 1978). The museum also attracts tourists for its collection of ethnological artefacts like pottery, beadwork, weapons and the largest collection of pole carvings in the country (Davison, 1978). Another tourist attraction contributing to the economy of Tzaneen as well as South Africa is the home of the Rain Queen Modjadji. The Rain Queen is the hereditary Queen of the Balobedu people and is a prominent figure in South Africa and many communities respect her position (Krige and Jensen, 1943). The Rain Queen and the royal institution have become a figure of interest and significant tourist attraction for Tzaneen (Lobedu material culture, 1984). Adding to the attraction is the Rain Queen's garden which contains the world's largest cycad trees which are in abundance in her garden. One species of cycad, the Modjadji cycad, is even named after the Rain Queen. There is also a collection of royal drums from the Rain Queen which equally attracts lots of attention.

3.3. APPROACH AND METHODS

3.3.1. Study design

According to O'Brien (2003) the "assessment of people's preferences for intangible benefits of trees through economic valuation techniques, which have been the predominant method used over the past decade to elicit environmental values, does not and cannot capture the full range of values and beliefs that people may have". Therefore, deliberative approaches such as life stories (in-depth interviews) and household questionnaires were used as tools for data collection for this study to explore urban residents' knowledge and appreciation of the intangible benefits of trees as well as the different factors affecting this appreciation. To establish the economic or monetary value that urban residents place on trees and the intangible benefits of trees, a Willingness to Pay (WTP) survey was carried out in both study towns. The household survey and life stories were expected to complement each other and, as additional triangulation, the relevant secondary data were collected and reviewed and personal observations of each household and the surroundings were also made.

The study took place in two different towns, with surveys being conducted in three distinctive

settlements within each town namely: informal settlements, formal townships, and RDP settlements. The study was particularly interested in making comparisons among the three different settlements within each town and also between towns (Figure 3.2). The study was conducted at household level; thus making the household the logical unit of measurement and analysis. For the purposes of this study, the household is defined as "a central unit, consisting of core members who live in the house permanently, and rely on complex socio-economic interdependencies among each other" (Ellis 2000).

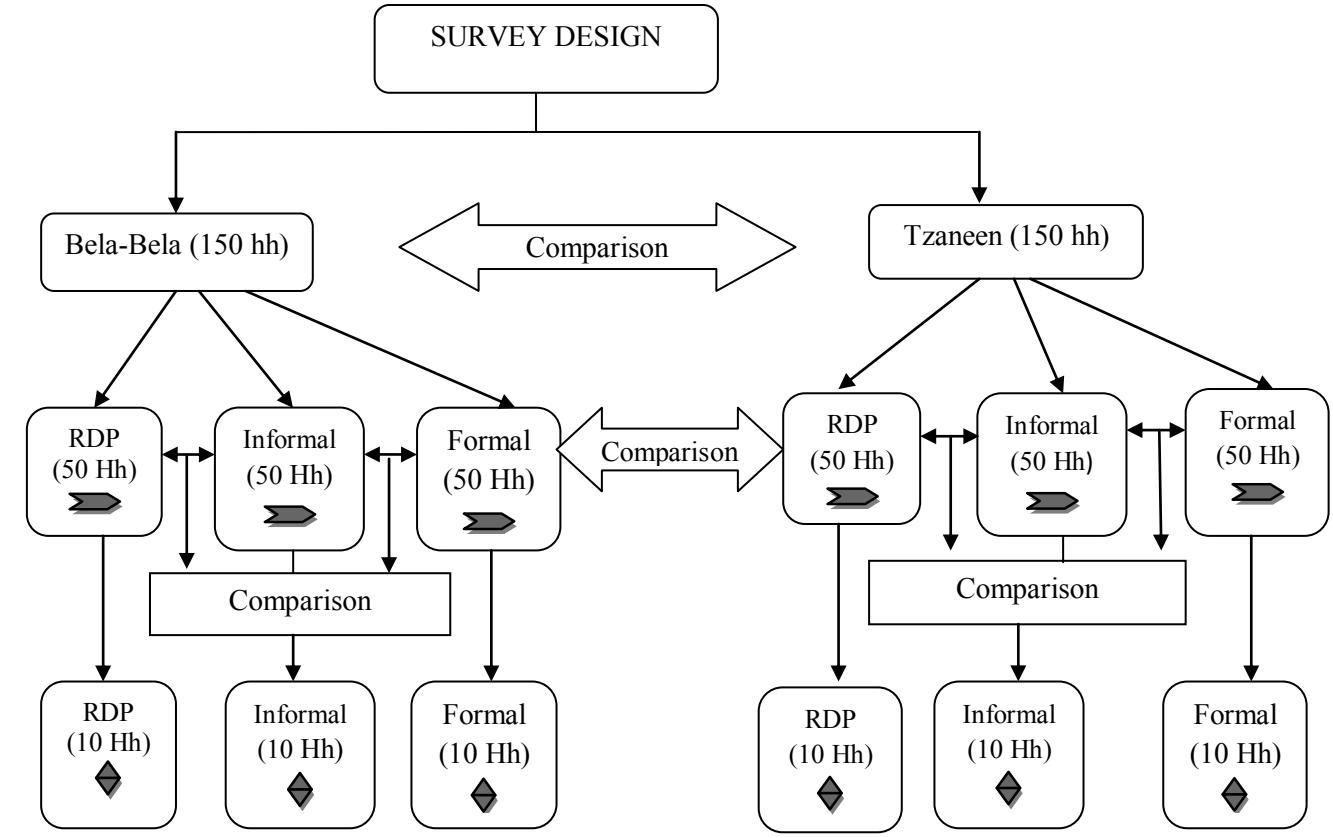


Figure 3.2: Study design showing the number of households for the survey and in-depth interviews (➡ represents the household survey and ◆ represents in-depth interviews)

3.3.2. Household survey

Sampling

Before commencement of data collection, households were identified and selected in each settlement type in both study towns using aerial photographs and maps. Simple random sampling was then used to select 50 households from each settlement resulting in a total of 150 households from each town.

Random coordinates were generated using Microsoft Excel to select the households by using grids which were laid over the aerial photographs.

Questionnaire design

The household questionnaire was composed of six sections (Appendix A). The first section was aimed at investigating the core or basic values that influence people's attitudes toward their natural environment based on responses they gave to a set of 12 likert items. The likert scale with strongly agree, agree, neutral, disagree, strongly disagree and not sure options were used because it is the recommended approach used to measure attitudes, beliefs and values towards urban green spaces (Downs and Stea, 1977). The set of value questions was partly based on Schwartz's general values and the New Environmental Paradigm (NEP). A new set of 12 value items was then produced from these two different approaches; this is because studies have shown that there is a relationship between general values and pro-environmental attitudes (Schwartz, 2005; Section 2.8.4). Findings from these studies indicated that people who give priority to collective or self-transcendent values are more willing to engage in different forms of altruistic, cooperative or pro-environmental behaviour than people who give priority to individual or self-enhancement values (Schwartz, 2005; Section 2.8.4). The New Environmental Paradigm (NEP) was also used because "it has been used worldwide as a tool for measuring environmental attitudes, beliefs and values during the past two decades" (Dunlap *et al*. 2000). The NEP has been used with samples of the general public, but also with samples of specific sectors such as farmers (Albrecht *et al*., 1982), as well as to examine environmental orientation of ethnic minorities in the United States of America (Caron, 1989). This section also aimed at finding out how residents rated treed green spaces in their neighbourhoods, in terms of whether their neighbourhoods had adequate green spaces or not. Residents were also asked if they had public parks within their neighbourhoods and whether those parks were within a walking distance and how many times they visited the parks.

Section two of the questionnaire was constructed to collect data on knowledge of the cultural and regulating services of trees including the social, cultural, ecological and recreational benefits of trees (Section 2.3 and 2.4). The third section addresses appreciation of the intangible benefits of trees and the different factors that underlie urban residents' appreciation. The appreciation items were based on findings from the review of literature around the main themes concerning peoples' appreciation of trees from aesthetics, recreation to physiological well-being as well as cultural and spiritual reasons. The mains themes were then selected and then appreciation statements were constructed base on these main areas. Likert scale questions were also used to capture urban residents' appreciation of the

intangible benefits of trees. The fourth section of the questionnaire examined urban residents' attitudes and responses towards tree planting and retention. This section collected information on the various factors that may influence urban residents' decision to plant or preserve trees on their private spaces. These factors included institutional, biophysical, social and practical factors.

The fifth section attempted to place an economic value on urban residents' appreciation of trees by asking respondents a hypothetical question related to how much they would be willing to pay in order to sustain a greening programme in their community. This method of valuing the intangible benefits of trees is called Contingency Valuation (CV) (Section 2.4). The CV method is based on a hypothetical market scenario in which people's views are solicited through questionnaires and/or interviews about their demand for a certain environmental good or service in terms of their WTP for that particular good or service (Garrod and Willis, 1999). It is widely used for valuing ecosystem services as it is capable of eliciting monetary value for goods or services which have no exchange value (Freeman, 1993).

The last section of the questionnaire provided the study with demographic and socio-economic information for the different households that were interviewed. This information included gender, occupation, income and age of respondents. Other data collected related to the wealth status, level of education and tenure security of the various households involved.

Data collection

Before commencing with fieldwork, an introduction and ground proofing procedures were carried out and permission to conduct the research was gained from the relevant authorities. Participation in both life stories and household interviews was completely voluntary and the confidentiality of the information received was assured.

The individual household interviews targeted the household head and in cases where the head was absent, the oldest member of the household was interviewed. Interviews were conducted in the local languages Sotho and Tswana in Bela-Bela and Tsonga in Tzaneen. During the household interviews the respondents were asked questions with the help of an interpreter and the responses were then recorded in the questionnaire booklet by the person conducting the interviews. Questionnaires booklets were never left with the respondents to be collected at a later stage or date. This was done in order to avoid misinterpretation of the questions by the respondents if they are left to answer and interpret questions on their own and also to avoid loss and damage of the questionnaire booklets.

Data capture and analysis

Data were captured in Microsoft (MS) Excel (2007) and analysed with the purpose of answering the key questions found in the Chapters 4, 5 and 6. Statistical analyses were undertaken using Predictive Analytics Software (PASW) formerly known as Statistical Package for Social Sciences (SPSS) (version 16.0, 2007). Basic descriptive statistics and frequency counts were undertaken for all data collected and three comprehensive scores were formulated for altruistic and pro-environmental values, knowledge of the intangible benefits of trees and appreciation of the intangible benefits of trees (details are provided in the specific method section in Chapters 4 and 5). These scores allowed for statistical comparison between towns and settlement types and for exploration of the relationships between knowledge and appreciation of the benefits of urban trees and several possible influencing factors as described below.

The first phase of analysis involved analysing data for the first objective which was to explore urban residents' knowledge of the social, cultural, recreational and ecological benefits of trees and identify the values and beliefs that are associated with specific tree species. Pearson's chi-squared tests were used to compare knowledge and awareness between towns and settlement types. Spearman rank order correlations were run to determine whether there was any relationship between age and level of education of respondents and their knowledge of the intangible benefits of trees.

The second phase involved analysing data for the second objective which was to explore urban residents' appreciation of the intangible benefits of trees and understand how different factors influenced this appreciation. To determine respondents' altruistic and pro-environmental values, a score was developed from a set of 12 likert items. A score for appreciation was also calculated (Section 5.2). The association between appreciation score and different influencing factors (altruistic and pro-environmental values, age and disservices of trees) was determined using Spearman rank order correlations. Cross tabulations in SPSS were used to determine the proportion of residents' that were WTP for maintenance of greening programmes within their neighbourhood. The association between WTP and other factors such as income, age and level of education was determined using Spearman rank order correlations.

The third phase involved analysing data for the third objective and the key questions. The third objective sought to examine the factors influencing urban residents' retention and planting of trees in their private space. To answer this objective, cross tabulations in PASW were used to determine which factors influenced planting and retention of trees the most. Cross tabulations were also used to determine the main reasons for cutting down trees. To determine whether tenure security and

residency time influenced the decision to plant/retain trees, Pearson's chi-squared test of independence was used.

3.3.3. Life stories (in-depth interview)

A life story can be defined as the account of a person's story of his or her life, or a segment of it, as told to another (Ojermark, 2007). Life stories may be topical, focusing only on one segmented portion of a life, or complete, attempting to tell the full details of a life as it is recollected. When related by the interviewee to the researcher it is the result of an interactive relationship. In this study the life stories provided qualitative in-depth information which complemented the household survey and provided a way of triangulating findings.

Sampling

Life stories were carried out after the household surveys were done. This was because household selection for the in-depth interviews was based on the household surveys. Respondents who seemed enthusiastic and had interesting ideas about the study were asked during the household interviews if they would be willing to participate in another interview at a later stage. Appointments were then made with the first 10 households in each settlement type (within each town) who were willing to be interviewed again.

Design of the in-depth interviews

For the purposes of this study, life stories were topical and they only focussed on one aspect of the respondents' life experiences related to nature and the environment. The topics/questions included how long the respondents had lived in a particular neighbourhood and the changes they had observed in their environment in terms of vegetation, tree cover, green spaces and climate and what they attributed those changes to (Appendix B). The respondents' opinions were sought on the differences in their own childhood experiences with that of the children of today and how their natural environment differed to that of children of today. Respondents were also asked about the value they attached to trees and nature in general (Appendix B).

Life story interviews

Life stories were conducted in the local languages of Sotho in Bela-Bela and Tsonga in Tzaneen with the help of a local interpreter. The life stories were recorded by an interpreter in English in an exercise book.

Direct observation of the different households was also done during the course of the interviews. The surroundings of the households were observed in terms of neatness of the yard, the presence of old and young trees and whether or not the trees were well trimmed. Clean and neat surroundings were an indication that the respondent cared about their immediate surroundings and consequently their environment.

Analysis of life stories

The life stories were typed in MS Word (2007). Then the copy and paste function in MS Word was used to rearrange and group together respondents views and comments related to particular themes such as the physical changes in their environment, value attached to trees and specific tree species and their childhood experiences with nature in comparison to children of today. Interesting quotes were extracted and used to support some of the survey findings. The general sentiments across different themes were also very useful as they gave more in-depth insights on some of the results from the household survey.

CHAPTER FOUR

URBAN RESIDENTS' KNOWLEDGE AND AWARENESS OF THE INTANGIBLE BENEFITS OF TREES

4.1. CHAPTER OVERVIEW

This chapter presents results and discussions of urban residents' knowledge and awareness of the intangible benefits of urban trees and the cultural values that they place on these and specific tree species. The chapter also considers how age and education may influence knowledge of the intangible benefits of trees in the different residential areas. Specifically, I hypothesise that knowledge of the intangible benefits of urban trees is positively influenced by age and level of education.

To understand knowledge and the level of awareness of the intangible benefits of trees, I investigated and answered the following key questions:

- How knowledgeable are respondents with regards to the intangible benefits of trees?
- Which cultural and regulating services of urban trees are respondents most and least aware of?
- Does the level of education and age influence knowledge of the intangible benefits of urban trees?
- What beliefs do urban residents attach to urban trees and specific tree species?

4.2. SPECIFIC METHODS AND CALCULATION OF SCORES

To answer the above key questions, data collected from both the questionnaire survey and in-depth interviews were used. The broad methods are presented in Chapter 3. This section presents specific methods on how the scores for knowledge of the intangible benefits of trees were calculated.

To determine knowledge of intangible benefits of trees, respondents were asked, without being prompted, to state the intangible benefits of trees that they knew. A list of 14 cultural and regulating services of trees (intangible benefits of trees) was prepared in advance. The interviewer was then required to tick the boxes on the checklist, according to the unprompted answers they were getting from respondents. The number of the intangible benefits of trees that individual respondents knew out of the total of 14, were then classified in the following way:

- Respondents who had scored between the ranges of 1 to 5 were classified as "less

knowledgeable".

- Respondents who scored between the ranges of 6 to 8 were classified as "knowledgeable".
- Respondents who scored between the ranges of 9 to 14 were classified as "very knowledgeable".

The above categories were used to classify the different 'levels of knowledge' among residents for this particular study.

4.3. RESULTS AND DISCUSSION

4.3.1. Knowledge of the intangible benefits of urban trees

Overall, results (both towns combined) revealed that residents in both towns had a fair amount of knowledge about the intangible benefits of trees with 29% being knowledgeable and 28% being very knowledgeable (Table 4.1).

Knowledge of the intangible benefits of trees between towns

Tzaneen had a significantly higher proportion of residents that were "very knowledgeable" (43%) and those that were "knowledgeable" (31%) than Bela-Bela which had only a few residents that were "very knowledgeable" (14%) and slightly more that were "knowledgeable" (26%) about the intangible benefits of trees (χ^2 = 42.660, df = 2 and p = 0.0001) (Table 4.1). This difference in knowledge levels can be linked to the findings from a complementary study done by Chishaleshale (pers. comm.). The study found that, the Municipality in Tzaneen had more greening activities and programmes compared to Bela-Bela Local Municipality. As such, residents in Tzaneen were constantly reminded of the importance and benefits of planting and having trees within their environment, especially during Arbor Day/Week. Furthermore, the study found that the Municipality in Tzaneen had not instituted any tree by-laws. This was because, there was a general understanding of the importance of trees, and as such, they had not experienced any problems with people cutting down or vandalizing trees. Bela-Bela Local Municipality, on the other hand, had very few greening programmes that were active; the reason being that the Municipality lacked funds to run greening programmes (Chishaleshale pers. comm.). Research shows that urban forestry and greening programmes provide a useful way for urban residents to become more aware of the benefits and functions of urban trees (Lorenzo *et al*., 2000).

Table 4.1: Proportion of respondents (%) that were less knowledgeable, knowledgeable and very knowledgeable about the intangible benefits of trees and Pearson's chi square results

Towns	Less knowledgeable	Knowledgeable	Very knowledgeable	$\chi 2$ value	df	*p* value
Bela-Bela	60%	26%	14%			
Tzaneen	26%	31%	43%	42.66	2	0.0001
Total sample	43%	29%	28%	12.62	2	0.002

Knowledge of the intangible benefits of trees among the different settlements

In Bela-Bela, the differences in knowledge levels among the different settlements were more extreme as compared to Tzaneen. In Tzaneen, the levels of knowledge among the different settlements were fairly evenly spread (Table 4.2). In RDP and informal settlements within Bela-Bela, there was a huge gap between the percentage of residents that were less knowledgeable and those that were very knowledgeable and this was statistically significant ($p = 0.0001$) (Table 4.2). Whereas, in the formal township these differences were slight and not statistically significant ($p = 0.538$) (Table 4.2). On the other hand, the gap amongst the percentage of RDP residents in Tzaneen that were less knowledgeable (30%), knowledgeable (38%) and those that were very knowledgeable (32%) was quite narrow, and statistically insignificant ($p = 0.771$). This pattern was repeated for the other two settlements (Table 4.2). These findings show that residents from the different settlements in both towns have similar distributions in terms of knowledge of the intangible benefits of trees except in RDP and informal settlements in Bela-Bela.

Table 4.2: Knowledge of the intangible benefits of trees among different residential areas and Pearson's chi square results

Towns	Settlements	Less knowledgeable	Knowledgeable	Very knowledgeable	χ^2 value	DF	*P* value
Bela-Bela	RDP	80%	18%	2%	50.92	2	0.0001
	Informal	62%	24%	14%	19.24	2	0.0001
	Older townships	38%	36%	26%	1.24	2	0.538
Tzaneen	RDP	30%	38%	32%	0.52	2	0.771
	Informal	24%	30%	46%	3.88	2	0.144
	Older townships	24%	26%	50%	6.28	2	0.063

4.3.2. Cultural and regulating services of trees that respondents were most and least aware of

Overall, the majority of residents (90%) in both study towns were aware of the role urban trees play in reducing temperatures by providing shade, while very few residents (15%) were aware of the fact that trees help in reducing noise levels in urban areas. The role of urban trees in promoting social interaction was the cultural service that most respondents (68%) were aware of, while promoting physical exercise was the least reported (9%) of the cultural services (Table 4.3). Research shows that people are generally aware of the benefits of trees that concern their welfare (Lohr *et al*., 2004). This is especially true for the residents of the informal and RDP settlements, who are continually affected by the scorching heat from the sun and the strong winds. As such, they recognise and easily relate to the benefits of trees, such as, provision of shade because these benefits directly affect their well-being. Similarly, the link between trees and physical exercise, according to most residents, was neither a priority nor a concern and as a result, such benefits were not easily recognised as compared to social interactions. The following quote (Box 4.1) is by a 42 year old female from Bela-Bela and highlights the significant benefits of trees in RDP settlements.

Box 4.1: Quote by a resident from Bela-Bela, underlining the importance of trees acting as windbreaks

> "*The past few days have been terrible. We have been experiencing strong winds and dust is everywhere now I have a very bad cough. I wish I had planted trees around the house for protection against these winds, or even a live fence would have been better than nothing*".
>
> Source: 42 year old female (Bela-Bela, 2011).

<u>Cultural and regulating services that residents were most and least aware of between towns</u>

Results between towns revealed that a high proportion of residents (74%) in Bela-Bela were aware of the fact that trees reduce temperatures by providing shade. Whereas, the majority of respondents (79%) in Tzaneen were aware of the role that urban trees play in removing pollutants from the atmosphere (Table 4.3). On the other hand, very few residents in both Tzaneen (21%) and Bela-Bela (9%) were aware of the role that urban trees play in reducing noise levels (Table 4.3). A high proportion of residents (67%) in Bela-Bela were aware of the psychological stress reducing effect of trees in the natural environment (section 2.5.2). While the majority of residents in Tzaneen recognised that trees enhance the beauty of the surrounding environment (Table 4.3).

Table 4.3: Cultural and regulating services of trees that respondents were most and least aware of

Towns	Regulating services						
	Removal of pollutants	Home for birds	Reduces soil erosion	Provides shade	Reduces noise level	Sequester carbon	Act as wind break
Bela-Bela	33%	11%	9%	**74%**	**9%**	15%	64%
Tzaneen	**79%**	73%	26%	74%	**21%**	30%	65%
Total sample	56%	42%	18%	**90%**	**15%**	23%	78%
Towns	**Cultural services**						
	Encourage child's play	Promotes social interaction	Encourages physical exercise	Relieves stress	Enhances beauty	Provides learning opportunities	Part of culture
Bela-Bela	31%	61%	7%	**67%**	41%	**7%**	15%
Tzaneen	67%	76%	**11%**	46%	**85%**	29%	29%
Total sample	49%	**68%**	**9%**	56%	63%	10%	22%

Cultural and regulating services that residents were most and least aware of among the different settlements

Comparisons were done with regards to the cultural and regulating services of trees that respondents were most and least aware of among the three different settlements in each town. Results revealed that the majority of residents in both the informal (96%) and RDP (94%) settlements in Bela-Bela and the RDP (96%) settlement in Tzaneen recognised the fact that trees reduce surrounding temperatures by proving shade and also remove pollutants from the atmosphere (Table 4.4). The general pattern across all the settlement types confirmed that residents tended to recognise the benefits or services of trees that directly affect their quality of life and ameliorate harsh conditions in their immediate environment. The benefits of trees such as reducing soil erosion and providing habitat for birds are more subtle and, thus do, not necessarily affect people's well-being or their quality of life, especially for those living in relatively raw and bare informal and RDP settlements. However, in the formal township in Tzaneen, a large proportion (74%) of respondents recognised that trees can provide a home for birds and other small animals (Table 4.4).

Most residents in all the three different settlements in Tzaneen were aware of the fact that trees enhance beauty of the surrounding environment, while none of the residents in Bela-Bela recognised this cultural service (Table 4.4). Tzaneen residents alluded to the fact that their town is well treed and very beautiful and that they have come to appreciate the importance of trees in making the environment look beautiful and more attractive. This has resulted in the increased awareness about this particular cultural service. The quote in Box 4.2 by one of the residents in Tzaneen shows how

residents value the role urban trees play in making their town look beautiful and in attracting visitors as well as investors.

Box 4.2: Quote by a resident from Tzaneen on the importance of trees in enhancing beauty

> "*There is something about this town that draws people to it and most visitors leave with the memory of the beautiful terrain, trees and vegetation. Upon entering the town one is greeted with a breathtaking view which is unforgettable and this is one of the reasons why tourists come back to this beautiful town, time and again".*
>
> Source: 39 year old man (Tzaneen, 2011).

Residents in RDP (68%) and informal (74%) settlements in Bela-Bela recognised the psychological stress reducing effect of trees in the urban environment, while 68% of the residents in the older townships recognised the role trees play in promoting social interactions. None of the respondents in the RDP settlement and only 10% in the older township in Bela-Bela recognised the important role trees play in people's cultures. Correspondingly, during the in-depth interviews, residents in the two settlements initially said little about urban trees being an important part of their culture. But, these residents after being prompted about the cultural importance of trees, said that trees play a huge role in their culture and that they attach spiritual and religious value to specific tree species (Section 4.6; Box 4.4). On the other hand, trees encouraging physical exercise was the least reported in all the three settlements in Tzaneen (Table 4.4).

Table 4.4: Cultural and regulating services that urban residents in different residential areas were most and least aware of

	Bela-Bela			**Tzaneen**		
Intangible benefits	RDP	Informal townships	Formal townships	RDP	Informal townships	Formal townships
Removal of pollutants	28%	26%	**46%**	68%	**98%**	70%
Home for birds	**2%**	18%	12%	64%	80%	**74%**
Reduces soil erosion	6%	12%	**10%**	**22%**	24%	30%
Provides shade	**94%**	**96%**	32%	**96%**	92%	34%
Reduces noise level	8%	**4%**	14%	24%	**18%**	**18%**
Sequester carbon	4%	22%	20%	26%	42%	22%
Act as wind break	74%	90%	28%	86%	88%	20%
Encourage child's play	20%	36%	36%	60%	78%	62%

Table 4.4 continued

Intangible benefits	Bela-Bela			Tzaneen		
	RDP	Informal townships	Formal townships	RDP	Informal townships	Formal townships
Promotes social interaction	50%	64%	**68%**	74%	80%	72%
Encourages physical exercise	2%	4%	16%	**8%**	**14%**	**12%**
Relieves stress	**68%**	**74 %**	58%	62%	38%	38%
Enhances beauty	28%	52%	44%	**86%**	**82%**	**86%**
Provides learning opportunities	2%	**2%**	14%	14%	58%	16%
Part of culture	**0%**	34%	**10%**	32%	30%	26%

4.3.3. Association between socioeconomic factors (age and education) and knowledge of intangible benefits of trees

Level of education

In both Tzaneen and Bela-Bela, results revealed that there was a significant but moderate positive correlation between level of education and knowledge of the intangible benefits of trees ($r = 0.323$, $p < 0.0001$ and $r = 0.348$, $p < 0.0001$) (Table 4.5). Basically as the level of education increases so does the knowledge of the intangible benefits of trees.

Table 4.5: Spearman's correlation results of the association between level of education and knowledge of the intangible benefits of trees

	Spearman's correlation		***R* results**
Tzaneen	**Knowledge of intangible benefits of trees**	Correlation Coefficient	0.323
	Vs	Sig. (2-tailed)	0.000
	level of education	*N*	150
Bela-Bela	**Knowledge of intangible benefits of trees**	Correlation Coefficient	0.348
	Vs	Sig. (2-tailed)	0.000
	level of education	*N*	150

Results showed that residents with higher learning qualifications had more knowledge on the regulating services of trees than the cultural ones (Figure 4.1). This is probably due to the fact that

environmental science and biology in school cover most of the regulating services of trees like carbon sequestration, removing pollutants from the atmosphere, prevention of soil erosion, etc. Whereas, there was not much of a difference between residents with different levels of education and knowledge of cultural services of trees (Figure 4.1). In some settlements, residents with no formal education were more knowledgeable of the cultural services while, in other areas, residents with higher learning qualifications were found to be more aware of the cultural services. This may be due to the fact that cultural services of trees have more to do with one's values and beliefs that are instilled in individuals during the course of their upbringing. For instance, promotion of social interaction is not taught in school but if it is part of family tradition to go to a park for a picnic every weekend, then that particular individual will easily recognise the crucial role that trees play in recreation and promotion of social interaction as well as providing a place for child's play.

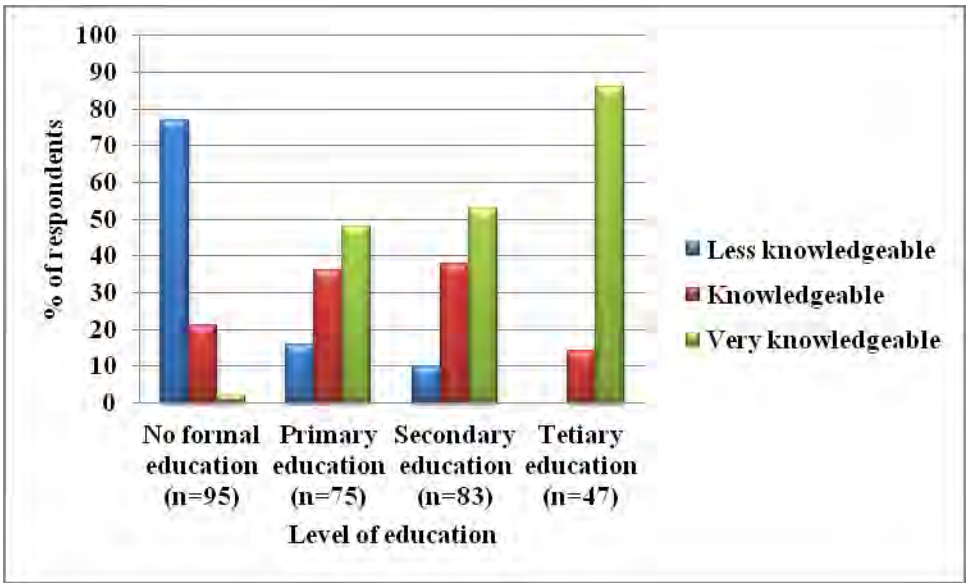


Figure 4.1: Relationship between the awareness of the intangible benefits of trees and different levels of education

Age

Results showed that there was a weak negative correlation, which was statistically significant, between respondents' age and knowledge of the intangible benefits of trees in both Bela-Bela and Tzaneen (r = -0.142, p = 0.023 and r = -0.033, p = 0.036) (Table 4.7). The negative correlation between the two variables implies that the younger respondents had more knowledge with regards to the intangible benefits of trees as compared to older respondents. Figure 4.2 shows that a high proportion (51%) of older respondents had less knowledge of the intangible benefits of trees.

Whereas, most (67%) of the younger generation were very knowledgeable about the intangible benefits of trees especially the regulating services such as carbon sequestration, removal of pollutants, etc. This may be due to the fact that the majority of them had attended school and, therefore, they had basic knowledge about the environmental services of trees (above section on level of education). On the other hand, the older residents exhibited a wealth of information about the spiritual, cultural, historical and religious benefits and uses of trees.

Table 4.6: Spearman's correlation results of the association between age and knowledge of the intangible benefits of trees

Study towns	Spearman's correlation		Results
Tzaneen	**Knowledge of intangible benefits of trees Vs Age**	Correlation Coefficient	-0.033
		Sig. (2-tailed)	0.036
		N	150
Bela-Bela	**Knowledge of intangible benefits of trees Vs Age**	Correlation Coefficient	-0.142
		Sig. (2-tailed)	0.023
		N	150

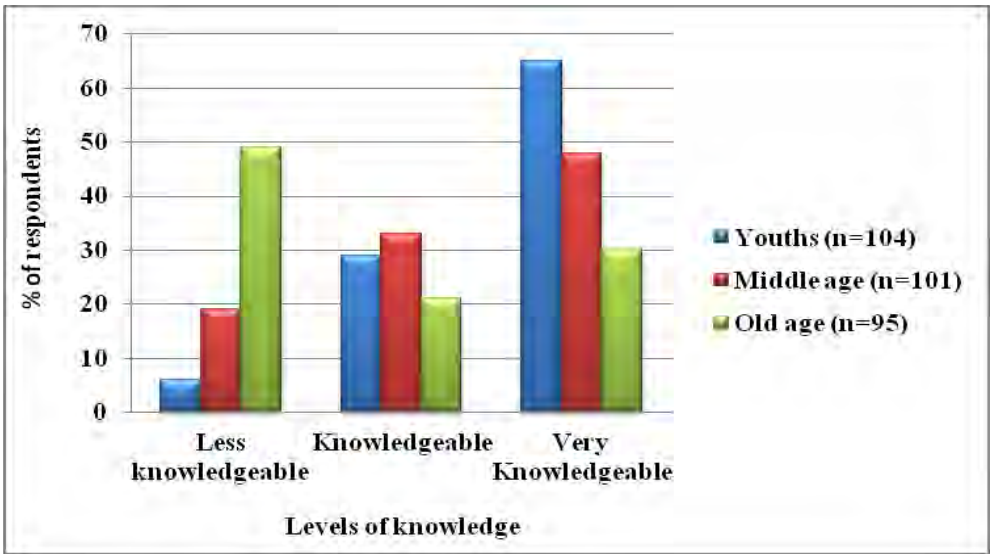


Figure 4.2: Relationship between knowledge of the intangible benefits of trees and respondents' age in both study towns

As mentioned above, results based on the questionnaire survey revealed that younger respondents had more knowledge of the intangible benefits of trees compared to older residents. Nonetheless, results based on the in-depth interviews suggested that, in terms of cultural services, the older generation were more informed. Within Bela-Bela, results showed that the majority of respondents that were

above the age of 45 had more knowledge concerning the intangible benefits of trees and they were able to give detailed explanations of various benefits of trees rather than 'just' stating them (Box 4.3). On the other hand, most of the respondents under the age of 30 did not seem very knowledgeable and they were also unable to explain the benefits of trees in detail. Box 4.3 provides a quote by an old woman in Bela-Bela, who explains the different benefits of trees in detail.

Box 4.3: Quote showing the depth of knowledge by older respondents on the different intangible benefits of trees

"*Trees are of paramount importance because of the shade they provide and also the fact that they shield us from strong winds. Initially, I did not have any trees within my yard. I felt very empty and I could not go outside the house with my granddaughter no matter how hot it became inside the house. I used to cry to God every day that He should provide me with trees. One day, I woke up to find small trees around my house. All these fruit trees you are seeing were given to me by God as I did not plant any trees. Trees are very useful because, on a hot summer day, I normally hold church meetings under the trees. I also like sitting under the trees to play with my granddaughter. We also harvest fruits and firewood from these trees and on a windy day, these trees shield us from strong winds and dust. All I can say is I am very thankful to the Almighty Lord for providing me with these trees. I am no longer sad or empty but very happy and grateful*".

Source: 61 year old woman (Bela-Bela, 2011).

Similarly, older respondents in Tzaneen were more knowledgeable about the various intangible benefits of trees and they took time to explain the different benefits. The older respondents were also able to give specific examples with regards to the uses and importance of urban trees (Box 4.4).

Box 4.4: Quote illustrating the insights of an elderly man on the cultural benefits of trees

"*In my journey through life, I have learnt that trees are of great importance and value. Trees play a huge role in my culture and tradition. I am able to maintain communication with my ancestors through trees where I make sacrifices to appease them and show my respects. Trees also provide us with medicines; such as, the bark, leaves and roots which are used for making herbal concoctions which are then used during the various rituals. Trees are also very symbolic in my culture. Certain trees are symbols of places where our ancestors reside. If one goes to worship near such a tree, then it means they are in direct contact with their ancestors because that tree is a place where the ancestors live".*

Source: 67 year old man (Tzaneen, 2011).

This 67 year old man gave an account of his experience with trees. This respondent did not just state that trees have cultural and spiritual importance but he further went on to explain the particular cultural importance of trees with so much passion indicating that he had a wealth of knowledge about the cultural and spiritual benefits of trees. Whereas, younger respondents would just state a particular benefit and sometimes mix up the benefits thus, indicating a degree of disinterest. For instance, the following quote by a young man clearly showed that while he knew some of the cultural uses of trees, this knowledge is relatively superficial. (Box 4.5).

Box 4.5: Quote illustrating the lack of cultural knowledge amongst the younger generation

"*Trees play a crucial role in our culture and they are a source of medicines. I think the roots of a marula tree are used in a concoction which is then applied on the body by men to attract ladies. No, wait a minute! I think its mohato (Mundulea sericea) which is used for that but then again I am not sure. Wish I could ask a friend of mine because I know he once used it and it worked*".

Source: 18 year male (Bela-Bela, 2011).

4.3.4. Importance, beliefs and uses associated with specific tree species

Exploring the value and importance placed on specific urban tree species was part of the first objective of the study. Results based on the questionnaire survey showed that respondents placed different values on different tree species ranging from utilitarian, medicinal to spiritual and cultural values, depending on what they deemed to be important and useful.

More than half of respondents in Bela-Bela valued specific tree species in their community for historical, spiritual and cultural purposes (Table 4.7). For instance, *Mundulea sericea* is believed to protect newly born babies from witchcraft and bad spirits, and as a result this particular tree is usually planted on homesteads even before the child is born. Another tree of spiritual and cultural importance is *Peltophorum africanum*. This tree is commonly used during a ritual that is done after a burial ceremony to cleanse the family of the deceased of any bad spirits such as the spirit of death. Box 4.6 is a quote by a 37 year old woman illustrating the spiritual and cultural importance attached to trees.

4.6: Quote illustrating the spiritual values and beliefs associated with trees medicines

> "*I recently lost my husband and I was told that his spirit will be coming for me because of the manner in which he had died. I was scared for my life and I was told not to start dating right away. After the burial, my grandmother gave me some 'muti' (medicine) in a dish to wash my whole body, which I did. After that, I started dating immediately and no harm came my way and also I did not have any nightmares*"
>
> Source: 37 year old female (Tzaneen, 2011).

Ochna cinnabarina is another tree that is greatly valued in Bela-Bela. This tree is believed to chase away witches during the night. Because of this belief, many people plant this tree on their home plots so that it can provide protection from evil spirits during night time. Trees of historical importance in Bela-Bela include *Acacia galpini* and *Sclerocarya birrea*. A large single *Acacia galpini,* is one of the oldest trees in Bela-Bela and as such it has become a historical symbol in the community. These findings mirror those in a study conducted by Dwyer *et al*. (1991) which revealed that there are deep spiritual and cultural ties between people and urban trees. These ties between people and trees are usually associated with traditions and symbolism.

Other respondents (35%) in Bela-Bela valued specific tree species for utilitarian purposes whereby, they engaged in the use of tree products such as roots, bark, leaves and fruits for medicines and food, respectively (Table 4.7). A study conducted by FAO (1995) confirms that urban trees are used for medicinal purposes. In this study, Asian and African students reported a concern that some amenity trees are harmed through their bark being removed by local people for medicinal use. The same study reports that some of the trees most commonly reported to be grown by Third World urban dwellers are those which provide food; particularly fruits, but also edible leaves, shoots and even flowers.

Unlike cultural and spiritual values, the ecological and social benefits of trees were not attached to any specific tree species. According to the residents in both towns, any tree can provide them shade or act as a windbreak, but only specific trees can be used during traditional rituals or protect them from bad spirits. Consequently, they are more likely to remove shade trees as compared to trees that have cultural or spiritual importance. For example, *Mundulea sericea*, as mentioned, is a tree of spiritual importance in Bela-Bela but it also provides very good shade and because of this community meetings are held under this particular tree. None of the respondents attached psychological or aesthetic value to specific tree species in their community. Table 4.7 shows a list of tree species and the beliefs and importance attached to them in both study towns

Table 4.7: List of tree species and their uses, beliefs associated with them and importance

Bela-Bela (n=150)			
No. (%) of respondents	Sotho/tswana	Scientific name	Importance/beliefs or uses of trees
8	Serokolo	*Siphonochilus aethiopicus*	treatment for sore throat and protection of small babies from bad spirits
30	Mongangatau	*Acacia galpini*	treatment of sexually transmitted diseases
10	Monyelenyele	*Ochna cinnabarina*	protection of house against witches
10	Mohato	*Mundulea sericea*	protects babies from witches
7	Marula	*Sclerocarya birrea*	used for brewing traditional beer, increases libido and treats impotence
2	Mulberry	*Morus rubra*	food-fruits are consumed
5	Jacaranda	*Jacaranda mimosifolia*	treatment for flu
3	Moselesele	*Dichrostachys cinerea*	used for cleansing blood
1	Monokwane	*Zanthoxylum capense*	increases appetite
8	Sekaname	*Urginea sanguine*	cleanses blood
5	Mosethla	*Peltophorum africanum*	used after funeral to cleanse bad spirits
5	Umahlanganisa	*Croton sylvaticus*	used for penis enlargement
3	Lengana	*Artemisia afra*	treatment for flu
2	Monamane	*Cassine transvaalensis*	cleanses blood
8	Mlomo mnandi	*Glycyrrhiza glabra*	attracting the opposite sex and bringing back lost lovers
2	Umkhanyakude	*Acacia xanthophloea*	brings light and chases bad luck
Tzaneen (n=150)			
No.(%) of respondents	Tsonga	Scientific name	Importance, beliefs or uses
30	Ntoma	*Euclea racemosa*	it is a protected tree/community meetings are held under this tree plus it has edible fruits also serves as a place to communicate with ancestors
6	Nkhanyi	*Sclerocarya birrea*	serves as a place where elders communicate with the ancestors/also used for making traditional beer
4	Xitsalala	*Gardenia volkensii*	various parts of the tree are used as medicine during rituals
5	Mondzo	*Combretum imberbe*	roots are used as medicine for diarrhoea
15	Nkuwa	*Ficus sycomorus*	the place where this tree is located is regarded as a heritage site
15	Feiye	*Ficus spp.*	served as a home for bushmen during the stone age/serves as a tourist attraction
1	Olive tree	*Olea europaea*	serves as a place for worshipping ancestors
3	Nkuhlu	*Trichilia emetic*	used for making traditional beer
5	Moduba	*Combretum zeyheri*	provides very good fire wood
3	Xikukutu	*Ansellia Africana*	helps in shaping a woman's body
10	Xanatsi	*Colophospermum mopane*	tree provides local people with Mopani worms
3	Mhangweni	*Mangifera indica*	used for food, shade and medicine

Similarly, results in Tzaneen revealed that the majority of residents (60%) equally recognised specific tree species for their cultural, historical and spiritual benefits (Table 4.7). Tzaneen is a town with a rich historical and cultural background with archaeological evidence that the Stone Age Bushmen left on the land in the form of rock paintings. Tzaneen also has protected trees that have cultural and historical importance such as the baobab tree that served as a home for Bushmen during the Stone Age and it is also a tourist attraction mainly because of its size (Goldman, 1997). This rich cultural heritage may have contributed to the way people in Tzaneen value certain tree species. Because of this, residents in Tzaneen demonstrated a high appreciation of the cultural and spiritual benefits of specific tree species.

A specimen of *Euclea racemosa* is a very large tree that is well known in Tzaneen and it serves as a site where elderly men gather to hold meetings. Community meetings are held under this tree because it provides very good shade and there is also a common belief that this particular tree serves as a place for people to communicate with their ancestors. By virtue of being the oldest tree, it has become a protected tree and has symbolic links to the past because it is believed that even in the past community leaders used to hold their meeting under this tree. This indicated that people can place different values upon one tree. In this case, residents valued this particular tree for the ecological benefits it provides (shade) as well as historical and spiritual value. One of the respondents described this tree as a "*mini church*" because that is where all the elders gathered most times other than the real church. Another protected tree is *Ficus sycomorus* and the place where this tree is located is considered a heritage site.

The rest of the respondents (40%) valued specific trees in their community for ecological benefits especially residents from the informal and RDP residential settlements who planted and preserved trees to act as windbreaks and provide shade at the same time. Other residents valued trees for utilitarian purposes, and tree products such as medicines, firewood and food are utilised. Trees such as *Gardenia volkensii* and *Combretum imberbe* are valued because they provide residents with roots, leaves and bark for medicinal use. *Combretum zeyheri* is a common tree among the locals because it is known to provide very good firewood. And also the Mopani tree (*Colophospermum mopane)* is widely valued for its Mopani worms which are consumed by a majority of people in Tzaneen (Box 4.7).

Box 4.7: Quote showing the value of Mopani trees to a local woman

"*I don't how life would have been for us without this tree (Mopani tree). There was a time when I was not working and money from grants wasn't enough. As a single mother, I struggle to raise my kids. So I decided to harvest Mopani worms which I then later preserved with salt. I kept some and then sold the surplus, you will not believe that I made R500 from just two bags. I thank God for these trees*".

Source: 32 year old female (Tzaneen, 2011).

The Mango tree is also popular in Tzaneen and is especially used for its shade, fruits and the roots are used as medicine for diarrhoea. The majority of residents in Tzaneen recognised the social and psychological benefits of trees; however residents did not attach psychological or social values to specific trees. As for Tzaneen, this was because, benefits of trees such as recreation and social interaction can be provided by just about any tree. Table 4.7 above shows the specific tree species and the importance, beliefs and uses.

4.4. CONCLUSION

The overall findings in this chapter indicate that a high proportion of residents had insights on the various intangible benefits of trees. Comparisons between the two study towns revealed that residents in Tzaneen had more knowledge of the intangible benefits of trees than Bela-Bela. This was attributed to the fact that the Municipality in Tzaneen had a number of greening programmes that ensured residents were constantly reminded about the importance and value of trees in the urban environment. Also it is much easier to grow trees in Tzaneen because of higher rainfall that is received compared to Bela-Bela which is arid and as such the entire town is more treed.

A study done by Lorenzo *et al*., (2000), suggested that, to build public support for urban forestry programmes, it is very critical to first determine the public's knowledge and perceptions of urban trees and forests and the importance that they attach to them. It is therefore, strongly recommended that municipalities undertake surveys of knowledge, appreciation and the value attached to urban trees, similar to this study, before they begin to plan and implement new urban greening programmes. This will give them insight into what trees to plant, where and what educational programmes might be needed, and how to engender the support of residents for urban greening programmes.

The importance and value of specific trees was grounded in some very deep feelings and ties that have

spiritual and cultural connections. The cultural and spiritual ties manifest themselves in strong support for the preservation of existing specific tree species by urban residents. Municipalities in both towns can then use this information to select tree species that have cultural or spiritual value to urban residents. The public will be more likely to render their support and take extra care of those trees and less likely to vandalise or damage the trees because of the value that they attach to them.

CHAPTER FIVE

URBAN RESIDENTS' APPRECIATION OF THE INTANGIBLE BENEFITS OF TREES

5.1. CHAPTER OVERVIEW

This chapter presents and discusses results related to urban residents' appreciation of the intangible benefits of trees and the different factors influencing their appreciation including; their altruistic and pro-environmental values, their perceptions of the services and disservices of trees, and the local environment and settlement type they live in. An economic valuation of urban residents' appreciation of trees was determined through a survey of residents' Willingness to Pay (WTP) for community urban tree preservation. The chapter also aims at testing whether there is any association between WTP and socio-economic variables such as gender, age, income and education.

In order to understand appreciation of the intangible benefits of trees and the different factors influencing it, I investigated and answered the following key questions:

- Do people demonstrate altruistic and pro-environmental values?
- Do people appreciate the intangible benefits of trees?
- Does appreciation of the intangible benefits of trees increase based on peoples' altruistic and pro-environmental values and their levels of concern for the environment?
- Is there an association between the disservices (annoyances) of trees and appreciation of the intangible tree benefits?
- Is there an association between settlement type and appreciation of the intangible tree benefits?
- What is the perceived economic value of urban trees?

5.2. SPECIFIC METHODS AND CALCULATION OF SCORES

Both qualitative data from the in-depth interviews as well as quantitative data from the questionnaire survey were used to answer the above key questions. This section only presents specific methods for the calculation of scores related to pro-environmental and altruistic values and appreciation of the intangible benefits of trees. The general methods are presented in Chapter 3.

To determine residents' pro-environmental and altruistic values, a list of 12 items was prepared (Table 5.2). Respondents were asked to rate each of the 12 items according to the level of agreement

on a scale from 1 (strongly disagree) to 5 (strongly agree). The highest score that individual respondents could get across items was 60 and the lowest score was 0. Respondents that scored between the ranges of 0 to 29 were considered to have weak altruistic and pro-environmental values and therefore low levels of concern about the environment, while those that scored between the ranges of 30 to 44 were considered to have some altruistic and pro-environmental values and concern for the environment, and those that scored between the ranges of 45 to 60 were considered to have strong altruistic and pro-environmental values and therefore to be very concerned about the environment.

Respondents' appreciation of the intangible benefits of trees was determined using a similar approach. A list of nine appreciation items was prepared (Table 5.5). Respondents were asked to rate each of the nine appreciation items according to the level of agreement on a scale from 1 (strongly disagree) to 5 (strongly agree). The highest score that individual respondents could get was 45 and the lowest score was 0. Respondents that scored between the ranges of 0 to 22 were considered to have little appreciation of the intangible benefits of trees, while those that scored between the ranges of 23 to 34 were considered to be appreciative of the intangible benefits of trees and those that scored between the ranges of 35 to 45 were considered to be very appreciative of the intangible benefits of trees.

In terms of calculating mean scores for appreciation and pro-environmental and altruistic values, mean scores were based on a scale from 1 (strongly disagree) to 5 (strongly agree). A high mean score (4 and above) indicated great concern for the environment while a low mean score (2 or below) indicated low concern for the environment and a mean score of 3 indicated that respondents were neutral. Similarly, a high mean score (4 and above) for appreciation indicated that respondents were very appreciative while a low mean score (2 or below) indicated low appreciation of the intangible tree benefits and a mean score of 3 indicated that respondents were neutral.

The relationship between WTP and basic socio-economic variables such as gender, income, age, education and settlement type were tested using Spearman rank order correlations.

5.3. RESULTS AND DISCUSSION

5.3.1. Urban residents' pro-environment and altruistic values

The majority of residents in both Bela-Bela (83%) and Tzaneen (84%) obtained high scores for pro-environmental concern (Table 5.1) with the difference in the levels of pro-environmental concern between the two study towns not being statistically significant ($\chi^2 = 0.096$, df = 1 and $p = 0.757$).

Table 5.1: Environmental concern among respondents in the two study towns and chi-square results

Towns	Pro-environmental concern (%)			Chi-squared results	
	very concerned	concerned	less concerned	χ^2 Value	*p* value
Bela-Bela (n=150)	83	16.3	0.7		
Tzaneen (n=150)	84	15.3	0.7	0.096	0.757

In both study towns, residents scored highly on each of the twelve pro-environmental and altruistic items. In Bela-Bela, 8 out of 12 value items (Table 5.2) had a mean score of above 4.3, indicating that residents were in agreement with those value items. In Bela-Bela, the fifth item "people should be treated the same way regardless of race, nationality or gender" scored highly with a mean score of 4.89. On the other hand, the first item "humans have no right to modify their environment in order to suit their needs" had the lowest mean score of 2.41 (Table 5.2). Some residents disagreed strongly with the first value item because they felt that as humans we have the right to use some of our natural resources in order to better our lives. These residents further said that "*it is better to involve yourself in charcoal burning than stealing, after all natural resources are there for humans to use as they please and there is no way I can be suffering all in the name of preserving natural resources*".

Similar results were obtained in Tzaneen, and it was found that most residents agreed with several of the items. Nine out of 12 value items had a mean score of above 3.5 (Table 5.3). However, there is an exception with the twelfth item "development should not happen at the expense of nature" which had a mean score of 1.98. This meant that residents were not in agreement with that particular statement. This was because some residents felt that development was equally important even at the expense of cutting down some trees (Box 5.1).

Box 5.1: Respondents opinions on development and preservation of the natural environment

> "*In as much as trees and other natural resources are important it is wise and necessary to leave room for development. Therefore, if it means clearing trees in order to build a shopping mall, then it should be done for the sake of development. Respondents further went on to say that, if we decided to preserve trees at the expense of development, then we would have been living like bushmen, where most of the land is bush with very little buildings*".

The 12 value items in this chapter are indicative of the two value types that can be described in two dimensions: "openness to change and self-transcendence" (Schwartz, 1994). Self-transcendence and openness to change is expected to influence environmental behaviour and values positively. Several

studies have revealed that people, who give priority to collective or self-transcendence values, are more eager to engage in different forms of altruistic, cooperative, or pro-environmental behaviour than people who give priority to individual or self-enhancement values (Schwartz, 2005; Stern and Dietz, 1994; Karp, 1996; Section 2.5.4). The total mean scores were calculated for each study town and results reveal that Tzaneen had a slightly higher total mean score (50.08) than Bela-Bela (47.47) which was not significant statistically.

Table 5.2: Pro-environmental and altruistic values of respondents in Bela-Bela

Pro-environmental and altruistic items	**Bela-Bela**					
	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean score and Std. error
1. Humans have no right to modify their environment to suit their needs	9%	6%	8%	7%	71%	2.41 ± 0.11
2. Protecting the environment will not threaten jobs for people like me	36%	11%	19%	16%	18%	3.31± 0.13
3. Laws to protect the environment do not limit my choices and freedom	33%	11%	35%	3%	9 %	3.55 ± 0.13
4. Claims that we are changing the climate are not exaggerated	40%	10%	6%	11%	33%	3.38 ± 0.14
5. People should be treated the same way regardless of race or gender	88%	9%	2%	1%	0%	4.89 ± 0.04
6. If people put their efforts together, they can attain peace and a world free of war	84%	16%	0%	0%	0%	4.69 ± 0.03
7. Environmental protection will help people have a better quality of life	78%	22%	0%	1%	0%	4.42 ± 0.03
8. Taking good care of the environment is my responsibility	81%	18%	1%	0%	0%	4.57 ± 0.04
9. Modern development threatens wildlife and natural resources	73%	15%	5%	7%	0%	4.32 ± 0.07
10. Plants and animals have as much right to exist as humans	84%	15%	1%	0%	0%	4.67 ± 0.03
11. As humans, we need to protect certain plant and animal species from extinction	87%	13%	0%	0%	0%	4.73 ± 0.02
12. Development should not happen at the expense of nature	81%	7%	6%	5%	1%	4.51± 0.07
Total mean score						**47.42**

Mean and standard error based on a 95% confidence interval. Mean scores are based on a scale from 1 (strongly disagree) to 5 (strongly agree).

Table 5.3: Pro-environmental and altruistic values of respondents in Tzaneen

Pro-environmental and altruistic items	Tzaneen					
	Strongly agree	Agree	Neutral	Disagree	strongly disagree	Mean score and Std. Error
1. Humans have no right to modify their environment to suit their needs	3%	17%	21%	39%	21%	3.98 ± 0.09
2. Protecting the environment will not threaten jobs for people like me	21%	49%	16%	14%	1%	3.77± 0.08
3. Laws to protect the environment do not limit my choices and freedom	23%	45%	15%	14%	3%	3.73 ± 0.09
4. Claims that we are changing the climate are not exaggerated	27%	32%	21%	14%	6%	3.60 ± 0.10
5. People should be treated the same way regardless of race or gender	98%	2%	0%	0%	0%	4.97 ± 0.01
6. If people put their efforts together, they can attain peace and a world free of war	99%	1%	0%	0%	0%	4.98 ± 0.07
7. Environmental protection will help people have a better quality of life	96%	4%	0%	0%	0%	4.93 ± 0.02
8. Taking good care of the environment is my responsibility	97%	3%	0%	0%	0%	4.95 ± 0.02
9. Modern development threatens wildlife and natural resources	32%	21%	41%	6%	0%	3.56 ± 0.08
10. Plants and animals have as much right to exist as humans	64%	35%	1%	0%	0%	4.77 ± 0.04
11. As humans, we need to protect certain plant and animal species from extinction	70%	29%	1%	0%	0%	4.56 ± 0.04
12. Development should not happen at the expense of nature	0%	3%	7%	32%	58%	1.98 ± 0.06
Total mean score						**50.08**

From the in-depth interviews it was also gathered that the majority of residents in both towns held altruistic and pro-environmental values. In Bela-Bela for example, the informal settlements had a number of foreign nationals from Mozambique and Zimbabwe and they alluded to the fact that "*they have blended in and that they no longer feel like foreigners as they are not treated as such*". This implied that residents in this town were not discriminating against foreigners and that they treat people equally regardless of race or nationality. In Tzaneen, the majority of respondents said that they felt compelled to take care of their environment and this was done either by not littering and making good use of the natural resources such as water. One of the respondents said that "*If I do not take care of my environment, then who will? I will try to reduce the negative impacts on the environment in any*

way I can".

5.3.2. Appreciation of the intangible benefits of trees between towns

In both Tzaneen and Bela-Bela, residents were found to have a high appreciation of the intangible tree benefits with the difference not being statistically significant (χ^2 = 1.763, DF= 1 and p = 0.184).

Table 5.4: Appreciation of the intangible tree benefits in the two study towns and chi-squared results

Towns	Appreciation of the intangible benefits of trees (%)			Chi-square results	
	Very appreciative	Appreciative	Less appreciative	χ^2 value	*P* value
Bela-Bela (n=150)	87	11	2		
Tzaneen (n=150)	92	7	1	1.763	0.184

Results show that urban residents in Bela-Bela overwhelmingly agreed (83%) with the second item "I like to sit under the tree to read a book or just relax and chat with friends" which had the highest mean of 4.85. Whereas, the majority of residents (80%) in Tzaneen agreed strongly with item number nine "I feel trees are an important part of history and heritage in my community" with the highest mean of 4.80. It was not surprising that most residents agreed strongly with this statement, as Tzaneen has a rich cultural heritage involving trees such as baobab (Section 4.3.4). The rest of the appreciation items in both study towns had mean scores of above 4 except for the fifth item "I am willing to pay slightly more for a house that has trees" in Bela-Bela which had a mean score of 3.03. Some residents in Bela-Bela when asked if they were willing to pay slightly more for a house that has trees said that they would rather buy a cheaper house without trees then plant their own choice of trees as they do not want to waste money on a house with trees when they can easily plant on their own.

The total mean scores were calculated for each study town and results revealed that Tzaneen had a higher total mean score (42.3) than Bela-Bela (40.8). This suggests that residents in Tzaneen may be slightly more appreciative of the intangible tree benefits than the residents in Bela-Bela.

Table 5.5: Urban residents' appreciation of the intangible benefits of trees in Bela-Bela

Appreciation items	Bela-Bela					
	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean scores and Std. Error
1. Parks are great places to bond /relax with family and friends	63%	31%	4%	1%	0%	4.57± 0.07
2. I like to sit under the tree to read a book or just relax and chat with friends	83%	4%	10%	2 %	1%	4.85± 0.05
3. A visit to the park after a stressful day makes me feel better and calm	62%	24%	9%	3%	2%	4.42 ± 0.07

Appreciation items	Bela-Bela					
	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean scores and Std. Error
4. Trees add colour to our environment and make it look beautiful	63%	31%	4%	1%	0%	4.63 ± 0.04
5. I am willing to pay slightly more for a house that has trees	20%	32%	1%	40%	7%	3.03± 0.09
6. Given global warming issues, trees are even more important now than ever	51%	41%	5%	2%	1%	4.41 ± 0.06
7. I feel trees are an important part of my culture	55%	41%	3%	1%	0%	4.47 ± 0.06
8. The beauty of nature and trees is a gift from our creator	58%	39%	3%	0%	0%	4.55± 0.05
9. I feel trees are an important part of history and heritage in my community	58%	40%	2%	0%	0%	4.55 ± 0.05
Total mean score						**40.8**

Table 5.6: Urban residents' appreciation of the intangible benefits of trees in Tzaneen

Appreciation items	Tzaneen					
	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean scores and Std. Error
1.Parks are great places to bond /relax with family and friends	65%	19%	6%	9%	1%	4.40 ± 0.08
2. I like to sit under the tree to read a book or just relax and chat with friends	83%	13%	3%	1%	0%	4.78 ± 0.04
3. A visit to the park after a stressful day makes me feel better and calm	66%	27%	6%	1%	0%	4.57 ± 0.06
4. Trees add colour to our environment and make it look beautiful	76%	22%	2%	0%	0%	4.74 ± 0.04
5. I am willing to pay slightly more for a house that has trees	78%	19%	1%	1%	1%	4.75 ± 0.05
6. Given global warming issues, trees are even more important	76%	22%	2%	0%	0%	4.75± 0.04
7. I feel trees are an important part of my culture	72%	26%	2%	0%	0%	4.69± 0.04
8. The beauty of nature and trees is a gift from our creator	72%	26%	2%	0%	0%	4.70 ± 0.04
9. I feel trees are an important part of history and heritage in my community	80%	18%	2%	0%	0%	4.80 ± 0.03
Total mean score						**42.3**

Appreciation of the intangible benefits of trees among different settlements

Results based on the appreciation items revealed that there was no difference in appreciation of the intangible of trees (Appendix C for cross tabulation tables and mean scores) among the different settlement types. Residents in RDP settlements were as appreciative of the intangible benefits of trees as the residents in informal and formal townships with regards to the appreciation items (Table 5.5 and 5.6). However, results based on the different factors influencing appreciation of the intangible benefits of trees show that there are differences in appreciation of the intangible benefits in the different settlement types.

5.3.3. Factors affecting appreciation of the intangible benefits of trees

Appreciation or lack thereof of the intangible benefits of trees is influenced by a number of factors including; settlement type, crime and pro-environmental and altruistic values. These factors affect the importance and value placed on different urban trees by residents.

Perceived association between urban trees and crime

A high proportion of respondents (55% and 62%) ranked the issue that "trees attract criminals and provide places for them to hide" as one of the main reasons for not visiting public parks within their neighbourhoods in both Bela-Bela and Tzaneen, respectively (Table 5.7), while a few respondents in both towns also said that "they do not visit the public parks in their neighbourhood because "parks are for kids".

Past studies to establish the relationship between urban trees and crime have yielded conflicting results. Some studies indicate that urban trees can lead to increased crime levels while other studies show that urban trees can reduce the incidences of crime (Kuo and Sullivan, 2001). However, this particular study revealed that urban trees in both study towns increased the fear of crime among some residents. Findings in both study towns also implied that fear of crime related to urban street trees and public parks as well as the uncontrolled use of public parks influenced appreciation of the social benefits of trees. Furthermore, residents felt that public parks within their neighbourhood were no longer safe places to 'hang out' because they were being used by dangerous young men to transact drug deals. Residents in Bela-Bela also said that young boys would play loud music and drink alcohol at the park and inconvenience other users, and as a result they have resorted to staying away from public parks.

Due to the increased incidences of crime, residents in Bela-Bela and Tzaneen said that they did not

allow their children to play outdoors or visit parks within their neighbourhoods because they feared for the safety of their children. The majority of respondents in both towns felt that urban trees including street trees attract criminals and as such they did not feel safe being outdoors in very treed environments. The perception that urban trees attract criminals, coupled with the uncontrolled use of public parks, had resulted in negative attitudes towards public parks and urban trees among some urban residents in both towns. The study also found that the majority of urban residents in both Bela-Bela and Tzaneen who felt unsafe in urban neighbourhoods that were densely populated with trees were female (Table 5.7). These results are similar to Koskela and Pain's (2000) findings. According to their study, trees in neighbourhoods and parks were sometimes perceived as unpleasant and unsafe by some people especially women. The study also found that children were fearful of being outdoors in very treed environments particularly during the night time.

Table 5.7: Reasons why urban residents did not visit public parks in Bela-Bela and Tzaneen

Reasons for not visiting public parks	**Bela-Bela**		**Tzaneen**	
	Female	Male	Female	Male
Do not have a park	10%	8%	8%	6%
Parks are for kids	0%	3%	1%	2%
Parks attract criminals	40%	15%	38%	24%
Because I am disabled	1%	0%	0%	0%
Do not have time	0%	4%	0%	3%
Not applicable (residents that visited the park)	9%	7%	10%	8%

Furthermore, results revealed that the majority of urban residents in Bela-Bela and Tzaneen who felt that trees attract criminal behaviour and provide places for them to hide also disagreed strongly with the statement that "parks are great places to bond and relax with family and friends" and vice versa (Table 5.8). For instance, 88% and 83% of respondents in Bela-Bela and Tzaneen, who had agreed strongly with this statement "parks are great places to bond and relax", also felt that urban trees' attracting criminal behaviour was not an important factor that can hinder them from going to public parks (Table 5.8). Similarly, the majority of urban residents in both towns who agreed strongly with the statement that "I feel the need to be outdoors more often, if there are trees in my environment" also said that urban trees attracting criminal behaviour was not an important factor that can prevent them from being outdoors (Table 5.9). On the other hand, residents who believed that urban trees promote criminal behaviour, did not like being outdoors as often. This therefore indicated that, safety

and crime issues related to urban trees does affect appreciation (social benefits) of trees in urban areas for some residents.

Table 5.8: Cross tabulation of the proportion of respondents in both towns who agreed and disagreed with the statement that 'parks are great places to bond and relax' versus the level of concern regarding urban trees attracting criminal behaviour

Parks are great places to bond and relax		**Urban trees attract criminals and provide places for them to hide**		
		Not important	Somewhat important	Very important
Bela-Bela	Strongly agree	88%	6%	6%
	Agree	89%	11%	0%
	Neutral	0%	71%	29%
	Disagree	0%	68%	32%
	Strongly disagree	0%	29%	71%
Tzaneen	Strongly agree	83%	2%	15%
	Agree	88%	12%	0%
	Neutral	0%	86%	14%
	Disagree	8%	42%	50%
	Strongly disagree	0%	5%	95%

Table 5.9: Cross tabulation of the proportion of respondents in both towns who agreed and disagreed with the statement that 'I feel the need to be outdoors more often, if there are trees within my neighbourhood' versus the level of concern regarding urban trees attracting criminal behaviour

I feel the need to be outdoors more often, if there are trees within my neighbourhood		**Urban trees attract criminals and provide places for them to hide**		
		Not important	Somewhat important	Very important
Bela-Bela	Strongly agree	100%	0%	0%
	Agree	95%	0%	5%
	Neutral	60%	40%	0%
	Disagree	0%	76%	24%
	Strongly disagree	0%	26%	74%
Tzaneen	Strongly agree	85%	2%	13 %
	Agree	91%	9%	0%
	Neutral	67%	33%	0%
	Disagree	0%	42%	58%
	Strongly disagree	0%	1%	86%

Information drawn from the in-depth interviews also strongly indicated that urban residents' perceptions about street trees and public parks being unsafe influenced their appreciation of the social

benefits provided by trees. During the in-depth interview respondents were asked "how often do your children play outdoors or go to public parks so as to interact with nature?" More than three quarters (80%) of the respondents in Bela-Bela said that they did not allow their children to play outdoors or even go to public parks within their neighbourhood because they feared their children would be kidnapped. Box 5.2 is a quote by a 49 year old woman and a mother of four children. This quote clearly indicates that urban residents' perceptions of the association between crime and urban trees influences their decisions as to whether they allow their children to play outdoors (public parks inclusive).

Box 5.2: Quote indicating the links between fear of crime and outdoor activities

"*My neighbour was coming from work one fateful evening and just when she bypassed a nearby park, a huge man just came from out of nowhere and lurched at her and grabbed her handbag and cell phone. She was so traumatised and she strongly suspects this thief was hiding behind one of the trees. Since then I make sure my children stay indoors as we stay nearby the parks and then again this neighbourhood has too many street trees which makes it easier for thieves to hide. Also there are too many incidences of kidnapping within our neighbourhood such that I would rather have my children play indoors watching T.V and playing video games than to risk anything happening to them all in the name of interacting with nature".*

Source: 49 year old woman (Bela-Bela 2011).

Similarly, the majority of residents (90%) in Tzaneen did not allow their children to play outdoors for fear of being kidnapped. Most residents expressed similar views to those in the following quote, "*times have changed and that it is no longer safe to allow children to play outdoors freely or visit the park, especially in very treed neighbourhoods"*. But at the same time residents appreciated the importance of encouraging children to have some interaction with nature, although most residents said they would rather deprive their kids from having any interaction with nature if that is what it took to protect them. A 53 year old woman in Tzaneen said "*I never allow my grandchildren to play outside the yard or even the nearby park because of the increased incidences of missing children, so it is better to be safe than sorry*".

Residents in both study towns who were less concerned about crime issues related to urban trees said that they allow their children to visit the public parks once in a while but always under supervision. But they said most of the time, they would only allow their children to play in the backyard where they climb trees and play all sorts of traditional games.

Settlement type

In order to determine whether respondents acknowledge and enjoy (appreciate) the intangible benefits provided by trees, they were asked practical activity questions such as "when was the last time you sat under a tree just to read a book and enjoy the fresh breeze?" (regulating services - shade) and "how often do you visit the park in your neighbourhood?" (cultural services - recreation). Comparisons were done among the three different settlements in both towns to see if there were any differences or similarities in the responses given to the above two questions and consequently determine if there was any association between settlement types and appreciation of the intangible benefits of trees.

When was the last time you sat under a tree to relax?

A high proportion of respondents in the RDP (54% and 62%) and informal (84% and 78%) settlements said that they had sat under a tree in the few days prior to the interview in both Bela-Bela and Tzaneen (Figures 5.1 and 5.2), while none of the respondents in these two settlements said they had never sat under a tree. On the other hand, the majority of respondents in the formal townships (74% and 66%) in both Bela-Bela and Tzaneen said that they rarely sat under trees (a year ago), and some respondents (16% and 12%) from this township in both Bela-Bela and Tzaneen said they had never sat under a tree. Spearman rank order correlation was run to determine whether there was any association between settlement type and the responses given to the above question. Results revealed that there was a significant association among the different settlements and the responses given in both Bela-Bela ($r = 0.27$ and $p = 0.001$) and Tzaneen ($r = 0.33$ and $p < 0.0001$).

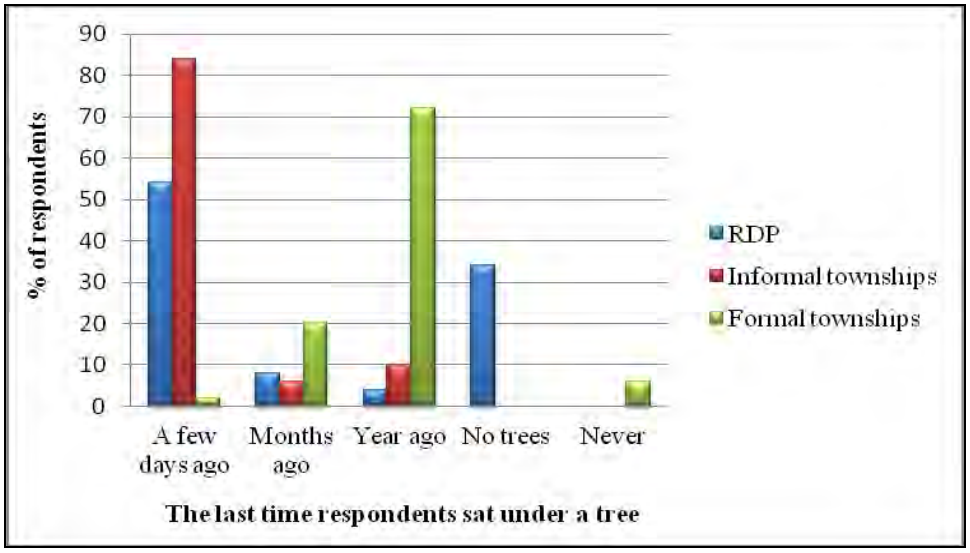


Figure 5.1: Percentage of residents in Bela-Bela that sat under trees

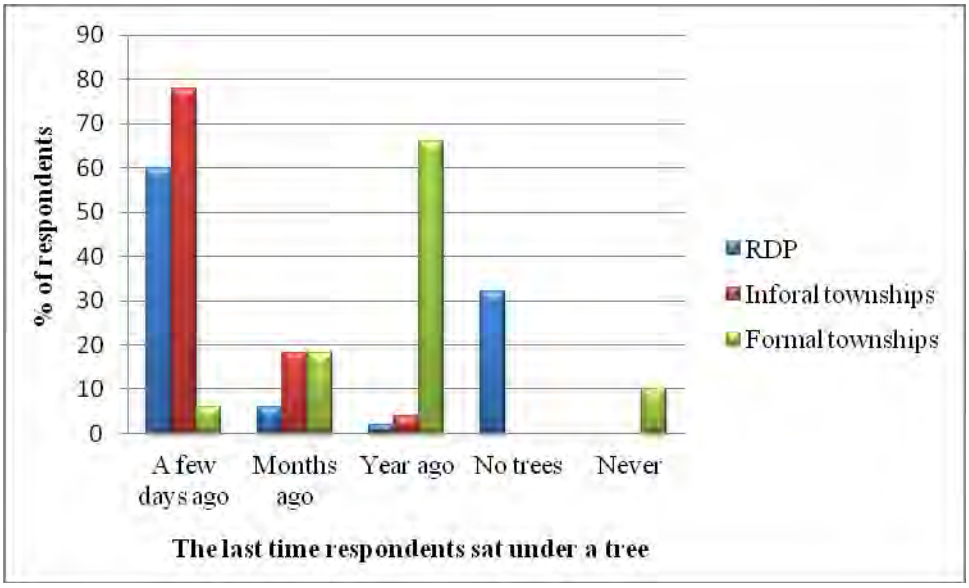


Figure 5.2: Percentage of residents in Tzaneen that sat under trees

From the in-depth interviews, it became clear why most residents in the formal townships (in both towns) did not usually sit under trees to either relax under the shade or read a book. Findings revealed that most residents in the formal townships are well off and live in much bigger houses that are well ventilated thus, they can afford to stay indoors even on a hot summer day. Some formal township residents said that they would rather stay inside their houses and turn on the air conditioner than sit under the tree for shade. Demographics of this study show that, the majority of residents in the formal townships in both study towns belong to the high income category (Figure 5.3) and are also more educated as compared to the residents in the informal and RDP settlements. This confirms that, residents in the formal townships can afford better houses and luxuries like air conditioners. One of the formal township residents was asked why they had never sat under a tree to relax said "*I just never have time. I am always working and when I come back home I relax in my living room watching T.V*". On the other hand, residents of the informal and RDP residential settlements in both study towns placed more value and importance on urban trees because of windbreak and shade attributes. Residents of these two settlements said that they are constantly experiencing strong winds and as a result of this they have come to value trees because they shield them from strong winds. Other reasons that were given for ranking the two benefits of trees as most important included the fact that the kind of houses in the informal settlements forced occupants to sit outside the house or under the trees especially during the hot summer. This is because most houses/shacks are tiny and poorly ventilated and they are made of iron sheets which absorb so much heat during the hot season that occupants are forced to seek solace under the trees around the yard.

Box 5.3: Quote highlighting the importance of shade from trees in the informal township

> "*Sometimes the heat drives me crazy when I am relaxing inside the house, so most of the time I end up spending time outside the house under a tree. I usually nap under the tree and enjoy the fresh breeze. It's also healthier for the kids to play outside where there is fresh air than inside our small house*".
>
> Source: 33 year old female (Bela-Bela, 2011).

Similarly, in the RDP settlement, houses are also tiny and are roofed with iron sheets. There are also very few trees around the yard and no street trees. This poses to be a big challenge to the residents who have to deal with strong winds and the scorching heat because of the absence of trees to provide shade and act as windbreaks. These experiences have taught residents from both RDP and informal residential settlements to value shade and windbreak (ecological benefits) as important attributes of urban trees.

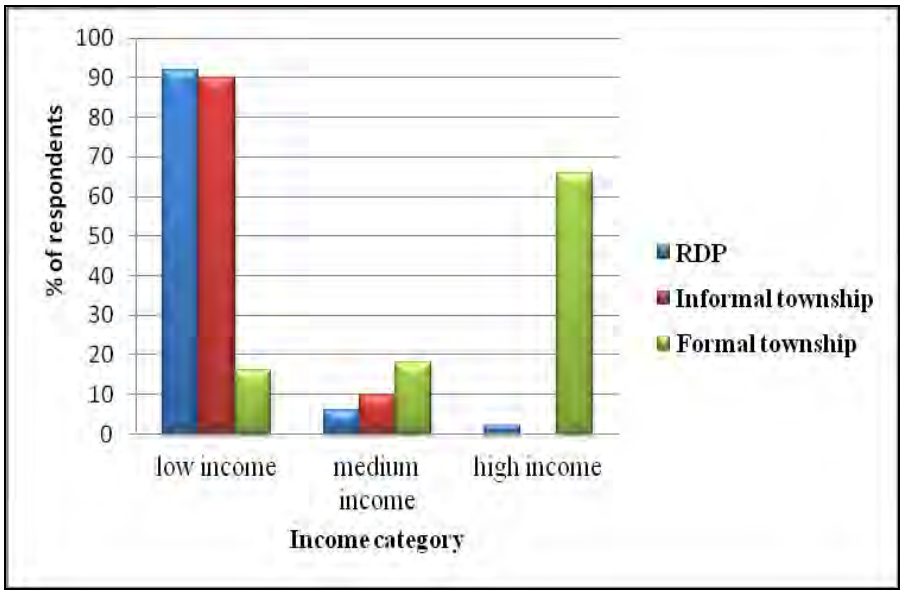


Figure 5.3: Income classes for the different settlements in both study towns

How often do you visit the park within your neighbourhood?

All the respondents in the RDP settlements in Bela-Bela and Tzaneen said they had never been to the park because they do not have a public park within their neighbourhood. Sixty six percent of the respondents in the informal settlements in Bela-Bela said they had never been to the park because of

the long distance to the park and the only way to get there was by car (Table 5.10). In Tzaneen, 96% of the respondents in the informal settlements also said they had never been to the park giving the same reason that the park is located very far from where they live. On the contrary, the majority of respondents in the formal townships in both Bela-Bela and Tzaneen said they regularly went to the parks within their neighbourhoods. Eighteen percent of the respondents from the formal townships in Bela-Bela said they went to the park once a week, while 32% of the respondents from the formal townships in Tzaneen said they went to the park weekly (Table 5.9). These results on frequency of visits to parks by formal township residents appear to contradict the results in section 5.3.3 on the perceived association between urban trees and crime. The findings in this section reported that residents in both study towns did not visit public parks because of the perception that urban trees promote crime. The different settlement types were found to influence activities linked to trees and green spaces such as going for picnics, dog walking, etc. Settlement type also influenced the number of visits to the park and consequently appreciation of the benefits they provide. The results of this study show that the travel distance to the park affected the frequency of visits. For instance, residents of the informal residential settlements in both study towns had to travel long distances to get to the public parks, whereas residents of the older townships have easy access to public parks as they are situated within their neighbourhoods.

Box 5.4: Quote revealing how absence of public parks influences appreciation of trees and nature

> "*I have never been to a park my whole life, neither have my children I feel parks are for well to do people and not for us poor people who live in shacks. If the government wanted us to benefit from these parks, they would have provided us with one. So now, we poor people have found our ways to relax. We meet at 'shebeens' (beer halls) where we catch up on stories, drink beer, dance and we have all sorts of fun. This is how our way of having fun and passing time*".
>
> Source: 44 year old female (Tzaneen, 2011).

RDP residents equally found it impossible to visit parks and enjoy the benefits because of the long distance to the park. Similar studies to establish the link between accessibility to public parks and urban green spaces and participation in outdoor recreation activities revealed that people who live in residential areas that have sufficient green spaces which are in close proximity to their homes tend to visit public green spaces more often (Neuvonen *et al*., 2006).

Another reason why residents from RDP and informal settlements found it difficult to visit public parks regularly, apart from the long distances to the park, was low income and poverty. Residents of

these two settlements said they have primary concerns such as paying bills, school fees and buying food which are of priority rather than spending money on for taxi or other means of transport to get them to parks for recreation purposes. Similar results were found by Getz *et al*. (1986), who conducted a study to explore the links between income deprivation and unequal access to public parks. Their findings show that the most deprived population had the poorest access to parks.

Table 5.10: Frequency of visits to the park in the different settlements in both study towns

Settlement type		How often do you visit the public park within your neighbourhood?			
		Weekly	Monthly	Once per year	Never
Bela-Bela	RDP	0%	0%	0%	100%
	Informal townships	0%	0%	34%	66%
	Formal townships	18%	32%	20%	30%
Tzaneen	RDP	0%	0%	0%	100%
	Informal townships	0%	0%	4%	96%
	Formal townships	32%	20%	38%	10%

Residents' value systems

The majority of respondents in Bela-Bela (85%) and Tzaneen (88%) that had altruistic and pro-environmental values were also found to have a higher appreciation of the intangible benefits of trees (Section 5.3.1). The results also revealed that respondents who lacked altruistic and pro-environmental values tended not to appreciate the intangible tree benefits in both towns (Table 5.12). Results show that there is a significant positive correlation between residents' score for pro-environmental and altruistic values and their score for appreciation of the intangible tree benefits in both Bela-Bela ($r = 0.63$ and $p < 0.0001$) and Tzaneen ($r = 0.69$ and $p < 0.0001$) (Table 5.11).

Table 5.11: Respondents' altruistic and pro-environmental values (environmental concern) cross-tabulated with appreciation of the intangible benefits of trees in each study town

Appreciation of the intangible tree benefits		Pro-environmental and altruistic values			Totals
		Very concerned	Concerned	Less concerned	
Bela-Bela	Very appreciative	85%	15%	0%	100%
	Appreciative	69%	31%	0%	100%
	Less appreciative	0%	6%	94%	100%
Tzaneen	Very appreciative	88%	12%	0%	100%
	Appreciative	45%	55%	0%	100%
	Less appreciative	0%	0%	100%	100%

Table 5.12: Spearman's correlation results of the relationship between environmental concern and appreciation of the intangible benefits of trees in both study towns

Study towns	Spearman's correlation		Correlation Results
Bela-Bela	**Appreciation of trees Vs Pro-environmental & altruistic values**	Correlation Coefficient	0.63
		Sig. (2-tailed)	0.0001
		N	150
Tzaneen	**Appreciation of trees Vs Pro-environmental & altruistic values**	Correlation Coefficient	0.69
		Sig. (2-tailed)	0.0001
		N	150

Information drawn from the in-depth interviews also revealed that people's value systems influenced their appreciation of the intangible benefits of trees. Residents who had a strong connection with their tradition and culture also attached great value and importance to trees in their community (Section 4.3.4). Specific trees to them provided a sanctuary where they could communicate with their ancestors and they believed that certain tree species housed spirits of their ancestors. Also, residents who obtained medicines from trees and tree products, such as herbalists, had a higher appreciation of trees and they took extra care of trees (Box 5.5).

Box 5.5: Quote illustrating the importance of trees to specialist groups such as traditional healers

> *As a traditional healer, my life revolves around trees. Without trees my world can fall apart. I relate to trees like no one else, with me, trees have life and they have practically told me what to do and how I should to do it. This happens in dreams, when I am meditating or just as a thought. I get information from trees about my different clients and I can tell them their problems even before they open up to me. This is because my ancestors live in the trees; it's not that trees can talk. My work is not a hobby, it's a gift. I inherited this gift from my great grandmother who inherited the same gift from her great grandmother. Some of the trees you are seeing on my homestead are not ordinary trees; they house spirits of my ancestors who direct me on which tree to get medicine from and for whom. Trees to me are basically my life".*
>
> Source: 38 year old woman (Bela-Bela, 2011).

Findings also revealed that a person's upbringing can have a huge influence on what and how they value certain things in life. For instance, one of the respondents in Bela-Bela narrated the story below about his childhood and how his childhood has impacted how he values certain things today (Box 5.6).

Box 5.6: Quote indicating how one's upbringing influences appreciation of trees

"*I was brought up by a single mother. My mom loved her plants very dearly and she would always make us water them. We also had several trees and a garden, so I was always watering plants and weeding that is pretty much I can remember about my childhood. As I grew up I found myself wanting to be around trees and plants. I did not manage to go to college, so I got a job as a caretaker at a certain school. My job was to clean the school surroundings and take care of plants. The school decided to get trees on Arbor day in order to make it greener and more attractive. As time went by, the trees started drying up one by one and I couldn't stand this. So I decided to take the trees home where I could give them the care they needed. It broke my heart to see the trees in that condition, I had to do something. Now the trees are big and healthy and as you can see I am a happy man. I don't necessarily think I stole those trees because they could have died anyway, so I just saved them".*

Source: 38 year old male (Bela-Bela, 2011).

5.3.4. Urban residents' Willingness to Pay (WTP) for trees and urban green spaces

In Bela-Bela, there were more residents (86%) that were WTP for maintenance of trees and green spaces in their neighbourhood than in Tzaneen (53%). However, a higher proportion of residents in Tzaneen were WTP larger amounts of money (R50 and above) as compared to the residents in Bela-Bela that were only WTP amounts between the ranges of R1 to R9 per month (Table 5.12). The main reason why most residents (78%) were WTP in Bela-Bela was "to make sure there is an adequate supply of green spaces and trees for recreation and social activities within their community" (Table 5.13). While, the reason why most residents in Tzaneen (76%) were WTP was "it is for the interest of other residents in my community". On the other hand, the major reason why some of residents (69%) were not WTP in Bela-Bela was because they felt it is the job of the municipalities to ensure continuity and improvement of all greening activities and programmes within their community, not citizens (Table 5.14). Whereas, the main reason why some of the residents in Tzaneen were not WTP was "they could not afford to contribute any amount".

Table 5.13: Amounts the respondents in Bela-Bela and Tzaneen were WTP and the Proportion of respondents that were not WTP

Towns	**Amount in Rands**					
	Not WTP	R1 to R9	R10 to R20	R21 to R30	R50 and above	**Totals**
Bela-Bela	14%	60%	19%	7%	0%	100%
Tzaneen	47%	4%	7%	17%	25%	100%

Table 5.14: Reasons why urban residents were willing to pay to sustain greening activities in their community

Why are you willing to pay this amount?	**Bela-Bela**	**Tzaneen**
It is for the interest of the other residents in my community	5%	76%
To make sure there is adequate supply of green spaces and trees for recreation and social activities	78%	4%
To make sure there is adequate green spaces to beautify the living environment	10%	15%
It is my responsibility and it is also the right thing to do	7%	3%
Trees exist on their own rights and are worth preserving	0%	2%
Totals	100%	100%

Table 5.15: Reasons why urban residents were not willing to pay to sustain greening activities in their community

Reasons why urban residents were not Willing To Pay	**Bela-Bela**	**Tzaneen**
Nature should not be measured in terms of money	3%	30%
50% of reduction of green spaces is acceptable	5%	0%
I cannot afford	21%	60%
Urban development is more important than greening	2%	5%
This is the job of the government and municipalities, not citizens	69%	5%

5.3.5. Association of socio-economic factors with WTP

In this particular study, it was hypothesised that WTP is influenced by various socio-economic factors including; age, gender, income and level of education. The subsequent section established how the different socio-economic factors influence WTP.

Gender

Results reveal that, there were slightly more female respondents (86%) than males (85%) that were WTP in Bela-Bela. Conversely, Tzaneen had slightly more male respondents (55%) than females (53%) that were WTP. However, these differences were not statistically significant in both Tzaneen ($\chi^2 = 3.058$, df = 4 and $p < 0.548$) and Bela-Bela ($\chi^2 = 1.671$, df = 4 and $p < 0.796$). Therefore, this means that gender has no influence on WTP. Nevertheless, the amounts of money that residents were WTP varied according to gender. In both study towns, male respondents were willing to contribute larger amounts of money (R50 and above) while female respondents were willing to contribute smaller amounts of money (R1 to R9) per month (Table 5.16).

Table 5.16: Showing the different amounts that male and female respondents were WTP and the proportion of male and female respondents that were not WTP

Amounts in Rands	**Bela-Bela**		**Tzaneen**	
	Female	Male	Female	Male
Not WTP	14%	15%	47%	45%
R1 to R9	77%	71%	33%	19%
R10 to R20	16%	22%	51%	59%
R21 to R30	4%	1%	7%	6%
R50 and above	3%	6%	9%	16%

Age

Spearman rank order correlations revealed that there was a positive significant relationship between WTP and age of the respondents in both Bela-Bela and Tzaneen ($r = -0.57$, $p < 0.0001$) ($r = -0.61$, $p < 0.0001$), respectively. The relationship between WTP and age of the respondents was negative because, instead of WTP increasing with age of respondents, it was decreasing. In both study towns, there were a higher proportion of younger respondents willing to make monetary contributions towards the greening activities in their community than older respondents. In Bela-Bela and Tzaneen, the majority (81% and 80%) of younger respondents (ages between 20 and 35) were willing to contribute towards greening activities in their community, respectively. Furthermore, the younger respondents were also willing to pay larger amounts of money ranging from R21 to R30 and R50 and above while older respondents were either not WTP or they were only willing to contribute amounts ranging from R1 to R9 (Table 5.17). The reason being, "they could not afford to contribute any amount" (Table 5.18). The majority of older residents belonged to the low income class and as such

they depended on government pensions as their only source of income. These findings are consistent with Treiman and Gartner's (2005) study on "what do people want from their community forest". The study found that younger respondents (ages between 20 and 35) were more likely to vote for the "hypothetical tree fund", with those over the age of 65 the least likely. According to this study, the reason why younger respondents were more likely to support and contribute towards the hypothetical tree fund was because of the long term nature of forestry. Younger voters may be more likely to see the results of their votes as compared to older respondents.

Table 5.17: WTP among different age groups

	Bela-Bela			**Tzaneen**		
Amounts in Rands	Youths	Middle age	Old age	Youths	Middle age	Old age
Not WTP	19%	29%	65%	20%	46%	37%
R1 to R9	3%	2%	49%	6%	3%	72%
R10 to R20	10%	75%	36%	20%	68%	18%
R21 to R30	64%	13%	10%	54%	4%	9%
R50 and above	23%	10%	5%	20%	25%	1%
Totals	100%	100%	100%	100%	100%	100%

Table 5.18: Reasons why respondents of different age groups are not willing to pay

Why are you willing to pay this amount?	**Bela-Bela**			**Tzaneen**		
	Youths	Middle aged	Old age	Youths	Middle aged	Old age
Nature should not be measured in terms of money	0%	3%	7%	9%	0%	10%
50% of reduction of green spaces is acceptable	10%	5%	1%	3%	5%	0%
I cannot afford	10%	30%	90%	15%	40%	85%
Urban development is more important than greening	5%	2%	0%	5%	10%	0%
This is the job of the government and municipalities, not citizens	75%	60%	2%	68%	45%	5%

Income

Results revealed that there were slightly more respondents (15%) within the low income class that were WTP as compared to the medium income class (6%) in Bela-Bela. Similarly, there were more respondents in Tzaneen from the low income (53%) class that were not WTP as compared to the medium income (36%). Whereas, there were no respondents within a higher income class that were

not WTP in both study towns (Table 5.19). The majority of respondents within the low income class were WTP smaller amounts of money ranging between R1 and R9 in both Bela-Bela (73%) and Tzaneen (71%). On the other hand, a high proportion of respondents within the high income category were WTP larger amounts of money of R50 and above in both towns.

Studies have shown that people can volunteer their time and labour in cases where they cannot afford to make monetary contributions (Tyrväinen, 2001; Treiman and Gartner, 2005). However, this study did not look at other forms of contribution except monetary and had that been done, results may have shown that some of the respondents may have been willing to contribute in the form of labour.

Table 5.19: WTP by residents within the different income classes

Amounts in Rands	Bela-Bela			Tzaneen		
	Low income	Medium income	High income	Low income	Medium income	High income
Not WTP	15%	6%	0%	53%	36%	0%
R1 to R9	73%	21%	0%	71%	11%	0%
R10 to R20	23%	51%	0%	21%	67%	20%
R21 to R30	3%	14%	33%	8%	17%	35%
R50 and above	1%	14%	67%	0%	5%	45%

Spearman rank order correlations revealed that there was a significant relationship between income and WTP in both Bela-Bela ($r = 0.55$, $p < 0.0001$) and Tzaneen ($r = 0.68$, $p < 0.0001$). These results may reflect some similarities to Dickerson *et al.*'s (2001) findings from Illinois, that communities with higher income and education levels (such as suburban communities) were more likely to support urban forestry programmes.

Level of education

A high proportion of respondents in Bela-Bela (62%) and Tzaneen (54%) with no formal education were not WTP any amount. While all of the respondents in both Bela-Bela and Tzaneen that had higher learning qualifications were WTP (Table 5.20). Most respondents in both study towns who had no formal education were willing to pay lesser amounts of money compared to the respondents who had tertiary qualifications. Spearman's rank order correlations reveal that there was a significant association between the amounts respondents were WTP and their level of education in Bela-Bela ($r = 0.543$, $p < 0.0001$) and Tzaneen ($r = 0.583$, $p < 0.0001$).

Table 5.20: WTP among respondents with different levels of education

Level of education		WTP- Amounts in Rands				
		Not WTP	R1 to R9	R10 to R20	R21 to R30	R50 and above
Bela-Bela	No formal education	62%	33%	5%	0%	0%
	Primary education	17%	38%	24%	19%	2%
	Secondary education	8%	26%	49%	13%	4%
	Higher learning education	0%	0%	10%	30%	60%
Tzaneen	No formal education	54%	27%	15%	4%	0%
	Primary education	37%	13%	50%	0%	0%
	Secondary education	11%	33%	36%	14%	6%
	Higher learning education	0%	4%	20%	28%	48%

Table 5.21: Spearman's correlation results of the relationship between level of education and WTP

Study towns	Spearman's correlation		Correlation Results
Bela-Bela	**Level of education Vs WTP**	Correlation Coefficient	0.543
		Sig. (2-tailed)	0
		N	150
Tzaneen	**Level of education Vs WTP**	Correlation Coefficient	0.583
		Sig. (2-tailed)	0
		N	150

5.4. CONCLUSION

According to the findings in this chapter, residents in both study towns held pro-environmental and altruistic values and they also had a high appreciation for trees and the intangible benefits of trees. Appreciation was found to be influenced by a number of factors including settlement type, level of safety in public parks and altruistic and pro-environmental values. Altruistic and pro-environmental values turned out to influence appreciation positively. Meanwhile, the issue of crime related to urban trees had a negative influence on appreciation of urban trees as well as utilisation of public parks. Most of the residents who felt insecure about being outdoors in very treed neighbourhoods also had little appreciation of urban trees and specifically the social benefits of trees. Settlement type on the other hand, influences appreciation in many ways. Formal township residents had a high appreciation of the social benefits of trees such as recreation and the aesthetic values, because of ease of access (short distances to the park), and yet they had little appreciation of regulating services such as shade and windbreaks. The inverse applied in informal and RDP settlements, where residents had high

appreciation of the regulating services of trees.

The majority of residents in both study towns were hypothetically willing to contribute money in order to sustain greening activities and programmes within their neighbourhood. However, the amounts of money that residents were willing to contribute varied according to income, level of education and age. Based on the findings from the WTP survey, the overall profile of individuals who are likely to support urban greening programmes in both towns includes both male and females, between the ages of 20 and 35, income of at least R5 000 per month, with college education and having a high appreciation of the benefits of urban trees. In contrast, the profile of individuals unlikely to support urban greening programmes is a male or female, 55 years or older, income less than R4 000 per month, limited education (primary or high school), and little appreciation of the benefits of urban trees.

CHAPTER SIX

PLANTING AND RETENTION OF TREES IN URBAN SYSTEMS

6.1. CHAPTER OVERVIEW

This chapter focuses on issues related to the planting and retention of trees in urban private spaces. It presents results on the number of trees that have been planted and retained from the time of occupation by residents and the reasons why residents planted and retained those trees as well as the factors influencing their decisions.

This chapter also aims to verify the hypothesis that tenure security and residency time positively influence urban residents' decisions to plant and preserve trees. It also considers whether there is any association between perceptions of the disservices of trees and the decisions made to plant, preserve or cut down trees.

To understand the motivations behind residents' planting and retention of trees and the number of trees on their homesteads the following key questions were asked:

- How many trees have been planted and retained from the time of occupation?
- What are the main reasons (in terms of the intangible tree benefits) influencing urban residents' decisions to plant and preserve trees?
- Do the disservices of trees affect urban residents' decision to plant, remove or retain trees?
- Is there an association between planting/retention of urban trees and particular biophysical, practical, social and institutional factors?
- Does residency time influence planting and retention of urban trees?

6.2. SPECIFIC METHODS AND RANKING OF REASONS FOR PLANTING AND RETAINING TREES

To answer the above key questions, data collected from both the questionnaire survey and in-depth interviews were used. The broad methods are presented in Chapter 3. This section presents specific methods on how the reasons for planting trees were ranked based on their mean scores.

The reasons for planting trees were ranked because there was a need to distinguish between the benefits (tangible and intangible) that residents ranked highly as reasons to plant/retain trees and those which were ranked very low. Respondents were asked to rate 12 reasons for planting trees (Table 6.2,

6.3 and 6.4) according to the level of importance of each one of them on a scale from 1 (not important) to 4 (very important). A high mean score of 3.5 and above indicated that the particular benefit was an important reason for planting/retaining trees, while a low mean score of 1.8 indicated that the particular benefit was not an important reason to plant/retain trees. The cut offs for the means were adopted from Lorenzo *et al.* (2000).

6.3. RESULTS AND DISCUSSION

6.3.1. Number of trees planted and retained

Overall, across all households, Tzaneen had a higher total number (906) of planted and retained trees since the time of occupation as compared to Bela-Bela (709) (Table 6.1). This may be well explained by relating to the findings and results in chapter four, where residents in Tzaneen were found to be more knowledgeable of the intangible tree benefits. According to a study conducted by Chishaleshale (pers. comm. 2011), Municipality officials said that the residents in Tzaneen have a general understanding of the importance of urban trees whereas most residents in Bela-Bela were less aware of the value and importance of trees in their neighbourhoods.

In both study towns, there were more trees that were planted than retained. In Bela-Bela, there were a total of 402 trees planted and only 107 trees retained, whereas in Tzaneen, there were 829 trees planted and 132 trees retained. Out of 906 trees that were planted and retained in Tzaneen, 531 (55%) were fruit trees, 220 (23%) were cultural and medicinal trees and 155 (22%) were ornamental trees. Similar results were obtained in Bela-Bela, whereby the majority of trees (62%) that were planted and retained were found to be fruit trees, followed by cultural and medicinal trees (26%) and then ornamental trees (12%). According to the residents in Tzaneen and Bela-Bela, fruit, cultural and medicinal trees are multi-purpose compared to ornamental trees and thus they preferred these trees.

As expected, the majority of residents in the formal townships in both Bela-Bela (98%) and Tzaneen (96%) had planted/retained more trees as compared to RDP and informal settlements. Formal townships also had the highest mean number of trees (6.64 and 7.56) per homestead in both Bela-Bela and Tzaneen (Table 6.1). This was mainly due to the fact that most of the formal township residents had tenure security. Other than the issue of tenure security, formal townships may have had more tree per homestead because the areas are older and the plots much bigger compared to RDP and informal settlements. Tenure security can have direct influence on planting and retention of trees on homesteads in urban areas. This finding is similar to the Treiman and Gartner's (2005) results that residents who owned their own home were more likely to plant more trees as compared to residents

who did not own the homes that they lived in. Most residents from the formal township expressed sentiments similar to those in the following quote "*it is encouraging to plant trees knowing the day you will enjoy the benefits especially if you own the house, because that way one is assured that their efforts will not be in vain*". This may explain why most residents in the informal residential settlements were less willing to plant trees as they were not sure on how long they were going to be staying as they did not have security of tenure. RDP houses had the least number of planted/retained trees mainly because they were newly built settlements and also because developers often bulldozed the site, removing all the trees and any form of vegetation in the process. Therefore, there were very few trees as compared to the other two residential settlements. However, the RDP residents were very willing to plant more trees and they also valued and appreciated trees and the intangible benefits of trees. Section 6.3.4 discusses in detail the relationship between security of tenure and the likelihood of planting trees.

Table 6.1: Proportion of respondents that had planted and retained trees

Have you planted any trees from time of occupation?					**Trees planted/Retained**		
Towns	Settlement types	Yes	No	Mean no. of trees ± SE per homestead	Total no. of trees per settlement	Trees retained	Planted + retained
Bela-Bela	RDP	60%	40%	2.44±0.22	122	19	141
	Informal	38%	62%	2.83±0.37	148	11	159
	Formal	98%	2 %	6.64±0.54	332	77	409
Totals					**602**	**107**	**709**
Tzaneen	RDP	68%	32%	3.48±0.30	174	26	200
	Informal	30%	70%	4.44±0.55	222	17	239
	Formal	96%	4%	7.56±0.82	378	89	467
Totals					**774**	**132**	**906**

6.3.2. Reasons for planting and retaining trees

Comparisons between Bela-Bela and Tzaneen revealed that the benefits of trees ranked as very important reasons for preserving/planting trees were providing shade and the provisioning services of food, medicines, fodder and fuelwood, respectively (Table 6.2). The two statements "urban trees provide shade and cool their surrounding environment" and "urban trees provide food and other tree products" had the highest means (3.83 and 3.79) in Bela-Bela and Tzaneen respectively. Respondents considered the ability of trees to enhance community appeal so as to attract new residents as the least important reason to plant/preserve trees in urban areas with the lowest means in both Bela-Bela (1.89)

and Tzaneen (1.73). These results are contrary to Hull's (1992) findings, where urban residents recognised and valued the role urban trees play in improving community image more than the other tree benefits. This may be due to the fact that in westernised countries trees are highly valued for aesthetics, property value improvement and improving the image of the community. Whereas, in African or developing countries, trees are valued more for utilitarian purposes as this can help enhance their livelihood. As such they focus less on aesthetics and other benefits like improving community image.

Residents across all the three different settlements in both study towns consistently ranked the fact that trees provide shade and cool surrounding areas as a very important reason to plant/preserve trees on their homesteads (Table 6.3 and 6.4). While the ability of trees to enhance community appeal to attract new residents was rated as the least important reason to plant/preserve trees by the majority of residents from all the three residential areas in both study towns. Previous studies of how urban residents ranked the different benefits of trees have yielded similar results that people generally attribute great significance to the ecological and functional benefits of trees (Hull, 1992). Also a study conducted by Lohr *et al*. (2004) showed that the highest ranked reason to have trees in cities was their importance in "shading and cooling downtown areas".

The results across the different settlements show that there were no large differences in the mean rankings amongst the various reasons given to plant/preserve trees (except for item 9, 11 and 12). This suggests that people plant/retain trees for multiple benefits that they provide.

Table 6.2: Reasons to plant/preserve trees, ranked by urban residents' level of agreement with each statement

	Bela-Bela		**Tzaneen**		**Total sample**	
Reasons to plant or preserve trees	**Rank**	**mean and std. Error**	**Rank**	**mean and std. Error**	**Rank**	**mean and std. Error**
1. To beautify the urban environment	4	3.48 ± 0.05	3	3.65 ± 0.06	10	2.56 ± 0.03
2. Provide shade and cool the surrounding areas	1	**3.83 ± 0.04**	2	3.74 ± 0.04	1	**3.80 ± 0.03**
3. To provide food, medicines, fodder and fuel wood	2	3.53 ± 0.05	1	**3.79 ± 0.04**	9	2.62 ± 0.03
4. To promote social interactions	3	3.49 ± 0.05	4	3.53 ± 0.04	2	3.50 ± 0.03
5. To be more in contact with nature	8	3.21 ± 0.09	9	3.14 ± 0.08	11	2.39 ± 0.04
6. To improve air quality	9	3.10 ± 0.08	7	3.27 ± 0.08	6	3.18 ± 0.06
7. Trees are part of history, culture and heritage	5	3.47 ± 0.06	5	3.40 ± 0.07	4	3.43 ± 0.05
8. To provide education opportunities	7	3.33 ± 0.05	6	3.37 ± 0.05	3	3.35 ± 0.03
9. Trees absorb storm water runoff	11	2.93 ± 0.09	10	2.71 ± 0.09	7	2.82 ± 0.06

Reasons to plant or preserve trees	Bela-Bela		Tzaneen		Total sample	
	Rank	mean and std. Error	Rank	mean and std. Error	Rank	mean and std. Error
10. To provide food and shelter for its inhabitants	6	3.38 ± 0.06	8	3.19 ± 0.09	5	3.29 ± 0.05
11. To increase property value	10	2.97 ± 0.09	11	2.40 ± 0.09	8	2.69 ± 0.07
12. Enhancing community appeal to attract new residents	12	**1.89 ± 0.09**	12	**1.73 ± 0.08**	12	**1.76 ± 0.06**

Table 6.3: Reasons to plant/preserve trees in the different residential areas in Tzaneen, ranked according to urban residents' level of agreement with each statement

Reasons to plant or preserve trees	Tzaneen					
	RDP		Informal		Formal	
	Rank	mean and std. Error	Rank	mean and std. Error	Rank	mean and std. Error
1. To beautify the urban environment	3	3.60 ± 0.11	3	3.60 ± 0.11	1	**3.88 ± 0.05**
2. Provide shade and cool the surrounding areas	1	**3.80 ± 0.08**	2	3.78 ± 0.06	3	3.79 ± 0.04
3. To provide food, medicines, fodder and fuel wood	2	3.66 ± 0.08	1	**3.92 ± 0.04**	4	3.78 ± 0.06
4. To promote social interactions	4	3.52 ± 0.07	4	3.44 ± 0.09	5	3.64 ± 0.07
5. To be more in contact with nature	9	3.06 ± 0.14	8	**3.07 ± 0.15**	8	3.30 ± 0.14
6. To improve air quality	7	3.17 ± 0.16	5	3.42 ± 0.11	9	3.22 ± 0.16
7. Trees are part of history, culture and heritage	6	3.32 ± 0.13	7	3.08 ± 0.15	2	3.80 ± 0.08
8. To provide education opportunities	5	3.38 ± 0.08	6	3.38 ± 0.09	7	3.36 ± 0.09
9. Trees absorb storm water runoff	10	2.90 ± 0.14	10	2.08 ± 0.15	10	3.16 ± 0.15
10. To provide food and shelter for its inhabitants	8	3.16 ± 0.13	9	2.94 ± 0.13	6	3.48 ± 0.12
11. To increase property value	11	2.52 ± 0.17	12	**1.88 ± 0.15**	11	2.80 ± 0.14
12. Enhancing community appeal to attract new residents	12	**1.74 ± 0.13**	11	1.94 ± .0.09	12	**1.68 ± 0.12**

Table 6.4: Reasons to plant/preserve trees in the different residential areas in Bela-Bela, ranked according to urban residents' level of agreement with each statement

Reasons to plant or preserve trees	Bela-Bela					
	RDP		Informal		Formal	
	rank	mean and std. Error	rank	mean and std. Error	Rank	mean and std. Error
1. To beautify the urban environment	3	3.52 ± 0.09	5	3.54 ± 0.09	5	3.40 ± 0.11
2. Provide shade and cool the surrounding areas	1	**3.76 ± 0.07**	1	**3.94 ± 0.03**	2	3.56 ± 0.09
3. To provide food, medicines, fodder and fuel wood	2	3.56 ± 0.07	4	3.56 ± 0.07	4	3.46 ± 0.10
4. To promote social interactions	4	3.39 ± 0.08	2	3.64 ± 0.09	1	**3.94 ± 0.03**
5. To be more in contact with nature	8	3.14 ± 0.16	11	3.14 ± 0.16	7	3.34 ± 0.11
6. To improve air quality	10	3.10 ± 0.12	9	3.36 ± 0.11	9	2.90 ± 0.16
7. Trees are part of history, culture and heritage	5	3.34 ± 0.12	3	3.60 ± 0.09	3	3.48 ± 0.10
8. To provide education opportunities	9	3.13 ± 0.09	6	3.52 ± 0.11	6	3.36 ± 0.70
9. Trees absorb storm water runoff	11	3.04 ± 0.15	10	3.30 ± 0.11	10	2.44 ± 0.15
10. To provide food and shelter for its inhabitants	6	3.32 ± 0.14	7	3.48 ± 0.10	8	3.31 ± 0.07
11. To increase property value	7	3.26 ± 0.13	8	3.42 ± 0.12	11	2.24 ± 0.18
12. Enhancing community appeal to attract new residents	12	**1.68 ± 0.14**	12	**2.72 ± 0.17**	12	**1.28 ± 0.08**

6.3.3. Reasons for the absence of trees on homesteads

As earlier mentioned in section 6.3.1, most of the RDP residents in both study towns were unable to retain or preserve trees on their homesteads because they did not find any trees as all the trees were removed off the site by developers (Table 6.1). Some respondents in the formal and informal settlements in both Tzaneen and Bela-Bela said they could not retain or preserve any trees because they needed to create extra space for building or extending their houses. Another reason for not retaining trees was lack and limited access to water. The newly built RDP houses in Tzaneen did not have water. All the RDP residents were getting their water from one house which was supplying the whole area with water. Residents felt that it was too much work to fetch water for domestic use and at the same get water for plants and trees. As a result of this they would get water for domestic use and most plants would dry up and die due to lack of water. So they had resolved that they would start planting and taking care of the existing trees once the government connects them with water.

Table 6.5: Reasons for not retaining trees on home plots

	Reasons for not retaining any trees			
Towns	Settlement type	did not find any trees	limited access to water	lack of space
Bela-Bela	RDP	100%	0%	0%
	Informal Townships	80%	0%	20%
	Formal Townships	90%	0%	10%
Tzaneen	RDP	75%	25%	0%
	Informal Townships	85%	0%	15%
	Formal Townships	94%	0%	6%

6.3.4. The influence of disservices of trees on urban resident's decisions to plant/retain or remove trees

Overall, respondents in both study towns felt that the eight annoyances of trees were not valid reasons not to plant/remove trees in urban systems (Table 6.6). However, some respondents in Bela-Bela and Tzaneen felt that trees attracting criminals was only an issue in public spaces such as streets and parks and not on private spaces like home gardens. Similar results were obtained from the different settlements in both study towns. The majority of respondents in the RDP, informal and formal residential settlements in both study towns said the annoyances or disservices of trees were not important factors they would consider when making tree planting decisions. Respondents said that the benefits of urban trees outweighed the disadvantages and as such respondents felt that they could tolerate the disadvantages of trees. These findings corroborate Westphal's (1993) study of urban forestry volunteers; where tree annoyances were considered to be less important than the benefits. Even the strongest annoyance was rated on average between "slightly important" and "moderately important." "This suggests that, although noticeable problems may occur with public trees, the annoyances from these trees generally are less prominent in people's minds than the benefits" (Lorenzo *et al*., 2000). As a result, residents may choose to tolerate what generally are professed as annoyances related with urban trees.

Table 6.6: Residents' view of problems associated with trees as factors influencing tree planting decisions

Disservices of trees	Bela-Bela			Tzaneen		
	not important	somewhat important	very important	not important	somewhat important	very important
1. Trees make it difficult to detect criminal behaviour	20%	5%	75%	11%	17%	72%
2. Trees block sunlight	83%	15%	2%	95%	3%	2%
3. Trees are destructive	70%	24%	6%	87%	9%	4%
4. Trees cause allergies	76%	14%	10%	94%	4%	2%
5. Trees attract insects, pests and snakes	75%	13%	12%	95%	3%	2%
6. Trees are messy (leaf litter)	92%	5%	3%	92%	6%	2%
7. Trees are costly (maintenance costs)	71%	3%	26%	98%	1%	1%
8. Tree planting process is tedious and time consuming	97%	3%	0%	99%	1%	0%

6.3.5. Association between planting/retention of trees and tenure security, soil quality, lack of space and crime in each settlement type

This section focuses on factors other than benefits of trees that may influence the decision to plant/retain trees in urban areas. These factors include; tenure security, soil quality, space around homestead where trees can be planted and crime levels (for trees in public spaces). To test for association, Chi-squared tests were used for all the factors except residency time. Spearman rank order correlation was used to test association between residency time and residents' decision to plant trees on their homesteads.

Tenure security

Statistical results revealed that there was a significant association between various households with different types of tenure and residents' decision to plant trees on their homestead (Table 6.7). As expected a high proportion of respondents (62% and 70%) in the informal settlements in both Bela-Bela and Tzaneen said they were not willing to plant trees on their homesteads. This was because of the lack of tenure security; most residents felt it would be unwise to plant trees only to be told to vacate the premises as they were just squatting. In-depth interviews revealed similar findings. Box 6.1 is a direct quote by a 43 year old woman. The following quote clearly points out that security of tenure is an important factor that is taken into consideration by urban residents when making

decisions to plant/preserve trees (Box 6.1).

Box 6.1: Quote showing, importance of tenure security for tree planting decisions

> "*Making a decision to plant trees and tending to them every day is a huge responsibility and you eventually get attached to the trees or plants and you want to see them grow. As for trees, one will be looking forward to harvesting fruits or sitting under the tree one day, therefore, if you even have the slightest doubts that after planting trees you will not be able to enjoy the benefits because your continued stay in that house is uncertain then the whole idea of planting trees will not follow through* ".
> Source: 43 year old woman (Tzaneen 2011).

Conversely, for most respondents in the RDP (90%) and the formal township (92%) in Bela-Bela, tenure security was not a determining factor for planting trees. The same result was obtained for Tzaneen with the majority of RDP (88%) and formal township (98%) residents saying tenure security was not an important factor they considered when making tree planting decisions (Table 6.7).

A survey conducted by FAO (1995), revealed that ownership of land on which planting is taking place is an important factor which affects the decision to plant trees or not. Insecure or unclear ownership of land discourages local people to engage in tree planting activities. Similarly, a survey done by Treiman and Gartner (2005) on public attitudes and community forests produced the same results i.e. residents who owned their own home were also more likely to plant trees on their homestead than those who did not own the houses they lived in.

Table 6.7: Influence of tenure security on tree planting decisions

Towns	Settlements	**Tenure security a factor influencing tree planting decisions**			**Pearson's chi-square results**		
		Not important	Somewhat important	Very important	χ^2 value	Df	*p* value
Bela-Bela	RDP	90%	6%	4%			
	Informal	24%	14%	62%			
	Formal	92%	6%	2%	1.421	1	0.0001
Tzaneen	RDP	88%	10%	2%			
	Informal	18%	12%	70%			
	Formal	98%	2%	0%	1.380	1	0.0001

Soil quality

The majority of residents in the RDP, formal townships and informal settlements in both study towns said that quality of the soil was not an important factor they would consider when making tree planting decisions (Table 6.8). Results revealed that, there was no significant association between soil quality and residents' decision to plant trees on their homesteads (Table 6.8).

Table 6.8: Influence of soil type on tree planting decisions

Towns	Settlements	Soil quality as a factor influencing tree planting decisions			Pearson's chi-square results		
		Not important	Somewhat important	Very important	χ^2 value	df	*p* value
Bela-Bela	RDP	82%	6%	12%			
	Informal	40%	52%	8%			
	Older townships	80%	10%	10%	55.548	1	0.24
Tzaneen	RDP	90%	2%	8%			
	Older townships	88%	10%	2%			
	Formal	90%	4%	6%	41.820	1	0.07

Limited/lack of space

A high proportion of residents in RDP settlements (100%), formal townships (96%) and informal (90%) settlements in Tzaneen said that lack of space or limited space was not an important factor to consider when making decisions to plant or preserve trees. Similarly, the majority of residents in both RDP (96%) and informal (66%) settlements in Bela-Bela had the same views. On the contrary, some of the formal township residents in Bela-Bela (56%) said that, lack of space was a very important factor to consider when making decisions to plant or preserve trees. Furthermore, residents said they would remove trees from their homesteads if there was need to build or extend their houses. However, a chi-squared test revealed that the association between lack of space on homesteads and residents' decision to plant trees was not significant at the 0.05 level (although close to this) (Table 6.9).

Table 6.9: Association between limited space and tree planting decision

Towns	Settlements	Lack of space as a factor influencing tree planting decisions			Pearson's chi-square results		
		Not important	Somewhat important	Very important	χ^2 value	DF	P value
Bela-Bela	RDP	90%	4%	6%			
	Informal	66%	30%	4%			
	Older townships	44%	0%	56%	45.690	1	0.06
Tzaneen	RDP	80%	10%	10%			
	Informal	90%	6%	4%			
	Older townships	90%	4%	6%	49.657	1	0.08

Crime

Results revealed that there was a no significant association between residents' decisions to plant trees on their homesteads and their perceptions about urban trees attracting criminal behaviour in both study towns (Table 6.10). The majority of respondents said that they would still plant trees on the homesteads despite the fact that urban trees may attract criminals. Most respondents felt that street trees and trees found in public parks are the ones that are responsible for promoting crime and not necessarily the trees on homesteads and in private gardens (Section 5.3.4).

Table 6.10: Association between perceptions that trees attract criminal and decisions to plant trees

Towns	Settlements	Crime as a factor influencing tree planting decisions			Pearson's chi-square results		
		Not important	Somewhat important	Very important	χ^2 value	Df	*p* value
Bela-Bela	RDP	54%	26%	20%			
	Informal	36%	38%	26%			
	Older townships	54%	16%	30%	7.800	4	0.99
Tzaneen	RDP	30%	28%	42%			
	Informal	54%	30%	16%			
	Older townships	52%	38%	10%	13.38	4	0.08

Residency time

The study found that residents who had lived at their current address for over 10 years were more likely to plant/retain trees on their homesteads as compared to those had lived at their current addresses for less than five years. This is because, the longer people stay in one particular residence the more time they will have to plant and develop their gardens. A chi-squared test revealed that there

was a direct association between residency time and planting/retention of trees in both Tzaneen and Bela-Bela (Table 6.11).

Table 6.11: Spearman's correlation results of the association between residency time and planting and retention of trees

Study towns	Spearman's correlation		***R* results**
Bela-Bela	**Number of trees planted Vs Residency time**	Correlation Coefficient	0.781
		Sig. (2-tailed)	0.000
		N	150
Tzaneen	**Number of trees planted Vs Residency time**	Correlation Coefficient	0.831
		Sig. (2-tailed)	0.000
		N	150

6.4. CONCLUSION

Results in this chapter point out that the decision to plant trees is guided by different motives. Some people may decide to plant or preserve trees for social and aesthetic benefits while others may choose to plant or preserve them for ecological or spiritual reasons. Whatever the reasons for planting trees, this study has established that the majority of urban residents hold positive attitudes towards greening their properties. Also, the fact that urban residents were willing to tolerate the annoyances of trees shows they understand their value and importance.

The important role that tenure security and residency time play in tree planting decisions has also been highlighted in this chapter. The majority of urban residents want to feel the sense of ownership for the trees they plant and also they want to see returns on the investment of time, money and effort involved in planting and caring for trees. Thus, residents who own their homes have a strong motivation to maintain the plants and ensure their survival. Therefore, if they do not own the land where planting is being done, they will be less likely to make the investment because there no guarantee that they will benefit from the trees in the long run. Residency time was also found to influence planting/retention of trees. Residents that had stayed in the house for more than five years had planted more trees as compared to those that had stayed for less than five years in the same houses. Therefore tenure security and residency time plays a significant role in urban residents' decisions to plant/retain trees on private space.

CHAPTER SEVEN

GENERAL DISCUSSION, POLICY IMPLICATIONS AND RECCOMMENDATIONS

7.1. INTRODUCTION

This chapter synthesises findings from Chapters 4, 5 and 6. It also discusses briefly the possible policy implications of the results. Conclusions from the study are drawn to highlight recommendations for the municipalities of Bela-Bela and Tzaneen in order to facilitate the accomplishment of urban and community forestry goals.

Understanding local residents' needs, desires, and knowledge is essential when seeking public support for the management of community trees and other green spaces (Treiman and Gartner, 2005). Lorenzo *et al*. (2000) further states that "determining public's knowledge and perception of urban forests and the importance the public attaches to these, is a critical step in building public support for urban forestry programmes" and that failure to this can affect the success of these programmes. Therefore, they recommended collection and use of unbiased data on public attitudes, perceptions and knowledge of urban forests and that communication between the public and urban forestry officials goes in both directions.

This study generated some interesting findings on both perceptions and knowledge of urban trees and the various intangible benefits. The study also provided information on appreciation of the intangible benefits of trees and the importance and value that is attached to specific tree species by urban residents. While, this study does not necessarily provide information to municipalities on how many trees to plant and where to plant them, it does, provide information and ideas on how urban greening programmes can be made more appealing to the general public as well as to policy makers and how the delivery of ecosystem services from trees can be enhanced.

7.2. REFLECTING ON THE USEFULNESS OF THE MA ECOSYSTEM SERVICES AND TEV FRAMEWORKS

The MA and TEV are conceptual frameworks (Section 2.2.1 and 2.2.2) that are often used for categorising and defining different types of ecosystem services and the values derived from ecosystems. Both frameworks were found to be very useful for this particular study. The MA framework provided a useful approach to look at people-tree interactions because it incorporates the human well-being aspect of ecosystem services, which is what this study mainly focussed on. For this

study, ecosystems (trees and treed environments) and the services they provide (intangible benefits) were perceived in terms of the role they play in enhancing human well-being and not 'just' improving the environment. The MA framework also takes into consideration that ecosystems have inherent worth and, particularly for this study, people believed that trees had cultural and spiritual worth that went beyond the provisioning and regulating services. Similarly, the TEV framework was a useful tool for looking at multiple values people attach to trees. Both frameworks were used to design a new framework for this study. The merged framework (Figure 7.1) provided the study with a useful way to classify and also think about the various intangible benefits of trees. Classifying the intangible benefits of trees into cultural services (direct use value) and regulating services (indirect use value) was very helpful in the sense that it was easy to look at various benefits of trees and make comparisons between the different intangible benefits of trees. If the intangible benefits of trees were not classified according to this merged framework, it would have been impossible to make comparisons (e.g.between regulating and cultural services). These comparisons provided useful information and results. For instance, it was found that the younger generation were more aware of the regulating services (probably because of environmental education taught in schools) whereas, the older residents had more knowledge and information on the cultural services of trees.

What neither frameworks (MA and TEV) covers is the perceived negative impacts or 'disservices' of ecosystems and their components such as, the various annoyances of trees, as well as their association with criminal activity. These disservices are important to consider as trees may be perceived negatively if they impact human well-being. The benefits (or ecosystem services) provided by trees will be traded-off against any possible disservices depending on the particular situation in which the trees occur and on people's value systems. Disservices are therefore important to consider in relation to urban greening as they will influence decisions such as where to plant trees (some places may not be suited to greening), the types of trees planted (e.g. deciduous versus evergreen, size of trees, species) and how to deal with possible conflicting understandings and values in urban forestry programmes.

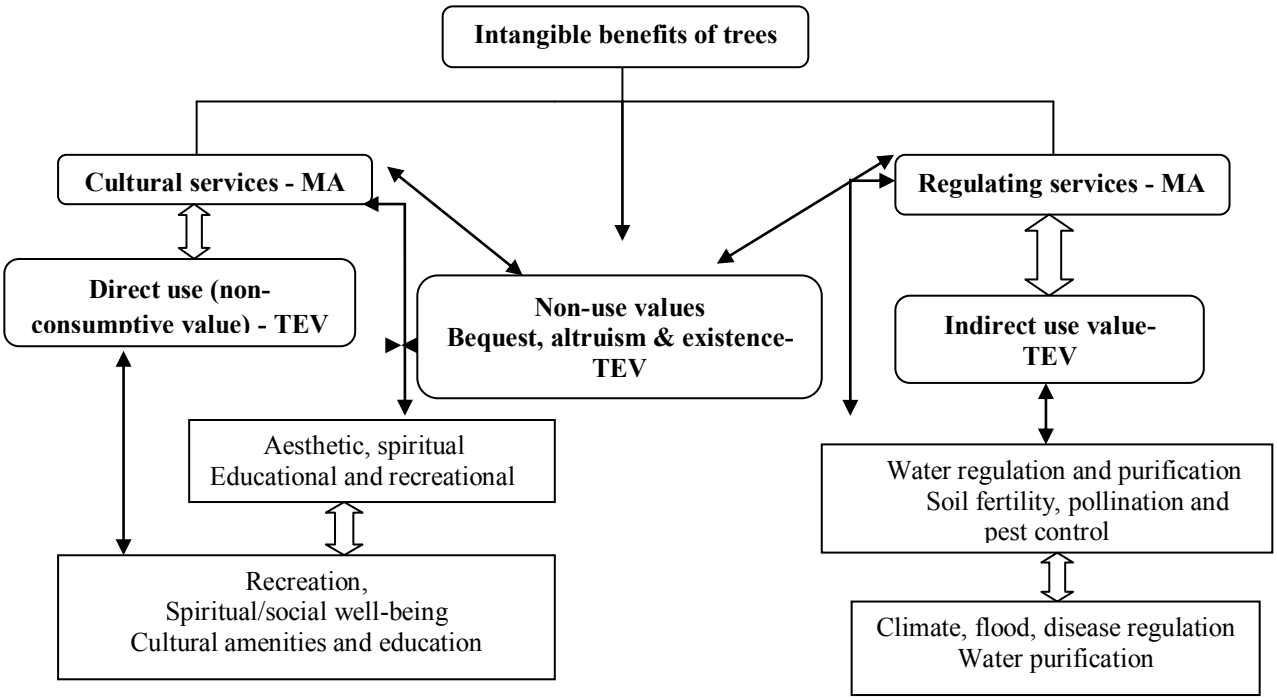


Figure 7.1: A framework derived from MA and TEV frameworks, illustrating the classification of the various intangible benefits of trees-(reproduced)

7.3. GENERAL DISCUSSION AND SYNTHESIS

Findings from this study have demonstrated that appreciation for the intangible benefits of trees is not necessarily based on knowledge of the intangible benefits of trees. Residents' knowledge or ability to list the cultural and regulating services of trees was found to be limited, yet appreciation for these services was very high and as such, the study came to the conclusion that knowledge does not necessarily lead to appreciation. It was also found that the majority of older residents were more aware of the cultural services of trees such as spiritual, historical and social values, while younger respondents had more knowledge of the regulating services (carbon sequestration, noise reduction, removal of pollutants, etc). For older respondents, trees were more than just providers of shade, habitat and removers of pollutants, but living things that represented their cultural and spiritual beliefs and also occupied a special psychological place in their lives. Younger residents, however, did not often mention the cultural benefits, suggesting that older residents were not passing on their knowledge about the cultural, spiritual and historical value of trees and specific tree species.

The study also established that most residents, and not just those with particular reasons to be involved with urban trees held common positive values toward trees and the residents who did not exhibit strong interests in urban trees still understood their importance and value in cities. Residents

placed cultural, spiritual, ecological and historical value on specific tree species. The mere fact that residents valued the cultural and spiritual benefits of trees very highly is an indication that they might be supportive of and volunteer in urban greening programmes in their communities. A study done by Westphal (1993) examined values and motivations of urban forestry volunteers, and it was found that "volunteers are motivated by deep values, such as spiritual benefits and bringing nature closer, more than by practical benefits, such as reducing noise and increasing property value".

Findings regarding the difference in knowledge levels between the two study towns have been ascribed to the fact that Tzaneen has active urban greening programmes, whereas Bela-Bela had none because of limited funds. According to a study done by Chishaleshale (pers. comm.), Tzaneen Local Municipality had enough funds to allocate towards urban greening activities because of the large population size of the town. This meant that the amount of taxes available and revenue was higher and consequently the potential for instituting urban greening activities. Bela-Bela, on the other hand, is a small town with a much smaller population. Municipal officials in Bela-Bela said that they usually lacked funds to run urban greening programmes and that they continually had to compete for funding from the city budget and they are often ignored in favour of more essential services. Johnson's (1982) case study in the United States produced similar results that unsuccessful urban forestry programmes was attributed to a lack of funding and city budgeting.

From the above findings, the study has established that there is a link between successful urban greening programmes and knowledge of the intangible benefits of trees and also how residents value trees. Other studies have also recognised that residents in well treed cities (with parks and other green spaces) are normally aware of the role trees play in the urban environment and have more appreciation of the natural environment (Nowak *et al*., 2001; Treiman and Gartner, 2009).

Appreciation of the intangible benefits of trees was found to be high in both study towns and this was demonstrated by residents' desire to plant and retain trees on their homesteads. The majority of residents understood the value of trees and recognised the important role they play in enhancing their quality of life. The value and importance attached to urban trees by residents was expressed by the fact that most of them had planted/retained trees and they were also willing to withstand and tolerate the annoyances of trees. Urban residents considered these problems to be inconsequential as the benefits of trees outweighed the disadvantages. They also said that the problems are insufficient to justify not planting trees in urban areas.

However, there was one particular disservice that most residents could not tolerate, which was crime linked with urban trees. Residents seemed to associate criminal activities with street trees and trees in

public parks, but not trees on private spaces such as home gardens. Public parks in both study towns were underused partly because they were often seen as undesirable, threatening places where crime frequently occurred. Crimes related to urban trees in public spaces negatively influenced appreciation of the social benefits of urban trees. Most residents felt insecure to move in well treed streets or in areas densely populated with trees, especially at night. Findings revealed that public parks in both study towns were not properly managed and were over-grown with shrubs and trees which heightened fear and feeling of insecurity. This is a similar finding to O'Brien's (2005) work on social and cultural values of trees and woodlands in northwest and southeast England, in which people felt more insecure in what appeared to be unmanaged parks; especially those lacking paths for walking, car parks and facilities such as play areas or toilets. Residents in both towns, especially women, were also very concerned about their safety and that of their children. The majority of female residents said they would not venture into public parks or take evening walks because they perceived these areas to be unsafe and they felt uneasy being alone in them. Some women also spoke of being harassed by men in open areas with trees. Such occurrences made women think twice about going to places such as parks alone because trees and dense vegetation reduced visibility and were able to conceal criminals.

Furthermore, anti-social behaviour such as young people drinking, taking drugs and being unruly also contributed to feelings of unease for other users. Work done by Thomas and Thompson (2004) on "why environment matters to children" produced similar findings. The study revealed that people were wary and fearful of using public parks which lacked visible management and in which signs of drug taking and other forms of abuse were evident. Thomas and Thompson's study concluded that the unsafe environment outdoors, lead to the increase in children's indoor activities such as computer and television programmes as parents were concerned over their children's safety outdoors. Similar sentiments were revealed in this study.

Appreciation of the cultural and regulating services of trees was found to be influenced by a number of factors including peoples' pro-environmental and altruistic values, type of settlement and crime associated with urban trees as already discussed. Pro-environmental and altruistic values were associated with increased appreciation of the intangible benefits of trees. Tarrant and Green (1999) suggested that urban trees and green spaces are important for the development of pro-environment attitudes. Additionally, Tarrant and Green's (1999) study also indicated that "pro-environmental attitude and behaviour improved appreciation of outdoor recreation participation of urban residents". This study mirrored similar results in which residents who held pro-environmental and altruistic values were also found to have a high appreciation of the intangible benefits of trees.

The different settlement types were also found to influence appreciation of both cultural and regulating services of trees. Some of the formal township residents had easy access to urban green spaces because they lived in close proximity to the parks, while residents in the RDP and informal residential settlements lived further away from where the parks were located. Consequently formal township residents visited the parks more regularly and recognised and valued the social benefits (recreation) of trees more highly. On the other hand, RDP and informal township residents felt deprived because of the absence of public parks in their communities. This influenced the way they perceived parks and consequently their attitudes and appreciation of the benefits derived from public parks. Neuvonen *et al*. (2006), explored the links between accessibility to public parks and urban green spaces and participation in outdoor recreation activities, and discovered that people who live in residential areas that have sufficient green spaces which are in close proximity to their homes tend to visit public green spaces more often.

Low income and poverty also affected the frequency of visits to public parks. RDP and informal residential areas had the highest proportion of respondents in the low income category that depended on government grants and remittances as a source of livelihood. The absence of public parks in these two townships meant that residents had to travel by car to get to a park. From the findings, residents said that they could not afford to take a taxi just to visit the park, as they did not have the money and that they had more serious expenses to prioritise such food, school fees, electricity bills, etc. This may reflect some similarities to Getz *et al*.'s (1986) findings from a study that explored the links between income deprivation and unequal access to public parks. Their findings revealed that poor households had limited access to public parks compared to affluent households. Ironically it is often the poorest people in urban slums and informal areas that need a chance to escape to parks as these settlements are often very overcrowded, lacking in space to plant trees, plus the lack of tenure may also discourage people from planting trees in their own yards.

A WTP survey was conducted which revealed that residents in both towns were willing to pay in order to sustain urban greening programmes in their communities. However, the majority of residents in Bela-Bela were more willing to pay for greening initiatives as compared to fewer residents in Tzaneen. Some residents Tzaneen may not have been willing to pay because their town was well treed and they had several urban greening programmes that were already running. Results from this study can be compared to other studies on WTP. Lorenzo *et al*. (2000) found that residents' WTP for recreational benefits, depended on how well informed they were about the value and importance of trees and green spaces and also the condition of the green spaces. In this study, WTP was found to be influenced by age of respondents, level of education and income. Gender was found to have no

influence on WTP. This contrasts with the findings by Treiman and Gartner (2005), who found that women were more likely than men to say that they would vote in support of the proposed urban greening fund to uphold trees and other green spaces in their community. The study found that younger respondents were more WTP as compared to the older respondents. Findings also revealed that the more educated residents (in possession of tertiary qualifications) were WTP, whereas most residents with no formal education were less WTP. Also, residents with a higher income were more WTP, while those with low monthly incomes were less WTP. This was unsurprising, as more wealthy residents had more money to contribute to causes in which they believed. These findings are in line with Treiman and Gartner's (2005) results of a public attitude survey in Missouri, USA. Their survey found that support and contribution towards the tree fund increased with both education and income.

The study looked into planting and retention of trees in both towns and the different factors that influenced residents' decisions to plant and retain trees on their homesteads. Residents in the different townships were willing to plant trees for various reasons. The most popular reason for planting/retention of trees was for provision of shade. While others had planted trees for cultural and spiritual purposes and a few had planted trees for consumptive benefits such as fruits, fuel wood and medicines. A study done by Lohr *et al*. (2004) in the United States produced similar results. People in large metropolitan areas had a wide range of reasons for planting trees in cities and that the highest ranked reason for planting trees was for shade and cooling. Planting and retention of trees was found to be influenced by residency time and security of tenure. These results are consistent with Treiman and Gartner's (2005) findings that people who owned their own home were more likely to plant trees on their homestead than those who did not own their own homes. They also found that residents who had lived at their current address over ten years were more likely to plant trees than those who had lived there for less than five years.

7.3.1. Commonalities and differences among the three settlement types

Findings have shown that there were differences as well as similarities among the three different settlements (RDP, formal and informal settlements) in terms of knowledge and appreciation of the intangible benefits of trees, tenure security and reasons for planting trees on private spaces. While there were differences in understanding of the benefits provided by trees between the different settlements, this was not repeated for appreciation of the services provided by trees. Despite this lack of differences in appreciation, it was noted that some intangible benefits of trees were more readily recognised and emphasised than the others. For example, residents in RDP and informal settlements in both towns recognised the role trees play in providing shade and acting as windbreaks more easily

than improving air quality. On the other hand, residents in the formal townships were more appreciative of the aesthetic value of trees. Other differences that were observed among the different settlement types pertained to the reasons why residents would plant certain tree species on their private space. Residents in RDP and informal settlements said, the main reason they would choose to plant specific trees was, to provide them with shade and protect them from strong winds. Whereas, formal township residents in both towns said they would plant trees to make their homes look more attractive and for the provision of fruits. This information can give local municipalities insight on the motives behind tree planting and guidance on specific tree choices for different neighbourhoods. For instance, residents in RDP settlements may need fast growing trees to provide them with shade and protect them from strong winds, whereas formal townships residents may prefer flowering and fruit trees.

Other dissimilarities among the different settlements were associated with tenure security and its influence on tree planting decisions. Most residents in RDP settlements and formal townships (in both towns) owned their homes and as such were willing to plant trees on their homesteads, while residents in the informal settlements lacked tenure security and were less enthusiastic about planting new trees.

7.4. POLICY IMPLICATIONS AND RECOMMENDATIONS

The study established that residents were both fairly knowledgeable and very appreciative of the intangible benefits of trees and they understood the value of planting, maintaining and sustaining trees and other green spaces in their communities. However, a complementary study done by Chishaleshale (pers. comm.) revealed contradicting results in that, municipalities reported that they had difficulties in getting support from the public. Municipal officials in both study towns said that lack of public support was one of the major challenges they were facing. The public were not supportive of the efforts municipalities were making to improve the urban forestry situation in their communities. Municipal officials also said that the public were responsible for vandalising newly planted trees and also that stray animals (goats) would destroy small trees as the people who are suppose to be looking after those animals were irresponsible. Municipal officials further said that people would steal the wires or the wood fences around public parks which compromised safety in the parks.

These results are contrary to Lorenzo *et al*.'s (2000) findings that the greater the importance attached to urban forests the greater the support from the public towards urban forestry programmes. The lack of public support may be due to the fact that municipalities do not involve local residents in tree planting programmes therefore, the sense of ownership for the trees is absent and as a result residents feel that it is not their responsibility to look after those trees. A study done by Moskell *et al*. (2010) on

examining motivations and recruitment strategies for urban forestry volunteers revealed that community participation in tree planting and maintenance activities builds local people's sense of ownership over the trees. Another study by Grese *et al*. (2000) revealed that "individuals derive a personal sense of satisfaction from planting trees and from taking action that improves their community".

Several studies have pointed out that municipal and urban foresters working under the private-public partnership cannot feasibly provide adequate and timely care for every newly planted tree due to staff and budget constraints (Moskell *et al*., 2010; Clary and Snyder, 1999; Bruyere and Rappe, 2007). Hence, stakeholders, such as residents, property owners, businesses and community organizations, should be invited to become involved in the planting and care of urban trees (Pincetl 2010). Therefore, these findings suggest that in order for municipalities to get public support, they need to involve the local residents in community greening projects from the planting stage and entrust them to care for the trees throughout the project, in order for these greening projects be successful.

Direct observations of residents' homesteads for this particular study indicated that residents had a number of well maintained trees on their homesteads and properly trimmed live fences. This finding can be attributed to the fact that residents felt compelled to take good care of the trees on their homesteads because of that sense of ownership and responsibility. The same assumption can be made that, if local residents are involved in a tree planting project in their community from inception, then they are likely to feel the same sense of ownership and responsibility and this may result in their long term engagement in the project and ultimately ensuring long term survival of urban trees. Also, having active local neighbourhood greening movements can help to ensure that trees are cared for and protected.

Consulting the public on what tree species should be planted in their communities (parks or streets) can improve stakeholder involvement in planting and caring of urban trees. This is because studies have shown that some individuals may have multiple and diverse motivations for becoming involved in urban forestry (Moskell *et al*. 2010; Svendsen and Campbell 2010). For instance some people may want to be involved in community greening projects because they like to be outdoors, whereas as others may want to plant a tree to commemorate a historical event (Svendsen and Campbell 2010). Therefore, motivations to be involved in community greening projects, arise from a variety of reasons including social, cultural, environmental, etc. This study has established that the majority of residents placed significant cultural and spiritual value on certain tree species. Such tree species are usually valued more than others and as a result, they are more likely to be given extra attention by local

residents as they are considered to be sacred. Therefore, if municipalities plant trees with cultural/spiritual importance, they are likely to get local support and involvement, as residents will have motivations to ensure the survival of those trees. Municipalities can also link planting of trees to cultural and historical events, memorials, etc as this will engender ownership for those particular trees. Also, neighbourhoods, schools or individuals could 'adopt' street and park trees and become responsible for their care, with the result that people will have a sense of ownership for the trees that they have 'adopted'.

Another important issue that emanated from this study was that public parks were under-used mainly because they are perceived as places where criminal activities took place. This perception was found to be as a result of lack of supervision of the parks by municipalities. The parks were also rarely maintained and as such, trees and shrubs were overgrown which made them appear unsafe and unattractive. Reduced visibility contributed to the feelings of unease for park users. This finding implies that municipalities need to look into these issues in order to attain maximum utilisation of parks, as this will provide some sort of informal surveillance which is known to be an effective deterrent for crime (Kuo *et al*., 2001). This will create positive feedback, because as more people start to use parks, it becomes more difficult for criminals to operate freely. Several other studies have also shown that "well maintained vegetation in public spaces serves as a territorial marker that discourages criminal behaviour by signifying that people care about the property and that someone may be more likely to notice mischief" (Nassaur 1988; Brown and Altman 1983; Brown and Bentley 1994).

Results from the WTP survey, indicated that the majority of people were WTP in order to sustain greening initiatives in their communities. The overall profile of residents who were most likely to contribute money towards community greening projects was male or female, between the ages of 20 and 35, income of at least R5000 per month, with a college education and having a great appreciation of the benefits of urban trees. This finding suggests that municipalities when soliciting public support can use this information as a guide during the planning process of urban greening programmes.

These results suggest that opportunities exist to improve public support and involvement in community greening projects. To get the most out of the information generated from this study, the following is recommended.

Table 7.1: Reccomendations

	RECOMMENDATIONS	***Baisis of the reccommendation***
1.	Municipalities should collaborate with NGO's to enable them to run training programmes or tree planting events for stakeholders who wish to gain knowledge or hands on skills related to tree planting and care	The study revealed that people felt they were not being engaged in tree planting decisions and as such did not feel sense of responsibility
2.	Municipalities should improve security in public parks by pruning overgrown shrubs and tree branches and also put security lights and fences around public parks	People did not feel safe visiting public parks as they are associated with increased crime. Therefore, improving safety measures may encourage regular use
3.	Municipalities should initiate a programme to engage urban residents around the possibilities for payment towards community greening projects and residents who are unable to make monetary contributions can volunteer in terms of labour	The study revealed that people were willing to pay in order to sustain greening initiatives in their communities. The WTP suggests an interest in a more attractive and gren environment.
4.	Municipalities can start distributing promotional materials about trees and tree care during events like arbor day, environmental education projects for schools and youth groups and informal lectures to community groups in order to broaden public knowledge of urban resources	It was found that people were not very knowledgeable about the various benefits of trees
5.	Municipalities should work with NGOs, schools and elderly community members to educate the younger generation on the cultural and spiritual values of trees as knowledge is being lost	It was found that information on the cultural, historical and spiritual importance of trees is not being passed from the older people to the younger ones
6.	Municipalities should work with schools to address the lack of interest in trees by young people can be tackled by including environmental education in school curriculums as a way of improving environmental awareness	The study found limited knowledge and lack of interest among young people
7.	Municipalities should consult residents in terms of what types of trees to plant and where. One way to do this would be to initiate neighbourhood greening committees.	Study found that vandalism was prevalent and people's opinions were not sought in terms of the types of trees they preferred and where they want them to be. It was also found that people identified different types of trees for different reasons that may be appropriate in different areas and green spaces.

7.5. CONCLUSION

In conclusion, this study has given some insight into urban residents' perceptions, knowledge and appreciation of the intangible benefits of trees. The study has also shed some light on the fact that, contrary to conventional wisdom, poor people and people in poorer residential areas actually do appreciate trees and green spaces and a more attractive environment and that trees are not something reserved for the well-off. The study has also highlighted the various factors influencing knowledge and appreciation of the intangible benefits of trees as well as the different factors influencing planting/retention of trees and WTP.

The story that unfolded from the study portrayed that urban residents' value of trees is not so much the tangible benefits such as food and firewood, but rather the experiences that trees provide and their contribution to people's general well-being. The study further established that urban residents recognise and embrace the environmental benefits that trees provide such as provision of shade, removal of pollutants, etc and, most importantly, share strong spiritual, cultural and historical bonds with trees. consequently during planning and management trees should not be thought of as just air conditioners, providers of food, and ornaments in the urban environment but as fundamental components of urban infrastructure that have deep spiritual and religious ties with people. Lastly, the study found that cultural, ecological, social, spiritual and aesthetic values that residents derived from urban trees and green spaces significantly enhanced their quality of life and ultimately contribute to more sustainable lifestyles.

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APPENDICES

APPENDIX A

HOUSEHOLD SURVEY QUESTIONNAIRE-ENGLISH

This questionnaire forms part of the data as partial requirement for MSc degree at the department of Environmental Science, Rhodes University in Grahamstown. The research on urban residents' knowledge and appreciation of the intangible benefits of trees and the role they play in enhancing the quality of life aims to investigate the perceived indirect uses and benefits of urban trees in both private and public spaces across areas of different socioeconomic status and the beliefs, values and attitudes influencing these perceptions. Information gathered through this questionnaire will be solely for research purposes. Your views and opinions will be kept confidential. No identities are sought in this questionnaire therefore your identity will be kept anonymous. You are kindly asked to participate in the study.

(Tick the box and provide written responses where applicable)

Name of town_____

Name of township_____

Street name _____

House No. _____

SECTION 1: PEOPLE'S TREES AND TREED GREEN SPACES IN THEIR COMMUNITY AND USAGE

1.0 In your opinion, rate the following statements.

Value Item	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Not Sure
1) Humans have the right to modify the natural environment to suit their needs						
2) Protecting the environment will threaten jobs for people like me						
3) Laws to protect the environment limit my choices and personal freedom						
4) Claims that we are changing the climate are greatly exaggerated						
5) People should be treated the same way regardless of race, or gender						
6) If people put their efforts together, they can attain peace and a world free of war and conflicts						
7)Environmental protection will help people have a better quality of life						
8) Taking good care of the environment is my responsibility to provide a better world for me, my children and others						
9) Modern development threatens wildlife and natural resources						
10) Plants and animals have as much right to exist as humans						
11) As human beings, we need to protect certain plant and animal species from extinction						
12) Development should not happen at the expense of nature						

1.1 Rate the amount of trees and treed green spaces within your neighbourhood?

Inadequate		Just right		Excessive	

1.2 Do you have a public park within your neighbourhood?

Yes		**No**	

1.3 If yes, where is the park?

Within the neighbourhood (walking distance)		Can only get to the park by car	

1.4 How many times do you visit green spaces such as parks?

Please pick the most suitable one for you from the five options:

☐ Approximately once per day ☐ 2-4 times per week ☐ weekly

☐ Monthly ☐ Never

1.5 If option is never, specify why……..

1.6 When did you last sit under a tree to relax or rest?

……..

1.7 Where was this tree?

……

1.8 Do you have kids?

Yes		**No**	

1.9 If yes, what are their favorite activities in their spare time?

……
……

1.10 How often do the kids play in the garden, climb trees or Public Park?

……

1.11 As a parent do you think it is important for your kids to be spending time outdoors playing in the garden or under the trees?

Yes		**No**	

1.12 If No, specify why?

……

1.13 As a child, did you ever climb trees or play in the garden/public park?

Yes		**No**	

1.14 If No, specify why?

……..

SECTION 2: PERCIEVED INTANGIBLE BENEFITS OF URBAN TREES

A. Ecological tree benefits

2.0 Which ecological benefits of trees do you know about? **(Indicate using 1,2or 3 according to respondent's response)**Which ones have you not previously thought or heard about? Indicate with a question mark **(?)**

Ecological benefits	**Tick(√)**
Trees:	
a)Remove pollutants from the air	
b)Provide a home for birds, insects and other small animals	
c)Help to reduce excessive water loss and run-off from soil and protect soils from erosion	
d)Reduce temperatures by providing shade	
e)Help reduce the noise levels in bustling cities	
f)Mitigation of climate change	
g)Protect the neighbourhood from strong winds	
h) Other…….	

B. Social benefits

2.1 Which social benefits of trees do you know about? (**Indicate with 1, 2 or 3 according to respondent's response)**Which ones have you not previously thought or heard about? Indicate with a question mark (?)

Trees and treed green spaces:	**Tick**
a) Provide places for children's play	
b) Promote social interactions	
c) Promote outdoor physical exercise	
d) Improves the mood and relieves stress	
f) Beautify the environment	
g) Provide learning opportunities	
h)Offer cultural, religious and spiritual fulfillment to some people	
h) Other……	

SECTION 3: ATTITUDES AND APPRECIATION OF THE PERCIEVED INTANGIBLE BENEFITS OF TREES AND TREED GREEN SPACES

3.0 Rate the following (Tick one box ONLY)

	Perceived Social and Economic benefits of trees	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
3.0.1	***Recreation and Social Interaction***					
a	I feel parks are great places to bond and relax with family and friends					
b	I feel the need to be outdoors more often if there are trees in my environment					
c	I feel that a tree planting program in my community would be a great way of knowing and interacting with my neighbours					
d	I like to sit under the trees outside the house and read a book or just relax and think					
e	I feel my **children** would be deprived if there were no trees in our neighbourhood					
3.0.2	***Physical health and mental well-being***					
a	A visit to the park after a stressful day makes me feel better and calm					
b	Trees and the natural environment make me feel happy and add to the quality of my life					
3.0.3	***Aesthetics and Quality of place***					
a	I feel the urban environment would be depressing without trees					
c	I feel that trees add colour to our environment and thus make it look beautiful					
3.0.4	***Economic benefits***					
a	I am willing to pay slightly more for a house that has trees around the yard					
b	I would prefer to buy a house with trees than one without					

	Perceived Social and Economic benefits of trees	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
c	I would choose a neighbourhood with trees					
3.0.5	***Ecological benefits***					
a	I believe the urban environment would be unsustainable without trees					
b	I believe given global warming issues, trees are even more important now than ever					
3.0.6	***Cultural, Historical and Spiritual benefit***					
a	I feel trees are an important part of my culture					
b	I feel trees and nature form part of my religion					
c	The beauty of nature and trees is a gift from our creator					
d	I feel taking good care of trees and nature is part of our duty as human beings					
e	I feel trees are an important part of history and heritage in my community					
3.0.7	***Disadvantages of trees***					
a	Trees have very little meaning for me					
b	I feel urban trees and green spaces just take up space for more useful developments					
c	I feel trees are dangerous because they provide spaces for criminals to hide					
d	Trees block sunlight light					
e	Trees create extra unnecessary work for me especially sweeping the leaves and pruning					
f	Trees are destructive because they crack roads and concrete					

	Perceived Social and Economic benefits of trees	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
g	Trees attract insects and birds and cause allergies(pollen)					
h	I feel trees and green spaces are for rural areas					

3.1. We have looked at the various intangible benefits of urban trees and green spaces, now I would like you to rate how important you feel these are.

Intangible benefits of urban trees and green spaces	**Not Important**	**Somewhat Important**	**Very Important**	**Don't Know**
a)Increasing property values				
b)Shade				
c) create a unique community character				
d) aesthetics/beauty				
e) enhancing community appeal to attract new businesses				
f) enhancing community appeal to attract new residents				
g) enhance recreation areas				
h) buffer sound				
i)Education opportunities				
j) places for community to meet socially				
k) provide food for inhabitants				
l) air quality improvement				
m) reduce wind speed				
n) prevent soil erosion				
o) provide wildlife habitat				
p) absorb storm water runoff				
q) trees are part of history and heritage				
r) trees are part of our culture and religion				

3.2 Rate which of the following aspects of trees and treed green spaces are important for you?

Aspects of urban trees	**Not Important**	**Somewhat Important**	**Very Important**
Pleasant / attractive streets			
Amount of shade along streets / sidewalks			
Appearance/condition of the trees(are they well maintained)			
Diversity of species / characteristics			
Number of trees in parks			

3.3 I would (feel)…….if I woke up one day and all the trees were gone?

3.4 Key words that I associate with urban trees e.g. Beautiful, Messy, etc

1.	6.
2.	7.
3.	8.
4.	9.
5.	10.

3.5 List the tree species found in your neighbourhood?

……

……

3.6 Are there any beliefs and importance attached to these tree species in your community?

Tree Species	**Beliefs**	**Why is this species important to you?**
1.		
2.		
3.		
4.		

SECTION 4: PEOPLE'S RESPONSES TOWARDS PLANTING AND RETENTION OF TREES

4.0 Have you or anyone in your family planted any trees within your yard from the time you occupied this house?

Yes (State how may)		**No**	

4.1 If No, would you like to plant any trees?

Yes (State how many)		**No**	

4.2Have you retained any trees within your yard from the time you occupied this house?

Yes (State how many)		**No**	

4.3 If No, why have you not retained any?

Specify: ……

4.4 Rate the following reasons for planting and retaining trees within your garden or yard

Reasons for planting and retaining trees	**Not Important**	**Somewhat Important**	**Very Important**	**Don't Know**
To beautify and make the environment attractive				
Utilitarian(for fruits, fodder, fuel wood e. t .c)				
Shade				
For relaxation(sitting under the trees to chat with friends and families)				
To be more in contact with nature				
Other: specify……				

4.5 Rate the following statements that would affect your decisions to plant or preserve trees within your garden or yar

Reasons for not planting/retaining trees	**Not Important**	**Somewhat Important**	**Very Important**	**Don't Know**
Lack of land ownership or tenure rights(not own place)				
Trees are messy(especially after storms or spring time)				
Insufficient funds for maintenance(e.g. money for fencing when trees are small)				
Lack of space				
Poor soils and bad terrain				
Destructive(e.g. concrete and falling branches)				
Keeping out sunshine light				
Attract insects, pests and snakes				
Allergies (pollen)				
Security risk(create dark and hiding places)				
Tree planting process and maintenance is time consuming and tedious				
Trees attract and host bad spirits				
Trees attract lightening				

4.6 What specific kinds/types of trees would you recommend for public spaces and plant in your private space?

Tree Species	**Public Space**	**Private Space**
a)Ornamental trees		
b)Fruit trees		
c)Shade trees		
d)Indigenous trees		
e)Exotic trees		
f)South Africa's Tree of the year		
g)Trees with cultural significance		
h)Medicinal trees		

4.7 Are there any specific species you would recommend?

Yes		**No**	

If Yes, Please list

……
……

4.8 Are there any tree species you would discourage?

Yes		**No**	

If Yes, Please list

……
……

SECTION 5: ECONOMIC BENEFITS OF TREES

5.0 Economic value of urban trees

Suppose that research shows there will be **50% reduction of trees in the areas around your neighbourhood within the next five years** as a result of urban development. If the government and some NGOs now plan to carry out a greening programme to create a similar land area for trees and treed green spaces within your neighbourhood as compensation, how much money are you willing to pay to support this programme? It is certain the money you pay will be entirely used in increasing treed green spaces, including parks and planting trees. And the amount of the money you pay will directly affect how much treed green space area can be created. Before you make the decision, please consider the followings:

a) Your **household** income and expenditure

b) Your habits and preferences

c) The social and environmental features of your neighbourhood

In these five years, what is the **maximum** amount of money that **your family** is willing to pay **each**

month to support the creation of this 50% area of treed green spaces? Here we have several amounts for you to choose. If you find no suitable amount here, you can suggest others.

[ ] R5 [ ] R10 [ ] R20 [ ] R30 [ ] R50 [ ] R80 [ ] R100 [ ] R200

[ ] R500 [ ] R0 Other (specify)……..

Motivations

5.1 Why this amount

You are willing to pay this amount because:	**Strongly agree**	**Agree**	**Disagree**	**Strongly disagree**	**Not sure**
It is for the interest of other residents in my community					
You want to make sure there is adequate supply of green spaces and trees for recreation and social activities					
You think it is the right thing to do, it is your have the responsibility to do it					
You want to make sure there is adequate green spaces to beautify the living environment					
Trees exist on their own rights and are worth preserving					
You want to make sure there is adequate supply of green spaces to improve air quality					

5.2Ask only if R0 or cannot choose is selected

You choose not to pay because:	**Tick**
Nature should not be measured in terms of money	
50% reduction of green space area is acceptable	
You cannot afford	
Urban development is more important than greening	
This is the job of the government and other municipality, not citizens	

Trees exists on their own right; it is unacceptable to cut them down and plant them elsewhere	

SECTION 6: DEMOGRAPHIC INFORMATION

6.0 Gender of respondent

1. Male		2. Female	

6.1 Date of birth

…….

6.2How many people in this household have a full-time, part-time or casual job? (*List by job type*)

No.	Job type	FT/PT/casual	Self employed(describe)	R/month
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Note: PT=part-time FT=full-time

6.3Do any of the household members receive old-age **pension, disability grant** or **child grant**?

No. of grants	P/DG/CG	R/month

6.4 Highest education level

1. No formal education		2. ABET	
3. Primary school		4. High School	
5. Diploma		6. Degree	
7. Honours		8. Masters	
9. PhD		10. Other (Specify)	

6.5 Residence

1. Born in this town		2. Born elsewhere (state where and year settled in this community)	

6.9 Security of tenure

1. Own house (specify for how long)		2. Rented house (specify number of years)	

APPENDIX B

LIFE STORIES (In-depth interviews)

Physical changes in the environment

1. How long have you lived in this neighbourhood?

2. What changes have you observed in your environment with regards to tree cover, vegetation, other green spaces and climate?

   Probe: What can you attribute these changes to?

Value attached to trees

3. What do you feel about your surrounding natural environment (nature)?

   Probe: Why do you feel this way?

   Probe: Are certain tree species more important than other and why?

Experiences with nature

4. What differences have you noticed in your own childhood experiences with that of the children of nowadays?

   Probe: What do your children do in their spare time activities and what the relationship children of nowadays have with the surrounding natural environment?

   Probe: Do you think your childhood experiences with nature have contributed to your appreciation for trees and the natural environment?

Appendix C

CROSS TABULATION TABLES AND MEAN SCORES ON APPRECIATION OF THE INTANGIBLE BENEFITS OF TREES AMONG DIFFERENT SETTLEMENTS IN BELA-BELA AND TZANEEN

Appreciation of the intangible benefits	**Bela-Bela- RDP**					
	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean scores and SE
Parks are great places to bond /relax with family and friends	70%	28%	2%	0%	0%	4.47±0.04
I like to sit under the tree to read a book or just relax and chat with friends	56%	36%	8%	0%	0%	4.23±0.05
A visit to the park after a stressful day makes me feel better and calm	64%	26%	10%	0%	0%	4.38±0.03
Trees add colour to our environment and make it look beautiful	66%	34%	0%	0%	0%	4.40±0.04
I am willing to pay slightly more for a house that has trees	66%	34%	0%	0%	0%	4.40±0.04
Given global warming issues, trees are even more important now than ever	48%	46%	6%	0%	0%	3.97±0.07
I feel trees are an important part of my culture	54%	42%	4%	0%	0%	3.99±0.08
The beauty of nature and trees is a gift from our creator	60%	36%	4%	0%	0%	4.09±0.06
I feel trees are an important part of history and heritage in my community	66%	34%	0%	0%	0%	4.66±0.07

Appreciation of the intangible benefits	**Bela-Bela- Informal**					
	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean scores and SE
Parks are great places to bond /relax with family and friends	54%	28%	12%	4%	2%	4.07±0.05
I like to sit under the tree to read a book or just relax and chat with friends	66%	32%	2%	0%	0%	4.29±0.04
A visit to the park after a stressful day makes me feel better and calm	64%	22%	4%	8%	2%	4.38±0.03
Trees add colour to our environment and make it look beautiful	62%	34%	2%	2%	0%	4.49±0.04
I am willing to pay slightly more for a house that has trees	54%	24%	5%	8%	8%	4.01±0.05
Given global warming issues, trees are even more important now than ever	48%	42%	6%	4%	0%	3.99±0.08

Appreciation of the intangible benefits	Bela-Bela- Informal					
	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean scores and SE
I feel trees are an important part of my culture	56%	40%	4%	0%	0%	3.89±0.08
The beauty of nature and trees is a gift from our creator	54%	40%	6%	0%	0%	3.09±0.06
I feel trees are an important part of history and heritage in my community	54%	44%	2%	0%	0%	3.66±0.07

Appreciation of the intangible benefits	Bela-Bela- Formal					
	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean scores and SE
Parks are great places to bond /relax with family and friends	58%	38%	4%	0%	0%	4.67±0.04
I like to sit under the tree to read a book or just relax and chat with friends	68%	26%	2%	4%	0%	4.89±0.03
A visit to the park after a stressful day makes me feel better and calm	58%	24%	14%	2%	0%	4.08±0.04
Trees add colour to our environment and make it look beautiful	70%	28%	2%	0%	0%	4.99±0.02
I am willing to pay slightly more for a house that has trees	60%	26%	2%	8%	4%	4.21±0.07
Given global warming issues, trees are even more important now than ever	58%	36%	2%	2%	2%	3.79±0.09
I feel trees are an important part of my culture	54%	40%	4%	2%	0%	3.09±0.06
The beauty of nature and trees is a gift from our creator	60%	40%	0%	0%	0%	4.77±0.04
I feel trees are an important part of history and heritage in my community	54%	40%	6%	0%	0%	3.06±0.06

Appreciation of the intangible benefits	Tzaneen- RDP					
	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean scores and SE
Parks are great places to bond /relax with family and friends	60%	24%	6%	8%	2%	4.47±0.07
I like to sit under the tree to read a book or just relax and chat with friends	90%	8%	2%	0%	0%	4.91±0.02
A visit to the park after a stressful day makes me feel better and calm	76%	16%	6%	2%	0%	4.68±0.04
Trees add colour to our environment and make it look beautiful	74%	20%	6%	0%	0%	4.56±0.04

Appreciation of the intangible benefits	Tzaneen- RDP					
	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean scores and SE
I am willing to pay slightly more for a house that has trees	82%	16%	2%	0%	0%	4.85±0.05
Given global warming issues, trees are even more important now than ever	84%	16%	0%	0%	0%	4.89±0.04
I feel trees are an important part of my culture	62%	34%	4%	0%	0%	4.43±0.07
The beauty of nature and trees is a gift from our creator	68%	30%	2%	0%	0%	4.36±0.04
I feel trees are an important part of history and heritage in my community	68%	28%	4%	0%	0%	4.32±0.04

Appreciation of the intangible benefits	Tzaneen- Informal					
	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean scores and SE
Parks are great places to bond /relax with family and friends	72%	28%	0%	0%	0%	4.87±0.04
I like to sit under the tree to read a book or just relax and chat with friends	74%	20%	4%	2%	0%	4.71±0.04
A visit to the park after a stressful day makes me feel better and calm	54%	42%	4%	2%	0%	2.99±0.07
Trees add colour to our environment and make it look beautiful	68%	32%	0%	0%	0%	4.87±0.04
I am willing to pay slightly more for a house that has trees	70%	28%	0%	2%	0%	4.56±0.04
Given global warming issues, trees are even more important now than ever	74%	26%	0%	0%	0%	4.79±0.04
I feel trees are an important part of my culture	80%	20%	0%	0%	0%	4.81±0.03
The beauty of nature and trees is a gift from our creator	70%	30%	0%	0%	0%	4.56±0.04
I feel trees are an important part of history and heritage in my community	68%	28%	0%	4%	0%	4.31±0.04

Appreciation of the intangible benefits	**Tzaneen- Formal**					
	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean scores and SE
Parks are great places to bond /relax with family and friends	64%	22%	6%	8%	0%	4.57±0.07
I like to sit under the tree to read a book or just relax and chat with friends	86%	10%	2%	2%	0%	4.91±0.03
A visit to the park after a stressful day makes me feel better and calm	70%	22%	8%	0%	0%	2.59±0.04
Trees add colour to our environment and make it look beautiful	86%	14%	0%	0%	0%	4.89±0.04
I am willing to pay slightly more for a house that has trees	84%	14%	0%	0%	2%	4.86±0.05
Given global warming issues, trees are even more important now than ever	72%	24%	0%	4%	0%	4.59±0.04
I feel trees are an important part of my culture	72%	26%	2%	0%	0%	4.51±0.03
The beauty of nature and trees is a gift from our creator	78%	18%	4%	0%	0%	4.66±0.05
I feel trees are an important part of history and heritage in my community	64%	28%	8%	0%	0%	4.571±0.04