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Health and the nature of urban green spaces

May Elizabeth Carter
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Health and the nature of urban green spaces

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**This thesis is presented in fulfilment of the requirements for the
degree of Doctor of Philosophy (Environmental Management)
Faculty of Computing, Health and Science
Edith Cowan University**

June 2009

USE OF THESIS

The Use of Thesis statement is not included in this version of the thesis.

Declaration

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- (i) incorporate without acknowledgment any material previously submitted for a degree or diploma in any institution of higher degree or diploma in any institution of higher education;
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Abstract

Recognition that city-dwelling people can benefit from contact with nature is not new. The urban open air movement of the 19th century advised retention of greenways and development of urban parks and gardens to stop disease spread through lack of fresh air, poor sanitation and overcrowding. Now, in the early 21st century, urban green spaces are under threat from inner city infill projects and clearing of remnant vegetation to accommodate suburban sprawl.

While much literature discusses positive health benefits of contact with nature, few studies explore explicit pathways between urban green space and health, despite mounting concern that disassociation between people and nature in urban communities may be detrimental to physical and mental health. This study explored how people's attitudes toward nature might influence perceptions of nearby green spaces and feelings of attachment to living in their neighbourhood, and in turn, whether people with positive attitudes towards nature and positive perceptions of nearby green space would report better health.

A mixed method research design was adopted in this study. Exploration of research questions required objective measurement of relationships between different aspects of health and nature, and interpretation of the subjective meanings people attach to those relationships. Study design involved distribution of a cross-sectional survey to residents in four neighbourhoods in Perth, Western Australia with respondents invited to participate in a semi-structured interview. Neighbourhoods were selected based on location (either an inner or outer suburban area), age of neighbourhood (established or new), diversity of nearby green space, and socio-demographic characteristics. Data from 440 surveys and 25 interviews were analysed.

Attitudes towards urban nature were diverse and it was clear that feelings about natural environments strongly influenced preference and perceptions of useable green spaces, and for some people, their choice of neighbourhood. In essence, people who enjoyed spending time in nature were more inclined to seek green spaces within their neighbourhood environment that provided complexity and opportunities for exploration or escape. Those who professed little connection to nature and saw bushland areas as untidy, uninviting or unsafe, tended to be more concerned about aesthetic and functional

aspects of green space design and preferred to visit 'civilised' parks and gardens with manicured lawns, formal paths and playgrounds.

Green spaces were important sites for physical activity, relaxation and social interaction and proximity to useable green space was a significant factor in predicting better self-reported health. In addition, neighbourhoods with trees and greenways were described as healthier places to live. People who lived in close proximity to parks and green spaces where social interaction regularly occurred, who reported that diverse green spaces and bushland areas were being retained in their neighbourhood, who cared about environmental issues and were interested in being involved in conservation activities, were more likely to report better physical function, general health, mental health and feelings of vitality. People who regularly visited nearby green spaces described feeling happier and more satisfied with living in their neighbourhood.

Encouraging people to regularly visit and become actively involved in caring for local nature reserves and parklands can play an important role in health promotion and preventive health strategies. Conservation, useability and management of diverse green spaces must be considered as a critical element of urban planning. This will only occur with continuing recognition of the health benefits that can be achieved by retaining diverse, quality green spaces within suburban neighbourhoods.

Acknowledgements

This project was accomplished with the support of many others. Foremost, I wish to thank my supervisors, Associate Professor Pierre Horwitz and Professor Sherry Sagers for their unflagging encouragement and resolve. Pierre and Sherry shared my academic triumphs, my tears and tantrums and taught me to work through each stage of the project, just one day at a time. I am a better person for knowing them.

To the people who responded to the survey and welcomed me into their lives to share their stories, I am extremely grateful. I wish to thank Jill Symons, Kerry Fry, Ute Goelt and Johnathon Busing for their help in distributing the survey and for their ongoing interest in my progress. Likewise, I am very grateful for the support of the Edith Cowan University academic community. Apart from financial support from the university itself, the interest displayed by staff and students in this project was very gratifying.

My family and friends endured many conversations dominated by the words *green* and *space*. I thank them for their patience. I particularly thank Sabrina Hahn for spending many hours talking with me and for giving me many reasons to finish what I started.

On a more personal level, I could not have begun this project without the support of Glenn Iles. My partner in life, Glenn has been with me since the early days of undergraduate study and this thesis is his achievement as much as mine. I also thank him for Mali and Jasper, our two dogs. They provided me with the best excuses to spend time away from the computer, exploring green spaces around our neighbourhood.

And finally I wish to acknowledge Julie Belle Isle who is no longer here to see the final result. Julie's incredible enthusiasm for life continues to inspire me. I dedicate this thesis to her and to all women who motivate others through their friendship.

The goal of life is living in agreement with nature.

Zeno, Greek philosopher, (335-264 BC)

*The tree which moves some to tears of joy is in the eyes of
others only a green thing that stands in the way. Some
see nature all ridicule and deformity... and some scarce
see nature at all. But to the eyes of the man of
imagination, nature is imagination itself.*

William Blake, English poet (1757-1827)

*Suburbia is where the developer bulldozes out the trees,
then names the streets after them.*

William E. (Bill) Vaughan, American columnist (1915-1977)

*Land as capital, heritage, nature,
as investment, inspiration, home.
All finite,
all requiring care.
So, add planning and ecology as wisdom,
for nature's future, our future.*

Richard T. T. Forman , American landscape ecologist (2008, p. xx)

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Chapter 1: Introduction

The impetus for this research project came while I was managing a state government-funded environmental education and activity program that was designed to encourage people of all ages to explore urban bushland and nature reserves in Perth, Western Australia. Apart from promoting environmental education and outdoor recreation, the underlying aim of this program was to foster interest in conservation through positive interactions between people and nature. To further heighten awareness of the value of nature and enhance opportunities for community involvement in urban conservation, the agency I was working for adopted the *Healthy Parks Healthy People* program initiated by another state government agency, Parks Victoria. This program:

... encourages people to enjoy the outdoors, experience and appreciate nature through recreation and involvement in voluntary activities. The program aims to demonstrate the link between a healthy parks system and a healthy community. By doing this, and encouraging individuals to value the natural environment, it will contribute to the protection of our biodiversity (Parks Victoria, 2005, p. 163).

As I became more involved in the implementation of this program in Western Australia, I began to think about how it might be possible to demonstrate links between healthy parks and healthy people. While I understood how community involvement in conservation activities might contribute to a “healthy” parks system, what really interested me was exploring whether experiencing nature did result in better health outcomes for people.

For me, entering a bushland area is like walking into welcoming arms, but over the many years I worked in nature-based recreation and education, I observed that this feeling was not universal. If people are fearful or simply do not enjoy contact with nature, can they still gain health benefits? Do people who feel comfortable and experience positive emotional or spiritual connections to natural environments derive more health benefits from contact with nature? While much literature espoused the potential health benefits of contact with nature, there seemed to be little that explored relationships between health outcomes and the values, preferences and perceptions people held about nature and natural environments.

Another set of questions relating to health and contact with nature also interested me. The environmental education and activity program I was managing focused on exploring urban nature. Much new residential development was occurring within the Perth metropolitan area, with infill of inner suburbs and new sprawling suburbs being created on the outskirts. Allocations of both private and public open space in many new residential developments appeared to be smaller than in older, more established neighbourhoods, and this observation was supported by research conducted in several Australian capital cities (Grose, 2009; Hall, 2007). If fewer and smaller areas of green space are being retained within urban environments, do people have opportunities to experience nature within their own neighbourhood? Do people living in new neighbourhoods have less access to green space than those living in more established areas? And if so, do they care? Does the presence (or lack) of neighbourhood green space make a difference to how people feel about living in their neighbourhood? Do people get actively involved in caring for neighbourhood parks and nature reserves?

What I wanted to know was whether it was possible to identify any relationships between an individual's values, preferences and perceptions of nature and access to green spaces in their neighbourhood and their health. Literature relating to public health and epidemiology, and from within environmental psychology (the study of interrelationships between human behaviour and environments), social ecology (the study of cultural, political and philosophical relationships between people and their environment) and human geography (the study of human interaction with physical environments) proved to be useful starting points in determining what was currently known about relationships between health and nature in neighbourhood environments.

With such multi-dimensional issues to consider, this study presented many challenges. My past academic and research experience was anchored within leisure sciences and community studies, my employment experiences over many years had introduced me to theory and practice in psychology and environmental management, but I had no experience of epidemiological practice and research. My greatest challenge was to develop sufficient breadth of understanding and knowledge of theory, practice and language relating to the various threads that ran through current literature and were relevant to the questions and relationships I wanted to explore. Within this study,

understanding key theoretical concepts and definitions relating to health, ecosystem services, nature, urban green space and neighbourhood was fundamental.

Health

In an urban context, public health epidemiology has a long history of investigating environmental exposures such as pestilence and pollution (Frumkin, Frank, & Jackson, 2004; Jackson, 2003; Pacione, 2003; Sturm & Cohen, 2004). Transmission of infectious disease can be intensified by urban overcrowding and this was once the primary health issue in major cities (Barton & Tsourou, 2000; Thompson, 2007). With improved hygiene and disease control, overcrowding has become less problematic and public health focus has shifted to exploring a broader range of social, cultural and environmental determinants of health and well-being (Eckersley, Dixon, & Douglas, 2001; Ellaway, Macintyre, & Kearns, 2001; Marmot & Wilkinson, 1999; Wilkinson & Marmot, 2003).

The World Health Organisation defines health as “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity” (WHO, 1948) with this definition of health more focused on quality of life rather than diagnosed illness (Ross, Mirowsky, & Goldsteen, 1990). Within social models of health, community influences, living and working conditions, socio-economic status, social activity and mobility within neighbourhood settings of built and natural environments all play a part in determining individual health and well-being (Figure 1.1). In addition, the Ottawa Charter for Health Promotion, adopted by the World Health Organisation (1986), includes a comprehensive list of conditions and resources that promote improved health: peace, shelter, education, food, income, a stable ecosystem, sustainable resources, social justice, and equity.

According to McMichael (2001) the three leading causes of death identified by the World Health Organisation in the 1990s were pneumonia, diarrhoeal disease and perinatal disorders. It is projected that by 2020, coronary heart disease, mental depression and motor vehicle accidents will have taken their place. The increasing incidence of non-communicable chronic diseases in the developed world is raising questions about inter-relationships between health inequalities, lifestyle choices, consumption and new

environmental exposures (McMichael, 2001). Conditions such as cardiovascular disease, hypertension, obesity, diabetes and depression are increasingly prevalent and aggravated by increasing urbanisation, sedentary lifestyles, greater affluence (for some) and associated patterns of consumption.

It is now suggested that a second major epidemiological transition is occurring globally as the result of environmental change, exacerbating the rich-poor gap and eroding social and ecological conditions (McMichael & Beaglehole, 2000). Post-industrial urbanisation and consumption of natural resources has resulted in patterns of climate change, ozone depletion, biodiversity loss, depletion of soil and water supplies and all of these factors have adverse implications for human health (McMichael, 2001). New approaches to population health need to consider the impact of changing ecological conditions, particularly those brought about by poor urban planning (Patz, 2007).

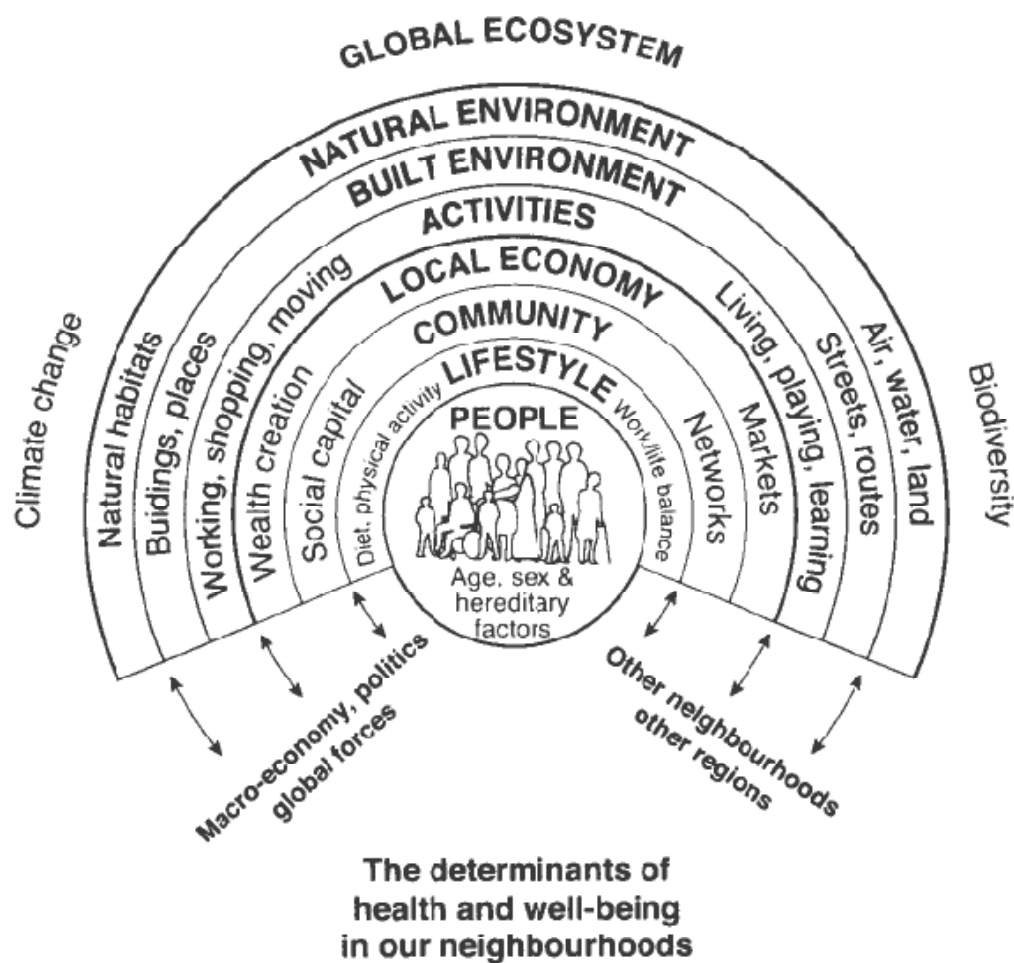


Figure 1.1: The health map (Barton & Grant, 2006)

Social, cultural and environmental determinants interact with each other within a hierarchical chain of causality, with proximal (direct) and distal (intermediary) determinants influencing health outcomes. Proximal determinants may include lifestyle factors (such as diet, level of physical activity, drug misuse, and ability to cope with stress), access to primary health services, social environment (safety and support), and quality of neighbourhood living environment (sanitation, clean air and water). Distal determinants may include effective public health policy, education and literacy, socio-economic status and equity, and access to ecosystem goods and services (Huynen, Martens, & Hilderink, 2005; Victoria, Huttly, Fuchs, & Olinto, 1997). Differences in levels of community safety, social support, and the quality of neighbourhood built and natural environments may lead to different population health outcomes, with health inequalities often attributed to lower socio-economic status (Kawachi, Kim, Coutts, & Subramanian, 2004; Marmot, 2007; Najman, 2001). Recent research also suggests that residents in lower income neighbourhoods are more likely to rate their health as fair or poor if they perceive their neighbourhood environment to be of poor quality (Collins, Hayes, & Oliver, 2009).

Ecosystem services¹

To achieve sustainable health, the complex links between population health and the health of urban and regional ecosystems need to be considered (Chivian, 2002; Neller, 2000; Verrinder, 2007; Wilcox, 2001). Material ecosystem services associated with human health outcomes include provision of resources (air, water, food), supporting systems (nutrient recycling, soil formation) and regulating changes (climate regulation, water purification) (Millennium Ecosystem Assessment, 2005b).

Within urban areas, trees and green spaces provide a number of material ecosystem services. Recognised benefits include: temperature modification, particularly mitigation of the “urban heat island effect” caused by concentration of roads and buildings (Cavanagh & Clemons, 2006, p. 125) and exacerbated by the removal of vegetation, improved air quality through trapping and assimilation of airborne pollutants, and reduction of energy consumption, particularly in relation to use of air-conditioners for

¹ An ecosystem (or ecological system) is a “biotic community and its abiotic [non-living] environment” ” (Krebs, 2001, p. 11) with ecosystems services defined as “the processes through which natural ecosystems and the species they contain, help sustain human life (Krebs, 2008, p. 531).

cooling. Urban green spaces play an important role in stormwater management and can reduce velocity and volume, and improve the quality of water run-off. In addition, vegetated areas provide habitat for flora and fauna which can contribute to increased biodiversity within urban ecosystems (Fam *et al.*, 2008).

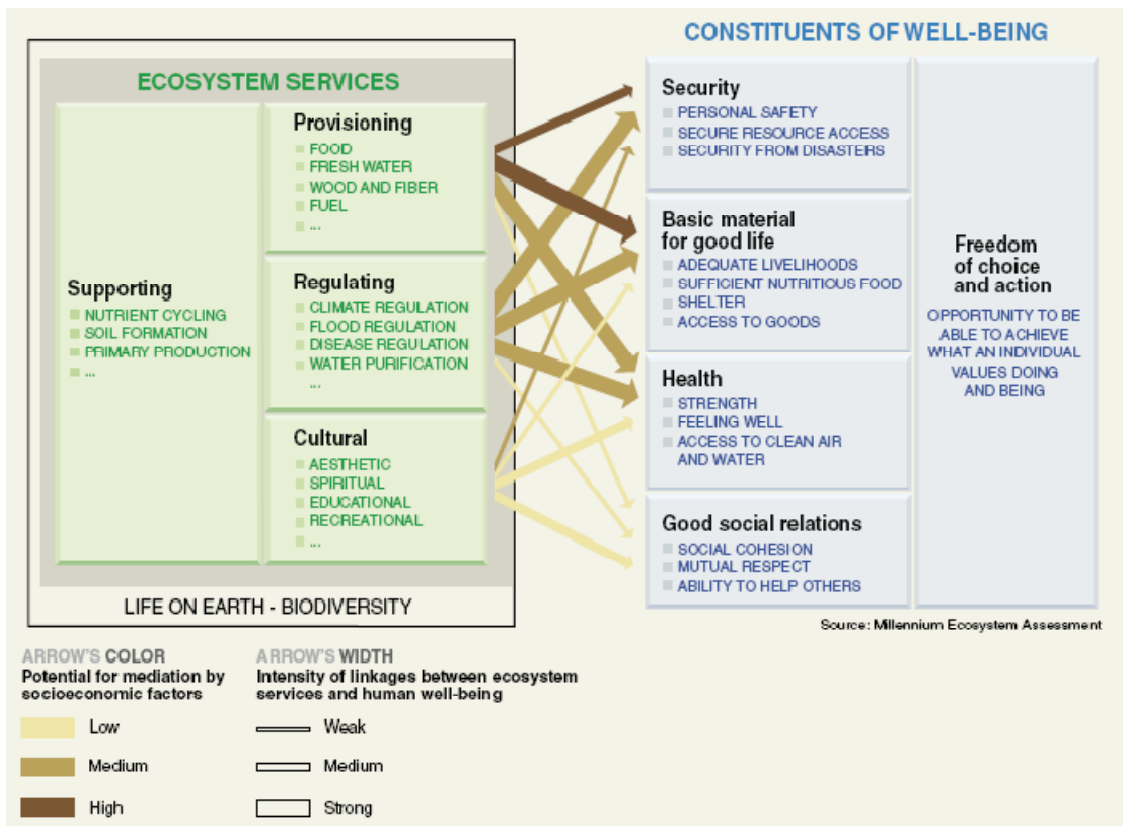


Figure 1.2: Linkages between ecosystem services and human health and well-being (Millennium Ecosystem Assessment, 2005b, p. vi)

Within the model presented here (Figure 1.2), material ecosystem services (supporting, provisioning and regulating services) are most strongly linked to health. Cultural ecosystem services (aesthetic, spiritual, educational and recreational) are associated with health and good social relations, with freedom of choice and action also acknowledged as important constituents of well-being. Despite acknowledgment that human life would cease to exist without ecosystem services, most are generally undervalued in western societies as few generate a quantifiable economic value (Krebs, 2001, 2008). Cultural ecosystem services appear to be most undervalued with some authors (Williams & Patterson, 2008) noting a dominant focus on material ecosystem services within the Millennium Ecosystem Assessment (MA) model (Figure 1.2) and raise their concerns that “the MA model implausibly characterises cultural services as

weak in their contribution to overall well-being compared to other ecosystem services, as well as being subject to relatively low levels of mediation by socio-economic factors”. These authors see cultural ecosystem services as unique within ecosystem services in that they are “socially derivative” with their perceived value and contribution to health outcomes “mediated through human/cultural systems” (Williams & Patterson, 2008, p. 107).

In general, positive relationships between natural environments and human health are often ignored, with people assuming that good health is derived from access to quality infrastructure or health services rather than good environmental conditions (Millennium Ecosystem Assessment, 2005a). While the potential health benefits of utilising natural environments as a site for physical activity are commonly recognised (Bedimo-Rung, Mowen, & Cohen, 2005; Giles-Corti *et al.*, 2005; Pretty, Griffin, Sellens, & Pretty, 2003; Pretty, Peacock, Sellens, & Griffin, 2005), the non-material psychological health benefits of contact with nature (such as mental restoration, connection to cultural heritage or creating a sense of place) are often taken for granted in materially comfortable societies (Millennium Ecosystem Assessment, 2005a).

Nature

Few authors exploring questions about positive relationships between health and natural environments make distinctions between different aspects of nature and human health and wellbeing (Tzoulas & James, 2005). Part of the problem appears to be related to conclusively defining *nature* and *natural environments* and the question about what constitutes “nature” or “native” or “natural” or “wilderness” has generated multiple viewpoints. One author described nature “as among the more elusive and vaguely defined concepts in our vocabulary” (Wohlwill, 1983, pp.6-7) with attempts to define nature and natural environment often using a process of excluding man-made environments such as cities and towns to describe what nature is not. Similarly, in further differentiating between nature and built environments it has been suggested that areas can be classified depending on whether they are the result of “*preserving* stretches of nature within an urban or urbanised area, as opposed to *creating* a park through the planting of trees, grass, and flowerbeds” (Wohlwill, 1983, p. 11). Some authors classify nature as both place and process with its existence dependent on the attitudes, values

and behaviours of societies surrounding it, interweaving nature and society with different effects (Hinchliffe, 2007). Others see understandings of nature occurring at cross-sections of science, religion, philosophy and common sense: providing both rational knowledge and emotional meaning (Milton, 2002).

It is also suggested that most traditional definitions describe nature as nonhuman surroundings, with an artificial dichotomy between what is the result of human influence and what remains untouched or that nature only occurs in places “where the influence of humans is minimal or nonobvious” (Clayton & Opatow, 2003, p. 6). Others refute this definition and speak of nature thriving in urban Australian environments (Archer & Beale, 2005) with some further stating that that the perception of nature as separate from humankind is false and that nature exists all around us (Low, 2002). Others put forward a slightly different view in suggesting that naturalness can be determined by degree and that the value of nature should not be lessened simply because it exists in humanised places (Elliot, 1997).

The notion that nature is somehow removed from urban environments does not take into account the complexity of urban ecosystems and the diversity of spaces and species that co-exist with people in cities and towns (Hinchliffe & Whatmore, 2006). This position is further confounded by the lack of definition surrounding “urban nature” or what Davison and Ridder (2006, p. 307) describe as “no single urban nature” but an “array of contested urban natures”. In addition, Davison and Ridder attest that because nature conservation within urban landscapes is inherently political and dependent on scientific discourse that devalues urban nature and biodiversity, the intense feelings many residents hold for nature in and around their home environments are also often devalued.

Within this study, I make no attempt to provide a definition of either *nature* or *natural environments*. In using these terms I recognise that, depending on context, a variety of definitions and understandings, often derived through social construction or individual experience, may be applied. A key focus of this study was exploring attitudes to nature and perceptions of urban green spaces – the parks, reserves and other green places found in local neighbourhoods. These urban green spaces are important environments

that include diverse vegetation and landscape and play their part in a natural process of city growth and regeneration (Erickson, 2006; Hinchliffe, 2007).

Urban green space

Urban green spaces take many forms, and as found with urban nature, there is some disparity regarding terminology. Most confusion is evident in descriptions of community open space and differing values and interpretations accepted by experts (such as planners or natural resource managers) and by residents (Kaplan, 2004). Terms such as urban green space, public open space, community shared space, green corridors and greenbelts, trails and greenways, nature reserves, conservation areas, bushland, forest, wetlands, sportsgrounds, playgrounds and children's parks, mown parks, landscaped and botanic gardens are often used independently or interchangeably (Kaczynski & Henderson, 2007; Kaplan, 2004). When researchers discuss urban nature or urban green space, most only describe these areas in generic terms (Tzoulas & James, 2004) with little differentiation between nature reserves, parks or other green spaces even though their appearance and ecological composition may be markedly different.

Lack of differentiation is exacerbated by a hierarchical approach to the classification of urban green space using ascending scales based only on size of street, community, county and regional spaces (Erickson, 2006, p. 12). Other approaches adopt open space standards with descriptions such as *neighbourhood park* (playground) and *community park* (playing field) based on average size and most common use (Erickson, 2006, p. 13) or natural green space hierarchies based on size, proximity and population criteria (English Nature, 1995, 2003). This last approach has proven to be problematic as there was little agreement as to what constitutes "natural" green space within an urban environment.

One term gaining acceptance in urban conservation literature is *green infrastructure* (Benedict & McMahon, 2006): defined by Tzoulas *et al.* (2007, p.169) as comprising "all natural, semi-natural and artificial networks of multifunctional ecological systems within, around and between urban areas, at all spatial scales". This definition encapsulates a typology of urban green space developed by Tzoulas and James (2004). The contents of Table 1.1 were adapted from their example and include descriptors of

various forms of urban green space (with minor language modifications for use in an Australian context). This typology was further adapted and used during data collection and analysis in this study.

Table 1.1: Urban green space typology (adapted from Tzoulas & James 2004)

URBAN GREEN SPACES	
Natural and semi-natural green spaces	Bushland, forest, grassland, wetlands, open and running water, wastelands, bare rock habitats.
Green corridors	Riverbanks, road and rail corridors, cycling routes, rights of way and pedestrian paths.
Parks and gardens	Mown grass parkland with trees, formal public and botanical gardens.
Play and social spaces	Play grounds, skateboard parks, hanging out areas.
Outdoors sports facilities	Sports pitches, golf courses, athletic tracks, school ovals, institutional playing areas and other sports fields.
Allotments	Allotments, urban farms, community gardens.
Amenity green spaces	Informal recreational spaces, domestic gardens, streetscapes and other incidental green spaces.
Churchyards and cemeteries	Churchyards, cemeteries, crematoria.

Throughout this thesis, urban green space is often referred to simply as *green space* or as *neighbourhood green space* as the research focused on green areas that were included in the landscape close to where people lived: their neighbourhood.

Neighbourhood

Like nature, neighbourhood can have many different meanings depending on use. In simple terms, neighbourhood is understood to mean people's "local living environment" (Talen & Shah, 2007, p. 584) though even this definition must be considered within spatial and social contexts. From an historical perspective, urban planning guidelines introduced in the 1920s described neighbourhood as a physically defined unit, designed to allow residents to walk no more than one-quarter mile (approximately 400 metres) to nearby community and commercial facilities (Lawhon, 2009). This early definition of neighbourhood continues to influence local planning and subdivision design. Liveable Neighbourhoods Planning Guidelines, first introduced in Western Australia in 1997, were designed to facilitate development of sustainable communities. Under these guidelines, neighbourhoods are represented in district structure plans by circles with a radius of approximately 400-450 metres from town and neighbourhood centres (Western Australian Planning Commission [WAPC], 2004).

Within health literature, neighbourhood is variously defined. Depending on context, neighbourhoods may be represented by physical, structural or social characteristics (Wandersman & Nation, 1998). Exploring differences between health outcomes and neighbourhood settings is the focus of much research and discussion. Neighbourhoods are variously defined by location, spatial boundaries, socio-economic status, ethnic composition, residential patterns, family structure and perceptions of community safety and cohesion (Altschuler, Somkin, & Adler, 2004; Barton, Grant, & Guise, 2003; Bowling, Barber, Morris, & Ebrahim, 2006; Collins *et al.*, 2009; Ellaway *et al.*, 2001; Ross, Tremblay, & Graham, 2004). The tension between defining neighbourhood as a physical or a social setting is explored within literature, with some authors suggesting that features of both place and people need to be explicitly considered in health research (Macintyre, Ellaway, & Cummins, 2002).

Literature addressing neighbourhood attachment and satisfaction also discusses definitions of neighbourhood, with levels of residential satisfaction often associated with perceptions of spatial, social and functional aspects (Bonaiuto, Aiello, Perugini, Bonnes, & Ercolani, 1999; Talen & Shah, 2007). Geographical limits (such as major roads), landscape features and socio-historical aspects of neighbourhood settlement are commonly used to describe neighbourhood boundaries (Talen, 1999; Talen & Shah, 2007; Uzzell, Pol, & Badenas, 2002).

In some neighbourhood studies, definition of neighbourhood is left up to individuals (Bonaiuto *et al.*, 1999; Bonaiuto, Fornara, & Bonnes, 2003; Uzzell *et al.*, 2002) and in this study, no specific definition of neighbourhood was provided to survey respondents or interview participants. In discussing the findings of this study, neighbourhood is variously defined as a setting for health, as a physical place with unique form and landscape features, and as a social construct determined by historical development and socio-demographic characteristics. The process of selecting neighbourhoods for inclusion in this study, and the characteristics of those neighbourhoods, are described in Chapters 3 and 4.

Aim and significance of this study

This study aims to explore the intersection of human health and cultural ecosystem services through identification of relationships between self-reported health and attitudes, perceptions and attachments to urban green space within different neighbourhood environments. Much prior research exploring relationships between urban environmental quality, well-being and quality of life often occurs within a single discipline and integration of physical, life and social sciences is necessary to understand the many issues involved (Brown, 2003). The use of a mixed-method, cross-sectional design in this study presents an opportunity to explore relationships from several perspectives. It is expected that findings from this study may inform practice and policy in urban parks and recreation services, natural area management, health promotion, community development and neighbourhood planning.

Overview of the thesis

This thesis is presented in eight chapters. In Chapter 2, I explore literature relating to health, nature and green space in urban environments. This includes literature on urban planning, urban nature, neighbourhood green space and neighbourhood attachment. In Chapter 3, the specific research questions and the study design, including ethical considerations and limitations, are discussed. Chapter 4 includes an overview of the physical and demographic characteristics of neighbourhoods selected for this study and descriptions of study participants.

In Chapter 5, I present participants' views of nature and natural environments including exploration of individuals' values, beliefs and attitudes and how people defined nature and natural environments in urban settings. In Chapter 6, opinions about neighbourhood green space are explored with particular reference to issues of preference and the influence of green space on perceptions of residential quality and neighbourhood attachment. In Chapter 7, relationships between self-reported health and attitudes to natural environments, proximity to green space, perceptions of green space quality and neighbourhood attachment are examined. In Chapter 8, I synthesise the study findings and discuss their relevance within the context of current literature. I conclude this thesis by making recommendations for future research and exploring application of the study findings.

Chapter 2: Contemplating health and urban nature

Health, nature and urban green space

Recognition that city-dwelling humans benefit through contact with nature is not new. In the late 18th century (at about the same time as Australia was being colonised by British settlers), residents of England's cities were encouraged to take journeys to the Lake District to admire the beauty of nature and experience peace and relaxation (de Botton, 2002, p. 88). William Wordsworth was instrumental in promoting English nature experiences and by 1850 (the time of his death), his suggestion "that regular travel through nature was an antidote to the evils of the city" was widely accepted (de Botton, 2002, p. 136).

In the latter half of the 19th century, the "urban open air movement" advocated for the development of parks and gardens to ensure fresh air to stop the "miasma" of disease that spread through crowded city streets (Parsons, 1991, p. 3). During that time, support for the establishment of public green spaces was often linked to public health. Frederick Law Olmstead's development of Central Park in New York City (1857-1871) was in direct response to concerns about the incidence of disease many believed was exacerbated by lack of fresh air, narrow streets and overcrowding (Frank, Engelke, & Schmid, 2003). Central Park was promoted as a place for physical activity, promenade and social interaction – with appropriate social behaviour mirroring 19th century middle-class values and mores (Taylor, 1999). Perth's Kings Park, gazetted as public reserve in 1872, was the first city park in Australia and its relevance to this study is explained in subsequent chapters. Originally comprising 175 hectares, by the time this park was officially opened as Perth Park in 1895 its size had increased to more than 400 hectares (Department of Premier and Cabinet, 2004).

Despite the advent of public city parks more than 100 years ago, investigation of the potential health benefits of contact with urban nature is a relatively new area of study. Emerging interest in this subject area is indicated by the number of comprehensive literature reviews recently published in Australia (Maller, Townsend, Brown, & St Leger, 2002a, 2002b; Maller *et al.*, 2008), the United States (Gies, 2006), the United Kingdom (Henwood, 2002; Morris, 2003; Tzoulas *et al.*, 2007) and the Netherlands

(Health Council of the Netherlands and Dutch Advisory Council for Research on Spatial Planning Nature and the Environment, 2004). The scope of literature reviewed in these documents spans public health, psychology, community studies, environmental health, ecosystem health, and urban planning and landscape design with each review adopting a slightly different focus. One UK study drew together literature to explore the question of how environmental agencies might assist in promoting the health benefits relating to stress recovery and psychological health (Henwood, 2002). From a different perspective, a publication from a Scottish open space research centre included economic and environmental benefits in its discussion of health, well-being and open space (Morris, 2003). The US-based Trust for Public Lands published a short review that extolled the benefits of physical activity in areas such as parks and playgrounds, greenways, trails and community open spaces (Gies, 2006). A recent Australian review took a different approach, using a triple-bottom line model to explore the environmental, social and economic benefits of maintaining urban green spaces (Fam *et al.*, 2008).

Despite their different foci, almost all of these published reviews draw heavily on seminal research that explored the psychological benefits of contact with nature. These early investigations found that views of green environments were conducive to stimulation of mental cognition and stress relief and that nature could provide places for solace and refuge (Ulrich, 1981, 1983, 1984, 1986a, 1986b). One cornerstone of this research was a nine-year study tracking patients' recovery from gallbladder surgery (Ulrich, 1984). This natural experiment enabled examination of the post-surgery recovery rate of 45 hospital patients who had a view through their window of either a blank wall or a park with trees. It was found that patients with a green view recovered better and left hospital sooner after surgery. A comparable study undertaken at Michigan State Prison indicated that prisoners with a view outside made fewer demands for health care services (Moore, 1981).

The development of "attention restoration theory" (ART) (Kaplan & Kaplan, 1995) complemented Ulrich's early psycho-evolutionary theories (PET) (Herzog & Strevey, 2008). Theories of "attention restoration" and "effective functioning" are linked to feelings of "being away", of "extent" or escape, of "fascination" and "compatibility" that are in turn, associated with preferred elements of security, competence, mystery,

complexity and coherence within natural environments (Kaplan & Kaplan, 1995, pp. 175-186). ART and PET theories are the most consistent area of research relating to contact with nature and health. Extensive quasi-experimental studies, and others using photo array and survey techniques, have focused on exploring relationships between viewing nature and the alleviation of mental (or attention) fatigue and stress reduction (Kaplan, 1983, 1984; Kaplan & Kaplan, 1995; Kaplan, 1995) and the notion that natural settings enable psychologically restorative experiences (Herzog & Barnes, 1999; Herzog, Black, Fountaine, & Knotts, 1997; Herzog & Bryce, 2007; Herzog, Chen, & Primeau, 2002; Herzog & Chernick, 2000; Herzog, Maquire, & Nebel, 2003).

Restorative benefits are closely linked to personal preference for particular environments that promote relaxation and stress relief (Korpela, Ylén, Tyrväinen, & Silvennoinen, 2008; Regan & Horn, 2005) or provide feelings of security and opportunities for exploration and discovery (Herzog & Bryce, 2007; Herzog *et al.*, 2002; Herzog & Miller, 1998; Herzog & Stark, 2004). The main features of preferred landscapes are openness with sufficient trees and other vegetation to provide a sense of mystery and discovery without feeling enclosed or entrapped (Kaplan & Kaplan, 1995). Other key features include coherence, smooth ground, mystery, a sense of depth and openings (Kaplan, Kaplan, & Ryan, 1998). Least preferred landscapes are large open spaces that offer little differentiation and densely forested areas where visibility is limited.

Two further components of preference were identified as “prospect” and “refuge” (Appleton, 1975) where “prospect is the opportunity to gain a clear view, refuge is the opportunity to hide from the view of others” (de la Fuente de Val, Atauri, & de Lucio, 2006, p. 394). It is suggested that one end of the preference spectrum relates to safety and feelings of familiarity and the other, to complexity and mystery (Herzog & Bryce, 2007).

Other authors have used ART and PET theories as the basis for further research on the importance of visiting favourite places. Visitors to favourite places can experience additional restorative benefits including regulation of emotions and feelings and reflection on personal goals (Hartig, Evans, Jammer, Davis, & Garling, 2003; Hartig, Kaiser, & Bowler, 2001; Hartig, Mang, & Evans, 1991; Korpela & Hartig, 1996;

Korpela *et al.*, 2008). In these research studies, participants almost invariably nominated a natural setting as their favourite place. It is now being suggested that promoting psychologically restorative experiences in nearby favourite places might be an important factor in primary healthcare (Korpela *et al.*, 2008).

From a different perspective, research conducted with residents in inner city Chicago neighbourhoods focused on the role of urban green space in addressing issues of violence, aggression and community safety (Coley, Kuo, & Sullivan, 1997; Kuo, 2001; Kuo, Bacaicoa, & Sullivan, 1998; Kuo & Sullivan, 2001; Kuo, Sullivan, Coley, & Brunson, 1998). Using structured interviews, common findings in these studies were that the presence of attractive, well-maintained open spaces with trees and grass encouraged higher levels of use, with fewer incidences of violence and aggression observed in greener spaces than in barren areas (Sullivan, Kuo, & DePooter, 2004). Positive behaviours such as social interaction and creative play by children were also observed (Taylor, Wiley, Kuo, & Sullivan, 1998) and more recent research specifically focused on health outcomes for children with attention deficit disorders. Using pre- and post-testing, it was found that a 20-minute walk in a park was enough to significantly improve concentration and it was suggested that “doses of nature” may be beneficial in managing the symptoms of attention deficit hyperactivity disorder (ADHD) (Taylor & Kuo, 2008, p. 6).

Exploring links between green space and physical activity is another common research theme with chronic illness such as cardiovascular and respiratory disease, diabetes, and obesity all exacerbated by low levels of physical activity (Hoehner, Brennan Ramirez, Elliott, Handy, & Brownson, 2005; Jackson, 2003; Schoeppe & Braubach, 2007). A five-year study conducted in Japan explored senior citizens’ use of green spaces and found that local access to walkable (pedestrian friendly) green spaces had a positive influence on longevity (Takano, Nakamura, & Watanabe, 2002). Apart from exercise in the form of walking, cycling or play, involvement in nature conservation and gardening activities can be beneficial to health. In an Australian study, people involved in a local conservation project reported better general health and a greater sense of belonging in their community than the control group who were not involved (Moore, Townsend, & Oldroyd, 2006). In a UK-based community program for people with mental health problems, working with others while in contact with nature highlighted the therapeutic,

social and physical activity benefits of gardening (Parr, 2005). Evaluation of two Chicago-based prairie conservation programs found being physically active was only one of many benefits associated with involvement (Miles, Sullivan, & Kuo, 1998, 2000). More important benefits reported by participants included spending time in nature, taking part in something meaningful, working with others, and the satisfaction of knowing they were making a positive contribution to preserving local environments.

Much research focuses on the psychological and physiological benefits of exercising and being active in green spaces. Using multi-variate analysis techniques, an Australian study found stronger relationships between positive self-reported mental health outcomes and the presence of neighbourhood green space, than between green space and physical health outcomes (Sugiyama, Leslie, Giles-Corti, & Owen, 2008). Advocates for the synergistic physiological and psychological benefits of “green exercise” are emerging, with researchers demonstrating positive effects on blood pressure, self-esteem and mood resulting from exposure to scenes of natural areas while running (Pretty *et al.*, 2003; Pretty *et al.*, 2005).

In other studies, logistic regression models based on results of resident surveys, audits of public open space and observation of users have been used to measure association between levels of physical activity and features of public open space. Attractiveness and the presence of trees and greenery, proximity to home, and size of public open space all encouraged higher levels of physical activity and community use (Giles-Corti *et al.*, 2005; Giles-Corti & Donovan, 2002a; Hoehner *et al.*, 2005; Pikora, Giles-Corti, Bull, Jamrozik, & Donovan, 2003). On the other hand, two studies using similar methods found little (or non-significant) relationship between levels of recreational physical activity and neighbourhood green space (Hillsdon, Panter, Foster, & Jones, 2006; Maas, Verheij, Spreeuwenberg, & Groenewegen, 2008). Methodological difficulties in defining and measuring green space quality and use, particularly between measures used in different countries, may account for some disparity in findings relating to green space and physical activity (Giles-Corti *et al.*, 2005; Hoehner *et al.*, 2005; Kaczynski & Henderson, 2007).

The *Vitamin G* research program, based in The Netherlands, includes a set of observational studies and incorporated health interview survey data from a substantially

larger primary sample (~250 000 people) than any previous study, with smaller sub-samples used to investigate specific questions relating to green space and health (Groenewegen, van den Berg, de Vries, & Verheij, 2006; Maas, Verheij, Groenewegen, De Vries, & Spreeuwenberg, 2006). As part of the first overarching study (*Vitamin GI*), comparison with existing land use data found a positive relationship between self-reported general health and the percentage of green space within a one and three kilometre radius from home. Elderly and young people (those often the least mobile within a community) appeared to benefit most from the presence of green areas (de Vries, Verheij, Groenewegen, & Spreeuwenberg, 2003; Groenewegen *et al.*, 2006). A similar study using Australian public health data and GIS imagery produced inconclusive results. While survey data collected as part of this project indicated that people liked to live near parks and used them regularly, the broad scale of available public health data (delimited by local government area) made comparison with more detailed socio-economic and landscape data problematic (Barnett, Doherty, & Beaty, 2005).

The most recent findings from the Dutch *Vitamin G* research team suggest that social contact may explain findings relating to better self-reported health for residents in neighbourhoods with more green space. Reports of loneliness and lack of social support were higher in areas with less green space and it was suggested that social contact may act as a mediator between green space and health. It was further suggested that perhaps this finding has more to do with strengthening “sense of community via place attachment and place identity” than actual contact with others in the neighbourhood (Maas, van Dillen, Verheij, & Groenewegen, 2009, p. 593). While these researchers were unable to pinpoint causal links between better health, social contact and green space, they concluded that provision of green space was “more than a luxury” and should be given greater credence in planning policy (Maas *et al.*, 2006, p. 592). They also acknowledge that while they consider it essential for findings of research such as theirs to become implemented in urban planning, not enough was yet known about the specific social and spatial conditions that created beneficial health effects. More research was required before findings could be translated into explicit urban design guidelines.

One set of social and spatial conditions that is acknowledged as directly influencing health outcomes includes lower levels of physical activity, lower socio-economic status and lack of supportive physical environments (Giles-Corti & Donovan, 2002b; Handy, Cao, & Mokhtarian, 2008). Several studies have noted that in neighbourhoods with different socio-economic status, there are corresponding differences in quality and availability of parks and other public green spaces, and in levels of neighbourhood physical activity and health status (Coen & Ross, 2006; Crawford *et al.*, 2008; van Lenthe, Brug, & Mackenbach, 2005).

How green space access might be related to socio-economic and health inequality was explored in some depth by British researchers (Mitchell & Popham, 2008). In an observational study, they classified population groups based on age, income and exposure to green space and examined morbidity records relating to each group. This study demonstrated “independent association between residence in the most green areas and decreased rates of all-cause and circulatory [disease] mortality” (Mitchell & Popham, 2008, p. 1658). Despite these results, Mitchell and Popham were not willing to posit causal links between greenness of residential environments and health inequalities and note that perhaps all their research did was identify better health status in wealthier populations. Even so, they propose that residential environment may affect health and health behaviours and that people living in greener environments are less likely to experience income-related health inequalities: leading to potential economic and social ramifications in highly urbanised, less green communities.

In response to this last study, Hartig (2008) noted that there appeared to be some intertwining of mechanisms relating to access to green space, increased physical activity and decreased stress. Hartig suggests that perceived attractiveness of green spaces as places for physical activity could be directly related to expectations of their potential restorative qualities. In light of prior findings that greater emotional, cognitive and physiological effects result from physical activity in urban green space than built environments (Hartig *et al.*, 2003; Pretty *et al.*, 2003; Pretty *et al.*, 2005), there seems to be a strong case for retaining green spaces in neighbourhood settings. To achieve healthy urban living for all, green space provision must be recognised as a key element in urban planning, rather than considered to be a luxury, accessible only to those who can afford to live in greener neighbourhoods.

Attitudes to natural environments

The history of European relationships with nature is complex: influenced first by Christian beliefs that wilderness represented the banished land with danger and terror found in untamed mountains and forests. Attitudes moderated during the period of Enlightenment (late 17th century) and natural phenomena were seen by some as “marvellous manifestations” of God’s will (Bell, Greene, Fisher, & Andrew, 2005, pp. 26-28). As Europeans began to colonise North America, attitudes again changed with the conquest of wilderness providing the means to secure food, clothing and shelter. It was not until the emergence of the Romantics (the urban European literary elite) in the early 19th century that rugged wilderness inspired the concept of the “sublime” where visually striking natural features were regarded with awe and reverence (de Botton, 2002, p. 155). Later, 19th century writers such as Henry David Thoreau and John Muir influenced North American literary tradition and philosophy as each strongly advocated appreciation and protection of natural areas (Bell *et al.*, 2005). Within western countries, some authors consider that the general public have strong “nature-friendliness” and recognise the intrinsic value of retaining natural environments (van den Born, Lenders, de Groot, & Huijsman, 2001, p. 65).

Several authors have attempted to explain human connections to nature. Kellert and Wilson (1993) explored the *biophilia* and *biophobia* hypotheses, first presented by Wilson (1984) who suggested that people have an innately emotional affiliation to other living organisms (*biophilia*) and an evolutionary aversion to dangerous aspects of nature such as snakes and spiders (*biophobia*). The associated emotional spectra moves “from attraction to aversion, from awe to indifference, from peacefulness to fear-driven anxiety” with responses influenced by culture and experience (Wilson, 1993, p. 31). The idea that evolution plays a role in human-nature connection expands into landscape preference. It is suggested that people universally prefer open savannah-like landscapes with views of water. This landscape description is associated with African savannah: the birthplace of humans (Ulrich, 1983, 1986a, 1986b). The savannah hypothesis, explored in depth by Ulrich (1993) and others (Joye & Van Locke, 2007) makes a direct link between preference for this type of landscape and positive aesthetic and restorative responses.

Many researchers refer to the biophilia hypothesis (Gullone, 2000; Kahn Jr, 1999; Kellert, 1993; Kellert & Wilson, 1993; Wilson, 1984, 1993) and support the notion that humans are inherently biophilic and have an innate connection to other living things. While Wilson and Ulrich speak of evolutionary processes that dictate connection and preference, Milton (2002) sees connection to nature as a more instrumental process, with the experience of nature producing emotion, perception and memory, and connections based on aesthetic preference, exploration and emotional attachment to specific places.

Other authors also focus on the importance of tactile or sensuous experiences, whether physically exploring, touching, smelling or simply viewing nature as important factors in developing connection to nature and attachment to specific places (Kaplan & Kaplan, 1995; Ryan, 2005). Attachment through regular experience of a favourite place is strongly supported as an important outcome of human-nature contact (Korpela *et al.*, 2008). Others adopt a psychological perspective in suggesting that identification with nature forms an important part of individual identity and self-concept (Clayton, 2003) with environmental connection based on emotional or historical attachment or collective identity, providing a sense of being part of a larger whole and recognition of similarity between others and ourselves. As a motivating force, strong environmental identity may shape personal, social and political behaviour.

Exploring links between emotions, experience, positive attitude and pro-environmental behaviours are also the subject of much research. Ecocentric (biocentric or ecosystem focused) or anthropocentric (human-centred and focused) orientations towards nature are identified by some as polar extremes of environmental attitude (Eckersley, 1992). Using several methodological approaches over a number of years, Kahn (1999) explored environmental behaviours, perceptions of nature, and environmental knowledge as predictors of ecocentric or anthropocentric values. He found that moral reasoning and judgement determined how people justified their use of natural resources or expressed concern about environmental issues. A recent study used a mail survey to explore relationships between sense of connectivity to nature and environmental values. Findings suggest that personal connection to nature (and political views) may have more influence on an individual's environmental values or attitudes than demographic factors such as age or education (Dutcher, Finlay, Luloff, & Johnson, 2007, p. 487).

More interestingly, while respondents to this survey mostly recorded high scores in environmental connection and concern scales, the majority indicated they did not practise pro-environmental-focused behaviours. It was found, however, that education played a role in influencing other pro-environmental activities such as making a donation, volunteering or political activism. Others identify affective (emotional) connection as one of the primary drivers of positive attitudes and values towards natural environments and intention to engage in pro-environmental behaviours (Hinds & Sparks, 2008). Childhood experience is often cited as an important determinant of environmental attitude and connection to nature in later life (Louv, 2005; Thompson, Aspinall, & Montarzino, 2008; van den Born *et al.*, 2001).

To measure the values people place on nature and natural environments, Kellert (1993, p. 59) drew on Wilson's biophilia hypothesis to develop a typology of environmental values (Table 2.1). Using this typology, Kellert investigated differences in values towards nature based on factors such as age, culture and place of residence (urban and rural). He found that values were shaped by the "formative influence of experience, learning and culture" and the erosion of expression of these values could "lead to a deprived and diminished existence" (1996, p. 9). These values and associated notions of nature can be influenced by individual experience, feelings of biophilia, affective connection, personal identity or political conviction and could be categorised as experiential, emotional, philosophical or functional².

Other authors have built on value-based research to develop a range of scales that measure environmental attitudes or perceptions. Each of these scales differs in conceptual or theoretical focus, though all measure some form of human behaviour or response in order to predict probable behaviours or attitudes (Table 2.2).

²The categorisation of environmental values as experiential, emotional, philosophical and functional represents my re-interpretation of Kellert's values as they relate to reviewed literature. These categories are used as reference points in this, and subsequent, chapters.

Table 2.1 Typology of environmental values (adapted from Kellert, 1993, p. 59)

Environmental values		Definition	Outcome
Experiential	Naturalistic	Satisfaction through direct experience/contact	Curiosity, outdoor skills, mental/physical development
	Aesthetic	Physical appeal and beauty	Inspiration, harmony, peace, security
Emotional	Humanistic	Strong affection, emotional attachment, “love”	Bonding, sharing, cooperation, companionship
	Negativistic	Fear, aversion and alienation	Security, protection, safety
Philosophical	Symbolic	Metaphorical expression, language and thought	Communication, mental development
	Moralistic	Strong affinity, spiritual reverence, ethical concern	Order and meaning, kinship and affiliation
Functional	Utilitarian	Practical and material exploitation	Physical sustenance and security
	Dominionistic	Mastery, control and dominance	Skill and prowess, ability to subdue
	Ecologicistic-scientific	Study of structure, function and relationship	Knowledge, understanding, observation

Table 2.2: Scales for measuring environmental attitudes, values and perceptions

Scale and author/s		Focus
NEP	New Ecological Paradigm (Dunlap, Van Liere, Mertig, & Jones, 2000)	Measures belief in balance of nature and pro-environmental orientations
MTES	Motivation Toward the Environment (Pelletier, Tuson, Green-Demers, Noels, & Beaton, 1998)	Measures motivation to protect natural environment
INS	Inclusion of Nature in the Self (Schultz, 2001)	Measures perception of self as part or apart from nature
CNS	Connectedness to Nature (Mayer & Frantz, 2004)	Measures trait levels of feeling of emotionally connected to the natural world
NRS	Nature Relatedness (Nisbet, Zelenski, & Murphy, 2008)	Measuring personal awareness, perspective and experience
EID	Environmental Identity (Clayton, 2003)	Measures importance of nature to self–concept
EAS	Environmental Attitudes (Gagnon Thompson & Barton, 1994)	Measures attitudinal values of ecocentrism, anthropocentrism or apathy

The New Environmental Paradigm (NEP) scale was first published in 1978, with a revised version appearing more recently and renamed the New Ecological Paradigm scale to reflect changes in accepted terminology (Dunlap *et al.*, 2000). It is perhaps the most commonly used scale and its primary focus is the measurement of environmental concerns at a broad philosophical (predominately moralistic) level. While well used, this scale provides limited opportunity to explore experiential or emotional connections to natural environments, or perceptions of these environments as places that might provide health benefits.

Of the scales listed in Table 2.2, three focus on measuring only one aspect of environmental value: the Motivation Toward the Environment Scale (MTES) measures motivation to protect; the Inclusion of Nature in the Self Scale (INS) measures perception of self as part of nature; and the Connectedness to Nature Scale (CNS) measures emotional connectedness. Two further scales, the Nature Related Scale (NRS) and the Environmental Identity scale (EID) each include a broader spectrum of items relating most particularly to experiential and emotional values. The final scale listed, the Environmental Attitudes Scale (EAS) is most focused on measuring experiential, emotional and functional values through assessment of ecocentrism, anthropocentrism or apathy towards environmental issues and pro-environmental behaviours.

How environmental values and experience translate into preference for particular types of natural environments, and what this might mean to psychological health, is also an important issue here. Feelings of affinity and aversion to nature can be experienced in different types of landscape and neighbourhood surroundings. As discussed earlier, studies focusing on landscape preference (Herzog & Miller, 1998; Kaplan, 1983, 2004; Kaplan & Austin, 2004; Ulrich, 1986a, 1986b) indicate that people prefer savannah type landscapes that are aesthetically pleasing and evoke feelings of safety and security.

A study of four parkland areas in a London borough explored personal and social associations with nearby open space and found differences in how residents viewed green spaces (Burgess, Harrison, & Limb, 1988). An area of mown grass open space (the local common) was described as devoid of nature and boring. There was strong preference for environments that provided variety and opportunities for social interaction. Residents found the woodland area to be the most attractive, not only for its physical features but because it triggered childhood memories and pleasant associations with nature. The scrubland was described as interesting but there was some fear expressed by residents regarding safety and uncertainty whether they would visit or walk in this type of environment. This fear was also expressed by a number of women in relation to the woodland. Despite this, residents still considered woodland and scrubland environments to be an essential part of their community surroundings. There was a strong sense of loss expressed for green areas that had been destroyed through urban development. With this also came a feeling that their children had less

opportunity for physical activity and exploration and would carry fewer local memories and feelings of attachment to neighbourhood places into their adult life.

Other recent research shows similar results. A site-based survey of visitors to two contrasting green spaces (a large botanic garden and a woodland in Sheffield, UK) explored public perceptions of “formal” and “naturalistic” landscape features (Ozguner & Kendle, 2006, p. 143). It was found that people appreciated both types of green space, though made use of different places for different purposes. Design and utility were major factors in preference. For some people, natural landscapes in urban areas were seen to be valueless, unkempt and frightening and neat and tidy, formal or ornamental landscapes were considered more attractive. Perhaps most interestingly, feelings of calmness, relief from stress and a sense of renewal were strongly associated with visiting the botanic garden, while feeling a sense of life, excitement and interest, social interaction and a sense of freedom were more strongly associated with being in the woodland (Ozguner & Kendle, 2006).

No matter what type of green space people seek, areas that are most preferred are open, inviting landscapes with evidence of care (Herzog & Miller, 1998; Herzog & Stark, 2004; Kaplan & Kaplan, 1995; Lothian, 2004; Williams & Cary, 2002). Negative perceptions of nature, particularly feelings associated with apprehension and fear lower the appeal of particular areas and restrict the range and type of activities undertaken (Bixler & Floyd, 1997). It is suggested that increasing levels of fear of injury occurring in natural environments is resulting in avoidance of potential risks, increasing insulation from nature and less direct contact, or contact only occurring in parks and outdoor spaces designed to be as non-threatening and non-challenging as possible (Stilgoe, 2001). Others propose that distancing ourselves from nature through fear may prove detrimental to modern health and highlight the need to sustain nature, even if only for our own benefit (Grootjans, Townsend, Butler, & Heyworth, 2005).

While preference for safe, visually pleasing landscapes may be understandable, it may also be problematic. Making nature neat and tidy with natural features “arranged for human enjoyment” may be considered culturally appropriate and the “aesthetic of care” laden with good intentions of stewardship and community pride (Nassauer, 2008, pp. 364-365). Such actions, however, may cause unintended harm through habitat

destruction or use of herbicides and potentially “create the antithesis of ecological health”. Nassauer further voices her concern that the “picturesque has been so successful in becoming popular culture that scenic landscapes are often assumed to be ecologically healthy”.

Running parallel with this line of thought, concerns are being expressed that increasing disconnection from nature, decline in nature-based recreation and decreasing ecological literacy may have serious implications for the future health of people and the planet (Brewer, 2006; Kareiva, 2008). Maximising health benefits may well be related to the richness and diversity of vegetation and wildlife present within green spaces. Researchers in a UK study interviewed visitors to fifteen different areas of urban green space in Sheffield. Higher scores for positive feelings of reflection, restoration and emotional attachment were recorded by visitors to green spaces with greater biodiversity and species richness (Fuller, Irvine, Devine-Wright, Warren, & Gaston, 2007). The authors suggest that biodiversity conservation, and consideration of the quality and complexity of urban green spaces may significantly enhance human well-being.

Urban planning, neighbourhood green space and health

In the latter part of the 19th century, links between urban planning and health were recognised, particularly in industrialised cities where the need to reduce urban epidemics saw space and infrastructure standards adopted for housing and other land-use zonings (Barton, 2005; Barton & Tsourou, 2000). The notion that open space within cities contributed to health by providing fresh air, was strongly supported by Ebenezer Howard’s Garden City movement in the United Kingdom (1898-1930). Howard advocated for the retention of open spaces and greenbelts in major cities and his vision was to reform urban planning and create new (sub)urban forms that combined the best of town and country: social opportunity and employment with the beauty of nature, fresh air and water and no slums (Frank *et al.*, 2003).

While there is some evidence that Howard’s vision continued to influence urban planning in the United Kingdom and United States during the first part of the 20th century (Jacobs, 1961), post-World War II public policy initiatives provided

transportation and sanitation infrastructure that enabled residential development to move away from inner urban areas, creating conditions that facilitated the advent of suburban sprawl (Frumkin, 2006). As suburban expansion moved outside established metropolitan limits to take advantage of cheaper agricultural land, concerns about land prices meant that greenbelts were more difficult to retain (Frank *et al.*, 2003). In addition, the need for suburban residents to commute to places of employment or drive to larger shopping malls, rather than walk to the local shopping strip, meant that neighbourhood plans that had once focused on quality of life for residents, now incorporated traffic management and vehicle flow as primary considerations (Frank *et al.*, 2003; Frumkin, 2006).

Much recent urban planning and health research has focused on issues relating to vehicle-dominated urban sprawl (Frumkin *et al.*, 2004; Jackson & Kochtitzky, 2001; Sturm & Cohen, 2004). There is some empirical evidence that supports the assumption that urban sprawl is bad for health, with the effects of traffic accidents, increased vehicle-related air pollution and respiratory disease, decreased walking and increased obesity well-documented (Frumkin, 2006; Sturm & Cohen, 2004). Apart from potentially detrimental health outcomes of vehicle dependence, discussion focuses on diminished opportunities for physical activity and social interaction (Frank *et al.*, 2003; Frumkin, 2006; Giles-Corti, 2006). Emerging research is exploring the role of neighbourhood green space in encouraging active lifestyles, with emphasis on social interaction and better mental health outcomes (Maas *et al.*, 2009; Sugiyama *et al.*, 2008; Sugiyama, Thompson, & Alves, 2009). Qualitative research conducted in Toronto found that the presence of parks, trees, gardens and walkable green spaces within a neighbourhood was perceived as an important pathway to generating good mental well-being (O'Campo, Salmon, & Burke, 2009).

As a counter to suburban sprawl, adoption of New Urbanism (also referred to as neotraditional design) was initially encouraged in many outer suburban (or greenfield) residential developments, and also is now increasingly being adopted within inner suburban infill (or brownfield) developments (Day, 2003). Principles of New Urbanism feature design elements focused on environmental sustainability through preservation of green space, promotion of public transport and neighbourhood walkability, mixed land-use and increased community contact through placement of houses on smaller blocks

closer to the street (Day, 2003; Talen, 1999; Youngentob & Hostetler, 2005). Streetscapes are designed with “prettier, more pedestrian-orientation streets” to be more conducive to social interaction than those found in traditional post World War II subdivisions (Hess, 2008, p. 196). Despite these stated principles, there is some evidence that developers are foregoing more socially orientated New Urban design elements (such as incorporating community space and preservation of green space) while justifying development of more financially viable residential estates based solely on small block size (Youngentob & Hostetler, 2005).

Australian post-World War II suburban development was designed around the quarter-acre block with a free-standing house and a large backyard (Gleeson, 2006; Millar, 2005). Even though Millar notes continuing demand for large blocks, few new residential developments offer this option. While anti-sprawl arguments support smaller block size and higher density residential development (Frumkin *et al.*, 2004; Newman, 2001), the ratio of block size and house footprint found within new Australian residential developments is generating a different set of concerns. Data collected on residential block size in Australian capital cities indicates that average block size has decreased over the past decade, while average floor area of new houses has increased markedly (Australian Bureau of Statistics [ABS], 2004). With larger houses on smaller blocks, there is less space for trees and gardens in suburban backyards (Hall, 2007) and less opportunity for vegetation to assist with modifying temperature or improving air quality (Fam *et al.*, 2008).

Where once the retention of greenbelts was a dominant feature of suburban planning, contemporary suburban sprawl in Australia often results in large-scale clearing of vegetation with many hectares of forest, wetland and other green spaces stripped ready for development of master-planned estates (Gleeson, 2006; Hall, 2007). Important landscape and ecological features are often destroyed (Beatley, 2004). Decreased retention, protection and provision of quality green space within urban environments is an emerging issue of concern within conservation, planning and urban design literature (Benedict & McMahon, 2006; Erickson, 2006; Register, 2002; Schwab, 2009). In most western countries, retention and management of green space within urban environments is considered to be critical to maintaining neighbourhood amenity and ecosystem

services (Erickson, 2006; Farr, 2008; Girling & Kellett, 2005; Gleeson, 2006; Gottlieb, 2007; Low, Gleeson, Green, & Radovic, 2005).

With smaller allocations of public and private green space within new suburban development (Hall, 2007), there are now fewer opportunities for city dwellers to interact with any form of nature (Bedimo-Rung *et al.*, 2005; Hinchliffe, 2007) and as discussed earlier, this may result in less positive attitudes to environmental issues. A comparative survey of residents in three different types of Florida neighbourhood (traditional, post-World War II and neotraditional) found that the level of pro-environmental behaviours, attitudes and knowledge reported by residents in new neotraditional-design neighbourhoods was considerably less than residents in both traditional and post-World War II neighbourhoods (Youngentob & Hostetler, 2005).

Other concerns relate to issues of equity and environmental quality and highlight the rise of urban planning policy that supports economic development over large scale conservation (Tang & Wong, 2008). Some authors strongly suggest that the intrinsic value of urban trees and natural areas is being disregarded in favour of economically rational (or neo-liberal) policies and capital accumulation (Heynen, McCarthy, Prudham, & Robbins, 2007; Heynen & Perkins, 2005). Cannavo (2007) proposes that professionals involved in urban conservation and urban planning need to develop new approaches that restore the balance between preservation of natural areas and development. Others call for realignment of urban-nature relations that recognise the importance of urban ecosystems (Benton-Short & Short, 2008; Kellert, 2005) and there is growing support for sustainable urban development that has the potential to enhance the vitality of both people and places (Barton, 2000; Farr, 2008; Girling & Kellett, 2005; Hellmund & Smith, 2006; Low *et al.*, 2005). Alongside these discussions there are calls for reconsideration of contemporary urban form to counter changing social and ecological conditions, reconnect people with urban nature and engender a stronger sense of place (Beatley, 2004; Gleeson, 2008; Relph, 2008).

The origin of the phrase “sense of place” has particular resonance in this study. The phrase was first used in literature relating to landscape perception and environmental design (Tredinnick, 2004) after it appeared as the title of a major work by geology, literature and philosophy academic, George Seddon (1972). Seddon wrote evocatively

of his response to the landscape and ecology of the Swan Coastal Plain, the region on which the Perth metropolitan area sits, and almost forty years ago, implored urban planners in Perth to recognise and cherish the unique physical characteristics of this place. He spoke of powerful emotional responses to particular places that were part of our shared Indigenous and European history, and stated that sense of place was best demonstrated by how a community felt about and used their landscape.

Use of the phrase “sense of place” is now common and most often associated with engendering a sense of well-being and positive feelings of community satisfaction and cohesion, neighbourhood attachment, place identity and meaning, local sentiment and belonging (DeMiglio & Williams, 2008).

Green spaces and neighbourhood attachment

In a recent study of neighbourhood satisfaction, residents in one Illinois neighbourhood were asked to evaluate neighbourhood conditions and rate satisfaction or dissatisfaction with specific neighbourhood elements (Talen & Shah, 2007). Proximity to services and facilities such as schools and parks was an important aspect of neighbourhood satisfaction, with overall physical appearance of the neighbourhood playing an equally important role. The presence of old homes with diverse architectural design, quiet streets and large shade trees were some of the features most valued by residents. Dissatisfaction with neighbourhood was often related to social considerations such as the behaviour of neighbours. Comments concerning dissatisfaction with physical aspects of neighbourhood most often related to removal of trees, poor street design and vacant, poorly maintained buildings.

Within studies of neighbourhoods and green spaces, the presence (or lack) of access to public green space plays an important role in perceptions of neighbourhood quality, satisfaction and safety (Coley *et al.*, 1997; Kaplan, Ivancich, & De Young, 2007; Kuo & Sullivan, 2001; Kuo, Sullivan *et al.*, 1998; Ryan, 2005). The most common economic measure of neighbourhood desirability – residential real estate prices – often reflects proximity to safe, attractive green spaces or views of landscapes or water (Crompton, 2005; Irwin, 2002; Low *et al.*, 2005; Lutzenhiser & Netusil, 2001).

In a survey-based study of perceptions of neighbourhood residential quality conducted in Italian cities, lack of green space was related to negative perceptions of environmental quality. While the presence of attractive, accessible green spaces was only one of several factors within this study that explored spatial, community and functional aspects of each neighbourhood, it proved to be an important factor in predicting resident satisfaction and neighbourhood attachment as well as positively influencing perceptions of aesthetic and social appeal (Bonaiuto *et al.*, 1999; Bonaiuto *et al.*, 2003). Significant positive relationships were also evident between socio-economic status, quality and quantity of green space and neighbourhood attachment (Bonaiuto *et al.*, 1999).

A review of research conducted within several New Urban residential estates suggested that physical design of a neighbourhood could engender a stronger sense of community, but these feelings may be most influenced by resident homogeneity or affluence, and interaction within safe, controlled environments such as well-designed parks and public spaces (Talen, 1999). Results of a survey conducted in two established English neighbourhoods (Uzzell *et al.*, 2002) suggest that residential satisfaction and neighbourhood attachment might be most related to personal identity and social cohesion. Within this study, attitudes to environmental sustainability were measured and it was found that resident satisfaction was higher in the neighbourhood where protection of nature and biological diversity, and preservation of flora and fauna were considered to be fundamental local processes. Residents in this neighbourhood perceived it as being more visually attractive, secure, and less polluted than residents in the other neighbourhood where concerns were expressed about traffic and the maintenance of public places.

Other research (using ranking, interview and photo array techniques) supports the notion that neighbourhood satisfaction, attachment and general well-being can be heightened by the presence of nearby nature and community involvement in local conservation and land management (Austin & Kaplan, 2003; Kaplan, 2001, 2004; Kaplan *et al.*, 2007; Kaplan & Kaplan, 1995). Survey responses from residents living in new-commuter based residential developments located on the fringe of a township in south-eastern Michigan, demonstrated strong preference for forested landscapes and it was suggested that residents were more likely to protect these areas if they saw natural

environments as an integral part of their community (Kaplan & Austin, 2004). For many people in these communities, the appeal of peri-urban living was being “out in the country”, being closer to nature, and having open space near their home (Kaplan & Austin, 2004, p. 235).

Frumkin (2003) identified the importance of urban settings in providing a sense of place, with individuals’ perceptions of quality and connections to local landscapes influencing potential health outcomes. Relationships between people and place have the potential to produce positive physiological, psychological, social, spiritual and aesthetic effects (DeMiglio & Williams, 2008) and for many people, “greenness” or the presence of nature plays an important role in “place-fixing” and place attachment (Beatley, 2004, p. 120). If the current trend of residential development with smaller private outdoor spaces and less space allocated for community use continues, communities may “have to fight for more human, more useable, public open space” (Seddon, 1997, p. 163).

Limitations of current research

While a general consensus about the positive benefits of contact with nature is evident in much literature, one issue that confounds reliable comparison of published studies is a lack of consistency about what is considered contact with nature. Most early research (Ulrich, 1981) showed that psycho-physiological benefits could be derived by simply viewing nature, even in a representative form such as photographs or other image media. Many of the studies undertaken by environmental psychology researchers to assess restorative benefits, preference or attachment used visual representations of nature (photo arrays, projected images, film) rather than actual physical contact (Kaplan & Kaplan, 1995; Pretty *et al.*, 2005). Concerns are being raised about the use of photo arrays and photo questionnaires in assessing responses to landscape as it is unlikely they can replicate individual experiences in real places (Ozguner & Kendle, 2006). While this is not such an issue in relation to studies of preference or attachment, it is being suggested that to objectively assess physical and mental health benefits there is a need for people to be directly involved or engaged with nature (Wilensky, 2002) as positive psychological effects are more “dramatic” with exposure to actual, rather than virtual nature (Mayer, Frantz, Bruehlman-Senecal, & Dolliver, 2008, p. 28). However, this is not always possible to incorporate into research design. A recent study conducted by

Pretty and colleagues (2005) used pre- and post-testing in controlled experimental environments with images of natural and urban settings projected onto a wall while participants ran on a treadmill. This type of experimentation is useful to demonstrate general effect, but the physical and psychological distractions or stressors that might be present in a real natural setting cannot be taken into account.

Further issues relate to selected research methods, particularly sampling techniques used in environmental attitude studies. In general, young, well-educated, politically liberal adults are identified as those most likely to exhibit pro-environmental behaviours (Dunlap *et al.*, 2000). This result is probably not surprising when it is noted that many environmental attitude studies (Clayton, 2003; Gagnon Thompson & Barton, 1994; Herzog & Strevey, 2008; Mayer & Frantz, 2004; Nisbet *et al.*, 2008; Pretty *et al.*, 2003; Schultz, 2001) describe using university and college psychology students as primary research subjects, with these research subjects paid for their participation, either directly or indirectly through gaining course credits. While convenience sampling is common research practice, it appears that the proportion of environmental attitude studies that sample only university students is high and it is unlikely that the views of predominately young students could be considered representative of those of the wider community.

An extensive review of current literature was published by Dutch researchers (Health Council of the Netherlands and Dutch Advisory Council for Research on Spatial Planning Nature and the Environment, 2004). This detailed review includes peer assessment of published research, particularly those studies considered to provide empirical evidence of a positive link between nature and health. The research committee responsible for this review reported that while there were plausible hypotheses concerning contact with nature and health, most studies that attempted to make direct links between contact with nature and health involved small, specific populations and almost all failed to produce methodologically sound, empirical research. Despite this opinion, the research committee did recognise that many of the quasi-experimental environmental psychology studies relating to recovery from stress and attention fatigue had generated consistent evidence. They also recognised that there was much less known about the mechanisms that produced positive results, particularly

encouragement to exercise or facilitation of social contact, with this observation due in part to methodological limitations of the research undertaken.

Kaczynski and Henderson (2007) reviewed fifty research papers exploring relationships between parks and recreation settings (PRS) and physical activity (PA). They raised concerns about the inconsistency of methods used and the validity of findings relating to health outcomes. Two specific concerns about the operationalisation of the relationship between PRS and PA were discussed. The first related to descriptors of access and proximity as many studies left the respondent to interpret terms like “near my home” (Kaczynski & Henderson, 2007, p. 346). The second related to the frequent use of regression analyses and odds ratios models with differing predictor variables and covariates (such as age or gender). While this in itself was not problematic, not all authors described how they controlled for covariates or how variables were introduced into specific models. Aside from these concerns, these reviewers were critical of the “dearth of detail” regarding descriptions of parks, trails or greenways, though recognised that some attempts have been made in more recent studies to isolate specific environmental factors in order to better assess their contribution to reported physical activity (Kaczynski & Henderson, 2007, pp. 346-347).

Another concern relating to current research examining green space and health is that many studies rely on self-reported health data and subjective measures of neighbourhood surroundings in cross-sectional research designs that are unable to establish cause and effect (Sugiyama *et al.*, 2008). It is also suggested that current research is limited by a tendency to focus on relationships between health and a singular phenomenon, such as urban sprawl (Sturm & Cohen, 2004). This is not always the case as recent epidemiological research in the Netherlands (the *Vitamin G* program) involves a large sample and a multi-dimensional approach with comprehensive survey, digital imagery and interview techniques amassing data relating to health and green space in that country (de Vries *et al.*, 2003; Groenewegen *et al.*, 2006). Other researchers have broadened the focus of their investigations to explore new avenues of enquiry that incorporate health, sociology, urban planning, biophysical characteristics and sustainability perspectives (Brown & Grant, 2005; Irvine & Warber, 2002; Parr, 2005; Tzoulas & James, 2004; Westphal, 2003). Even so, many utilise only one method of

either quantitative or qualitative data collection and there is limited opportunity for interpretation and integration of complementary data sets.

In an attempt to bridge the somewhat fractured nature of current discourse, Tzoulas and colleagues (2007) reviewed epidemiological, experimental and survey studies that demonstrated a measurable link between green space and public health. Their work provided a conceptual framework incorporating many perspectives and key issues recognised by urban planners, ecologists, natural and social scientists, psychologists and public health professionals (Tzoulas *et al.*, 2007, p. 175). As such it provides a “conceptual meeting point” that highlights opportunities for collaboration or multi- and interdisciplinary approaches to research. Their position echoes Frumkin (2001, p. 238) who suggested that a new research agenda for the “greening of environmental health” required collaboration among professionals from health, planning and other associated disciplines.

Collaborative or interdisciplinary research is often defined as the integration of perspectives, knowledge and theory from two or more disciplines in order to form new or common understandings that explain phenomena, provide solutions or answer questions in ways that may not be possible through single disciplinary means (Lattuca, 2001; Mansilla & Gardner, 2003). Despite emerging support, there is much debate regarding its merits. One of the major concerns regarding interdisciplinary research design relates to how differences in construction of knowledge, as well as differences in power, status, experience, perspectives and purpose might influence how ideas were considered and communicated (MacMynowski, 2007). A further critical issue regarding the potential success of interdisciplinary research is the willingness of the researcher(s) to gain understanding of unfamiliar disciplines’ theory, practice or paradigms. MacMynowski (2007, p. 20) suggests that three steps need to be undertaken to ensure “transparent development” of interdisciplinary research. These include differentiation of analytical elements, clarification of purpose and intellectual synthesis.

To address some of the issues identified here, I chose to integrate perspectives from several academic disciplines within this study. The scope of questions and issues raised draws on past research and methods used within epidemiology, environmental psychology and sociology. Where possible, data analysis further explored insights

gained in prior investigations into relationships between health and urban green space. Building on prior research also entailed the use of validated research instruments for quantitative data collection. Selected indices included scalar measures of environmental attitude (Gagnon Thompson & Barton, 1994), perceptions of green space quality and neighbourhood attachment within a specifically urban context (Bonaiuto *et al.*, 2003) and self-reported health (Ware *et al.*, 2007). In addition, questions about favourite areas enabled exploration of potential relationships between favourite place, neighbourhood attachment and health (Hartig *et al.*, 2003; Korpela & Hartig, 1996; Korpela *et al.*, 2008). Questions regarding visitation enabled assessment of potential links between frequency of use and health outcomes (Giles-Corti *et al.*, 2005; Giles-Corti & Donovan, 2002a; Sugiyama *et al.*, 2008). Similarly, information regarding current or past involvement in conservation activities was sought to enable further exploration of potential relationships between conservation activity and health outcomes (Bird, 2004, 2007; Townsend & Moore, 2005).

As discussed in the following chapter, mixed methods of data collection and analysis were incorporated into the research design, with multiple perspectives applied to data analysis, enabling explanation of findings and exploration of many questions that could not be answered using a single disciplinary approach.

Chapter 3: Method

Researchers in different academic disciplines conduct studies using different research models. Investigation of unique circumstances leads to research questions being framed in particular ways, with the collection and analysis of data meeting expectations and norms held within their respective fields. Environmental psychologists often use observation or experiential settings to determine behavioural outcome or preference (Bell *et al.*, 2005). Health research is often conducted within epidemiological frameworks of systematically generating evidence to determine phenomena and causality, though more qualitative approaches are becoming increasingly incorporated into study design (Higginbotham, Albrecht, & Connor, 2001). Ecology and environmental management research most often draws on scientific processes such as experimentation and population studies (Krebs, 2001; Southwood & Henderson, 2000). Research in landscape architecture and urban planning leans towards case studies in order to further knowledge within that field (Francis, 2003). Social scientists are perhaps the most comfortable with the use of many research methods (Green, 2008; Neuman, 2006), recognising the subjectivity inherent in most human research and utilising methods that value, acknowledge and balance empirical and intuitive knowledge (Creswell & Plano Clark, 2007).

A mixed method research design was adopted in this study. Exploration of research questions required objective measurement of relationships between different aspects of health and nature, and interpretation of the subjective meanings people attach to those relationships. The major advantage of using a mixed method approach is the combined strengths of quantitative and qualitative methodologies in assisting to develop and inform the data collected, and provide insight into different levels of analysis (Creswell, 2003).

Mixed method research

Historically there has been a division between researchers with preference for either of these two approaches. Quantitative data is considered to be “hard, rigorous, credible, and scientific” while qualitative data is “sensitive, nuanced, detailed and contextual” and proponents of each approach often argue that one is inherently superior to the other

(Trochim, 2001, p. 11). Elliott (2005, p. 2) recognises that in practical terms, the division between forms of research can be useful and describes each as follows:

Quantitative research uses a standardised set of questions with a large sample of individuals to generate data that can be coded and expressed in a numerical form.

Qualitative research adopts a less structured set of questions, allows the respondent to set the agenda within the parameters of the topic under investigation and generates rich textual or observational data.

Combining quantitative and qualitative methods in one study can enable the researcher to explore several dimensions of a topic and gain different perspectives on the data collected, enabling research questions to be investigated with greater depth and understanding (Creswell & Plano Clark, 2007; Henderson, 1991; Higginbotham *et al.*, 2001). In essence, quantitative data can tell what may be, qualitative data can tell why it may be so.

Early advocates of mixed method research (such as Henderson, 1991) identified a major drawback related to the lack of researcher expertise in using, and combining, multiple methods. Elliott (2005, p. 175) noted that this remains a current problem as few researchers have expertise in both approaches and as a result, it is unusual to find examples of research projects where both quantitative and qualitative results are given equal weight. Reasons for this are discussed by several authors. Bryman (2007) identified writing for different audiences as one potential barrier to integration of quantitative and qualitative approaches, with one aspect of the research being emphasised at the expense of the other. Dunning (2004) suggested that while many researchers acknowledge the advantages of mixed method research, there is limited methodological discussion regarding how to operationalise the twin goals of confirmation and comprehension. Others argue that mixed methods research needs to be recognised as a third research paradigm, separate to quantitative and qualitative research, with a “pure” form of mixed method research recognised in research designs that give equal weight to quantitative and qualitative data (Johnson, Onwuegbuzie, & Turner, 2007, p. 123) .

When this study began, I was much more comfortable working within a qualitative research paradigm. I had worked with quantitative data in previous research, but had done little beyond generate and analyse descriptive statistics. Learning how to work

with multivariate techniques was demanding, both technically and intellectually. Ultimately, the mixed method design of this study proved both beneficial and detrimental. One bonus was the richness of the data and the depth of interpretation that emerged during integration of all the data. A more personal benefit was development of skills in quantitative research methods that enabled me to conduct more complex statistical analysis than I had previously experienced. The detriment was the time spent gaining those skills and determining how to best interpret and integrate all the data, rather than simply interpreting and presenting quantitative and qualitative research outcomes independently.

Integrating data interpretation occurred within an ongoing process of identifying commonalities and differentiation in results through constant cross-referencing between the two data sets. The specific steps taken in data analysis and interpretation are discussed later in this chapter. As predicted by MacMynowski (2007) finding an integrated, balanced and coherent approach to presentation of both quantitative and qualitative data results, proved to be one of the more challenging aspects of this study.

Several approaches to presentation of the research findings were attempted, with preliminary drafts of results chapters combining both quantitative and qualitative responses to a specific set of questions in a single section. When specific questions asked in survey and interview overlapped, presenting complementary results was not particularly difficult. Difficulty arose when analysis of survey results needed comprehensive explanation or, as often occurred, interview responses related to more than one survey question. After much trial and error, the approach used in the following chapters evolved as the most effective means of presenting and discussing research findings. In each, the results of quantitative data analyses are presented first, followed by interpretation of thematic qualitative data analysis, with each chapter concluding with a discussion of the overall findings. The final chapter of the thesis draws on all of the prior data analysis and interpretation to provide answers, explanations and integrated responses to the research questions posed in this study.

Research questions

The purpose of this study was to explore relationships between human health and contact with nature within urban environments. As identified in the previous chapter, factors associated with achieving positive nature-based health outcomes included social determinants, such as social and economic status, living conditions such as neighbourhood type (established or new) and location (inner or outer suburban), attitudes to nature and natural environments, perceptions of proximity, diversity and quality of neighbourhood green space, and neighbourhood attachment. Therefore, specific research questions explored in this study included:

1. Do measurable or identifiable relationships occur between attitudes to nature and natural environments, perceptions of proximity, diversity and quality of neighbourhood green space, or attachment to neighbourhood and self-reported health?
2. Is there significant difference in measurable or identifiable relationships based on socio-demographic factors or neighbourhood type and location?
3. What importance do people attach to neighbourhood green space and what part does green space play in influencing residents' perceptions of their health and the health of their neighbourhood surroundings?

Research design

This study used a purposively structured design involving four neighbourhoods within two local government authorities (cities of Subiaco and Wanneroo), representing inner and outer suburban regions of the northern Perth metropolitan area in Western Australia (Table 3.1). The two inner suburban neighbourhoods selected for this study comprised an established neighbourhood with diverse architectural heritage (Subiaco) and a new brownfield infill development, incorporating New Urban design principles (Subiaco Centro). The two outer suburban neighbourhoods comprised an established neighbourhood of relatively homogenous age and design (Wanneroo) and a new greenfield sprawl-type development (Ashby). This enabled comparison of results between each neighbourhood, as well as between established and new neighbourhoods, and between inner and outer suburban neighbourhoods.

Table 3.1: Neighbourhoods selected for distribution of survey questionnaire and recruitment of interviewees

	Inner suburban neighbourhoods within City of Subiaco	Outer suburban neighbourhoods within City of Wanneroo
Established neighbourhood	Subiaco	Wanneroo
New neighbourhood	Subiaco Centro	Ashby

In order to explore the influence of socio-demographic factors on the relationships identified within the research questions, residents in these two local government authorities reported different personal characteristics, particularly levels of socio-economic status. Census data for people living within Subiaco and Wanneroo postcode zones indicated that residents of inner suburban Subiaco tended to be more affluent and well-educated than those living in the outer suburban Wanneroo. Other points of difference included median age, diversity of cultural background, living arrangements (couples or families with children), style and type of residence and whether people owned or were renting their home. Ensuring there were identifiable differences between neighbourhoods meant that health determinants associated with socio-demographic factors could be taken into account during data analysis. The specific socio-demographic and biophysical characteristics of each neighbourhood are discussed in Chapter 4.

To ascertain whether proximity and access to green spaces played a role in determining health outcomes, both established neighbourhoods were located adjacent to large nature reserves, with Kings Park bordering Subiaco, and Yellagonga Regional Park adjoining Wanneroo. The distance between established and new neighbourhoods was approximately one kilometre in both cases.

Data was collected using a sequential strategy as described by Creswell (2003, p. 215). This model is characterised by the collection of quantitative data, followed by qualitative data, with integration of the two methods during initial interpretation. Figure 3.1 shows the process of data collection and preliminary analysis used in this study. This process assisted in development of the research instruments (Appendices 3.3 and 3.4). Justifications for post-pilot changes to the survey questionnaire and interview schedules are discussed below.

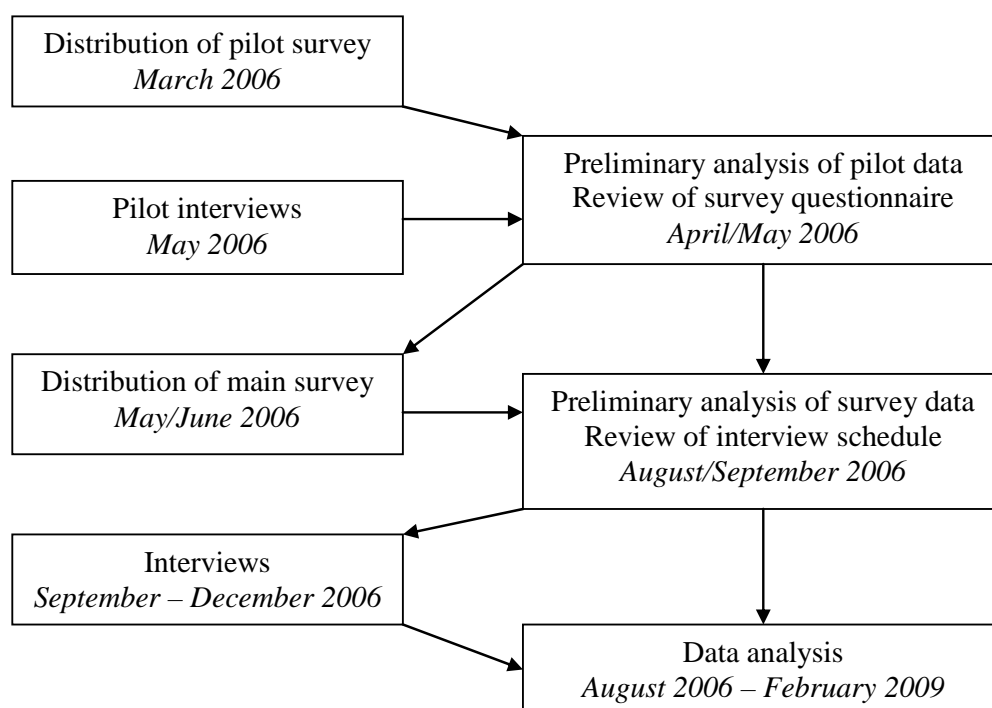


Figure 3.1: Process of data collection and preliminary analysis

More comprehensive analysis of the final data set used a concurrent triangulation model, with simultaneous analysis of quantitative and qualitative data used to “confirm, cross-validate and corroborate findings” (Creswell, 2003, p. 215). Within this model, data analysis is ongoing with interpretation noting either convergence of findings, or providing explanations for anomalies or inconsistencies. This is a traditional approach to mixed method data analysis and because of the possible convergence of findings, can produce well-validated results (Creswell, 2003; Creswell & Plano Clark, 2007).

Ethical considerations

Approval for this project was granted by the Edith Cowan University Human Research Ethics Committee. In accordance with approved guidelines, all data was handled and stored securely throughout the research process.

The level of personal risk or harm that might be incurred through participation in this study was relatively low. It was essential however, that participants voluntarily entered with informed consent and needed to be aware of their rights as respondents (Trochim, 2001). All respondents had an assurance of voluntary participation, safety and

confidentiality. All potential survey respondents and interviewees were given written and/or verbal information prior to their participation in the study to enable them to make an informed choice. All interviewees were aware of their right to terminate the interview, or to withdraw any information provided, without fear of reprisal.

The questionnaire forms used in the quantitative survey did not include respondent name or address so it was not possible to identify individuals. A signed consent form was not required, as return of the survey by mail implied informed consent. When potential interview participants provided contact details, it was requested that this information was sealed in a small envelope provided as part of the survey pack. On receipt of completed surveys, any personal information was immediately separated from the questionnaire and stored in a different location.

Interview participants were invited to choose their own pseudonym and their choices are used throughout this thesis. All interview recordings and transcripts were coded and personal references removed. An external contractor was used to type interview transcripts and a confidentiality agreement was signed prior to commencement. Once transcription of the interviews was completed, a printed copy was sent to each interviewee for verification. All were asked to review the transcript and to make note of any personal or other information that they did not wish to be published. On return of reviewed transcripts, requested changes were made.

Development of the survey questionnaire

Kellert (1996, p. 38) describes surveys as “a blunt instrument for exploring the complexity of how people perceive nature” as well as individual attitudes and values in general. Notwithstanding this description, Kellert acknowledged that surveys provide the means to efficiently gather information from a large number of people. Survey responses also enable multiple variables to be examined and baseline measurements of different variables to be established (Creswell, 2003). Selection of question focus and themes included in the survey questionnaire in this study was based on prior research and the availability of previously validated scalar measures. The survey questionnaire included four sections containing mostly closed-ended questions and scalar measures (Appendix 3.3).

You and your home (demographic data)

This section included standard questions relating to age, gender and income, living arrangement, type of residence, and length of time living in the neighbourhood. Where possible, question categories were aligned with Australian Bureau of Statistics data to enable direct comparison.

Your neighbourhood (proximity to green space, perceptions and attachment)

In the pilot study, the first section (You and your home) included questions relating to proximity to parks and nature reserves, visitation and involvement in conservation activities. After review of the pilot study responses, these questions were expanded and moved into this second section. Following these changes, the first question in this section asked respondents to identify all of the different types of green spaces that were within easy walking distance (up to 500 metres) of their home using an adapted version of the green space typology presented in Table 1.1 (p. 10). Respondents were also asked if they had a favourite area of public green space in their neighbourhood and if so, to describe it. Next, respondents were asked how often they usually visited nearby green spaces and if they had ever been involved in conservation activities.

The remainder of this section contained two scalar measures: the first asking about perceptions of green space quality and the second, about neighbourhood attachment. These scalar measures were developed and evaluated as part of a comprehensive study of perceptions of residential environment quality and neighbourhood attachment (Bonaiuto *et al.*, 1999; Bonaiuto *et al.*, 2003). Permission to use these scales was granted through communication with the principal author.

As part of the pilot study, several colleagues commented that wording of particular items in the perceptions of green space and neighbourhood attachment scales were vague and open to multiple interpretations. Minor changes were made to enhance comprehension and clarity. In addition, “green space” was replaced by “bushland” in items 3 and 5 of the green space quality scale to capture perceptions about the presence of neighbourhood bushland.

The natural environment (attitude to nature)

In order to select the most appropriate scale for the third section of the survey, numerous validated scales were assessed. In the pilot study questionnaire, this section was entitled “Your connection to nature” and included the 24-question Environmental Identity scale (EID) (Clayton, 2003). This was changed post-pilot study and the EID scale replaced by the 30-question Environmental Attitude Scale (EAS) (Gagnon Thompson & Barton, 1994). The EAS was not initially selected for this study as its focus was on measuring environmental attitudes (ecocentrism, anthropocentrism and apathy towards natural environments) and not individual connection to nature. The original decision not to use this particular scale was reviewed as problems with the EID scale became evident during evaluation of the pilot study.

The Environmental Identity Scale (EID) developed by Clayton (2003) had the strongest focus on individual functional interaction and emotional connection with nature when compared to other considered scales. While the EID scale had not undergone such rigorous testing for validity and reliability as some scales, initial testing with college students demonstrated good internal reliability (Cronbach’s alpha >0.90). Validity was tested in three studies that used the EID scale as a predictor of pro-environmental behaviours and attitudes (Clayton, 2003, pp.54-56).

One reason for the initial selection of the EID scale was the positive focus of its questions and the inclusion of several functional items (such as *I spend a lot of time in natural settings*), rather than more philosophical statements (such as *I think of myself as part of nature, not separate from it*). Preliminary analysis of results, however, provided little distinction between respondent scores. It was difficult to break down individual scores into common areas of agreement, or to distinguish strength of opinion in particular areas, without manual dissection of the scale into the four stated components: salience, self identity, ideology and positive emotions (Clayton & Opatow, 2003) and how scale items related to each component was not clear from Clayton’s description of her construction of the EID scale. Identifying which items were aligned with each component might have been possible through factor analysis, but the pilot study sample size ($n=30$) was simply too small to conduct any type of confirmatory or exploratory analysis.

The Environmental Attitudes Scales (EAS) provided an opportunity to examine and score responses in three designated categories: ecocentrism, anthropocentrism and apathy. In discussion of the utility of this scale, Gagnon Thompson and Barton (1994) link ecocentric attitude to personal eco-identity (how an individual identifies as part of nature). In comparing these two scales, the EAS also included a number of functional (such as *I enjoy spending time in natural settings just for the sake of being out in nature*) and philosophical (such as *Humans are as much a part of the ecosystem as other animals*) items similar to those in Clayton's EID scale. With regard to the scale itself, reported internal reliability was regarded as adequate (Gagnon Thompson & Barton, 1994, p. 154). For these reasons, it was deemed to be a more suitable inclusion in the final questionnaire. Permission to use both of these scales (EID in pilot study and EAS in final survey) was granted through communication with the principal authors.

Your health and well-being (self-reported health)

The final section of the questionnaire contained a 36-question self-reported health survey. The SF-36 health survey is commonly used to measure self-reported health and has an excellent reputation for reliability and validity (Kaplan, Ganiats, Sieber, & Anderson, 1998). Development of an international SF-36 Health Survey Version 2 (SF-36v2™) was finalised in 2000 (Hawthorne, Osborne, Taylor, & Sansomi, 2007) and the Australian language version of the SF-36v2™ was used in this study. Testing of the Australian version with local populations has demonstrated its validity and support for its use in research examining population health characteristics (Butterworth & Crosier, 2004). Permission to use this survey was granted through purchase of a licence, includes access to software that generates composite scores for overall physical and mental health and for eight specific health domains (Ware, Kosinski, & Dewey, 2000).

Development of the interview schedule

The final page of the survey questionnaire invited respondents to add comments. In the pilot study, this page was headed: *Are there any comments you would like to add about green space near your home?* In the main study, this single question was expanded to read: *Is there is anything you would like to add about local green space and your neighbourhood environment? Do you think having more or less green space could affect your health?*

More than 150 written comments were received from respondents in the pilot study and the main survey. Comments covered a range of topics related to green space and health. In general, most were positive about green space and their neighbourhood environments, though it was apparent that issues relating to increasing urban development caused concern. Written comments provided by survey respondents were considered during development of the interview schedule and assisted identification of initial themes.

Interview questions were framed to explore the key themes of attitude to nature and the environment, perceptions of green space, neighbourhood attachment, and health. At one level, they focused on expanding understanding of the quantitative survey responses and relationships (or lack of) noted in preliminary data analysis. At a second level, interview questions were designed to explore meanings given to nature and understandings of relationships between green space and health as these questions were not specifically addressed in the survey questionnaire.

A naturalistic process of enquiry was used in all interviews. This approach is discovery-orientated and lacks pre-determined constraints on outcomes (Patton, 1990). The interview schedule was used only as a guide and essentially provided a checklist to ensure all relevant topics were discussed at some point during the interview. On review of the pilot interview responses, it became obvious that the interview questions were not generating the depth of data sought and, as a result, the interview schedule was expanded (though little change was made to the overall question themes) and questions worded more generally to elicit a wider range of responses. In addition, the flow of questions was changed to enable easier transitions from different topic areas throughout the interview (Appendix 3.4).

The pilot study

A pilot study was conducted from March to June 2006. The first aim of the pilot study was to evaluate the survey questionnaire, particularly completion time, survey structure, comprehension, context and relevance. The second aim was to assess the survey distribution method within each neighbourhood for operational ease and time taken. This also enabled calculation of potential employment hours for research assistants (or

volunteers) to assist with distribution of the main survey. The third aim was to gauge the quality of responsiveness from residents in each neighbourhood (welcoming or dismissive) and measure the response rate of completed questionnaires. Finally, pilot interviews were conducted, enabling evaluation of the scope and depth of response to interview questions.

The first phase of the pilot study involved distributing survey packs to 25 households in each of the four selected neighbourhoods (100 in total). Survey packs for residents in each neighbourhood were enclosed in an A4 reply paid envelope stamped *Resident survey enclosed*. The pack included a covering letter, A4 size questionnaire booklet, an information sheet and consent form to complete if the respondent was willing to take part in a future interview, and a teabag. Survey pack items (except the teabag) are included as Appendices 3.1-3.3.

One adult (over 18 years of age) in each household was asked to complete and return the questionnaire. Ten questionnaires were also distributed to academic colleagues. Each of my colleagues was invited to complete (and return) the questionnaire and comment specifically on design, structure, comprehension and time taken to complete. In the second phase of the pilot study, one respondent in each neighbourhood who had returned their completed questionnaire with a completed interview participation form was selected for interview (four in total).

Self-completion and self-return surveys usually elicit a lower response rate than phone or face-to-face interview as direct interaction between researcher and respondent may positively influence the decision to participate (Data Analysis Australia, 2005). As such, surveys were hand delivered and residents personally approached where possible to test whether hand delivery was likely to generate a substantially better response rate. Personal approaches to potential respondents, and provision of a reply paid envelope to return the completed questionnaire, have been shown to increase response rates in postal questionnaires (Edwards *et al.*, 2002).

Notes were made during distribution to record the number of survey packs that were hand delivered at the door, left in a letterbox, and how many people refused to accept a survey pack at the door. Survey packs left in letterboxes were marked (L in a circle) to

enable them to be identified on return. In Subiaco Centro, security grilles and locked gates at the entry to most residences presented a deterrent to direct doorknocking. In order to evaluate the response rate from letterbox delivery only (with no face-to-face contact through doorknocking), an apartment block with more than 25 residences was selected. Survey packs were randomly placed in 25 letterboxes.

To ensure the safety of the research team while doorknocking in each neighbourhood, precautionary procedures were established. Hand delivery was undertaken in teams of two with one person on either side of the street or a block. Team members were to maintain visual checks or to arrange a check point if they were separated at any time. All carried mobile phones. It was also agreed that team members were not obliged to enter any yard where they felt unsafe (because of dogs, high fences or overgrown vegetation) and they were not to go inside any residence.

With respect to delivery time, letterbox delivery in Subiaco Centro was very efficient and took less than five minutes. Distribution to 25 houses (by a two-person team) in two streets in Subiaco took approximately 30 minutes. A similar time for distribution was recorded in Wanneroo. Distribution in Ashby took slightly longer as several new houses were unoccupied. Survey packs were not left at these houses. The refusal rate in Ashby was higher than in Subiaco and Wanneroo with five residents refusing to accept a survey pack, compared to only one in Subiaco and two in Wanneroo. This, combined with the number of incomplete or uninhabited houses, meant that the pilot area was expanded to include two more streets than originally planned. In order to determine the best time for distribution, distribution in Subiaco and Subiaco Centro was conducted on a weekend and during the week in Wanneroo and Ashby. Fewer people were at home during the week.

Thirty (30) completed questionnaires were returned by the end of April: approximately six weeks post initial distribution. Nine (9) completed questionnaires were returned from each neighbourhood (36% response rate) except Subiaco Centro. The response rate from Subiaco Centro residents was lower with only three (3) completed questionnaires returned (12%). Responses provided some confirmation that hand delivery with a personal approach to residents can result in a far higher return rate: 63 percent of hand delivered questionnaires were returned compared to only 18 per cent of

those left in letterboxes. The overall response rate (30%) was deemed to be satisfactory and in excess of a minimum response rate of 20 per cent required to generate a main study survey sample that would meet accepted levels of statistical power (Neuman, 2006). The response rate for interview participation was also encouraging. Eleven of the 30 respondents (36.6%) indicated that they would be willing to participate in an interview. .

With regard to the pilot study data, the sample size was too small for any findings to be analysed statistically, though some patterns relating to scores for perceptions of green space quality and neighbourhood attachment were noted. Undertaking the process of data entry and preliminary analysis, however, was used to assess the effectiveness and efficiency of these processes. As a result, some minor changes were made to question categories in the main survey questionnaire to make response coding simpler and more consistent.

Potential interviewees provided information relating to gender, age and years lived in the neighbourhood. Selection was based on generating a sample that included two males and two females and people of varying age. (Descriptions of all interviewees are included in the following chapter.) One respondent from each neighbourhood was selected and contacted to arrange a time and place for the interview to occur. All interviews took place in a location chosen by the interviewee. Two were conducted at the interviewees' home, one at a place of work and one in public at a quiet café. All were recorded using a small (and relatively inconspicuous) digital device.

As some interviews took place in private homes, my safety was a concern. A system of checking in and out of each location was used to ensure my partner knew the address and first name of the person I was interviewing. My partner was chosen for this task as besides being personally concerned about my safety, he had no interest in reading the interview transcripts and interviewee anonymity could be maintained. This system continued for each interview during the main study.

Each interview began by asking about each individual's personal situation (such as age, qualifications and living arrangements). Opening questions delved into how long participants had lived in their current home, why they chose to live in that

neighbourhood and perceptions of their neighbourhood. These questions were designed to ease participants into an open discussion by initially focusing on a known subject – their personal history. This was considered to be an important step in developing trust and rapport between myself and each of the interviewees to facilitate honest self-disclosure (Reinharz, 1992). It was expected that interviews would last for approximately one hour each and be preceded by consent procedures and an explanation of the research purpose and interview process. As it happened, pilot interview times ranged from 35 minutes to 50 minutes, less time than expected. As noted earlier, to enhance the quantity and quality of data collected, the interview schedule was reviewed and expanded prior to the main study.

Qualitative data collected in the pilot study was initially transcribed in summary form. Summaries (with selected verbatim passages) underwent broad thematic analysis to gain initial understanding of the effectiveness of questioning and the interview process. Two interviews were transcribed in full and manually colour-coded to identify significant statements relating to perceptions of neighbourhood, natural environments and green space, individual and community health, health of neighbourhood surroundings, and connection to nature.

The main study

Following evaluation of the pilot study, the sample grid, distribution plan and recruitment processes for the main study were finalised. The following sections discuss when data collection occurred and describe the main sample grid and survey distribution, recruitment of interviewees and response rate.

Data collection

Data for the main study was collected over a seven month period from April to December 2006. The survey distribution was undertaken first (April to June) with survey return occurring until August 2006. Preliminary analysis of the survey data enabled further refinement of the interview schedule. Interviews were conducted from September to December 2006.

Sample grid and survey distribution

One resident in each of 500 homes in the four selected neighbourhoods was invited to participate in the study: a total of 2000 potential respondents. In order to best secure random selection of residents, only one adult (over 18 years of age) in each household was asked to complete and return the questionnaire. All distribution in the main study was conducted on Saturday from late morning to mid-afternoon as it was found during the pilot study that more people were home (and more responsive) at this time.

A grid for distribution of the questionnaire (and interview invitation) was drawn for each of the four neighbourhoods with each containing at least 500 houses. In Wanneroo and Subiaco, the sample grid boundaries were aligned with three 2001 census collection districts (average 200 houses in each). This was done to enable comparison of 2006 census data (collected July 2006) with demographic data collected through survey.

This was not possible for the new residential developments in Ashby and Subiaco Centro as 2001 census collection districts did not include the new developments and census data collected at that time was not indicative of current population. Cadastral maps obtained from each local government authority were used to identify the number of planned house lots. Based on data current in early 2006, 500 homes represented almost all of the completed residences in Ashby and Subiaco Centro. Maps showing survey distribution grids (Figures 4.2 and 4.3, pp. 80-81) and a list of relevant census collection districts (Table 4.1, p. 77) are included in the following chapter.

Once 2006 census data was released, it was found that Subiaco, Subiaco Centro and Wanneroo grids were contained wholly within three respective census collection districts (CCDs) but this was not the case in Ashby. The survey distribution grid in Ashby crossed over three CCD boundaries, with a secondary grid enclosed within a fourth CCD as the original Ashby grid was expanded to include 100 residences in a similarly new development in the neighbouring suburb of Tapping. This became necessary when, as found in the pilot study, there was a large number of unoccupied homes in Ashby and a higher refusal rate than other neighbourhoods.

In order to provide the best possible representation of the population living within Ashby's survey grid, data from one CCD were not included in census data presented for

Ashby as the major portion of this CCD contained a 316-home retirement village which was not included in the study. A similar situation occurred in Subiaco Centro with a 110-home retirement village included in one CCD. In this case, even though surveys were not distributed within the retirement village, it was not feasible to exclude data from this CCD as a substantial number of homes adjacent to the village were included in the survey grid. Representativeness of the study sample is discussed in the following chapter.

Recruitment of interviewees

It was planned that five face-to-face interviews would be conducted with residents within each neighbourhood (a total of 20 interviews across four neighbourhoods). Data collected during the pilot interviews had demonstrated that diverse viewpoints were present within the community and it was felt that this number of interviews would encapsulate this diversity and provide sufficient depth to enable adequate data analysis. If not, and if there was enough interest from respondents, more interviews could be scheduled.

As with the pilot study, selection for interview was based on information provided by the respondents (gender, age and time lived in neighbourhood). This information aided stratification of the interview sample as substantially more than five people from each neighbourhood location were willing to be interviewed (Table 3.2, p. 56). The initial sample included a semi-randomly selected mix of male and female interviewees, of different ages who had lived in their neighbourhood for different lengths of time. Semi-random selection meant that respondents in each neighbourhood were sorted into six groups based on same gender and age group (male/female split of younger/middle/older age groups). One person from each of these groups was randomly selected and included in the first list of potential participants. Five of these six were then selected to best provide a cross-section of interviewees based not only on gender and age but also on time lived in their neighbourhood. For Ashby respondents, this selection process was a little different as only two male respondents indicated they were willing to be interviewed and both were automatically included on the list of potential interviewees. If selected interviewees were unavailable or no longer interested, another respondent of the same gender and similar age was selected from the remaining pool of respondents.

Individuals participating in the interview process were offered a \$25 gift voucher as a token of appreciation.

As it turned out, 21 interviews were conducted as part of the main study. An additional interview was conducted after discovering that one interviewee's home was just outside of the survey grid though his letterbox sat on the grid boundary. This interview was included in the data set as he was one of only a few interview respondents less than 30 years of age. In addition, during two of the interviews, interviewees' wives were present and contributed to the interview process. During Gordon's interview, his wife made several comments but declined to complete a consent form and her comments were not included in the data set. As I began Matt's interview, his wife, Toni, expressed interest in taking part. This couple were interviewed together, though due to the presence of their young daughter, Toni was absent for short periods of time. Toni was willing to complete a consent form and her comments were included in the data analysis.

All interviews took place in a location chosen by the interviewee. Most were conducted at the interviewees' home, with a small number conducted at their place of work. All were recorded using a small digital device. The length of time spent in each interview ranged from 35-90 minutes with the average time being approximately one hour. Shorter interviews occurred with younger people at their place of work. Older people interviewed in their home were more inclined to be expansive and spend time exploring multiple themes and questions.

Response rate

Survey response rates have been examined by a number of researchers. In the main, the style of approach made to potential respondents (whether personal or impersonal), length of the questionnaire (shorter is better), inclusion of a pre-paid return envelope, follow-up reminders, monetary incentives and level of interest in the survey topic (salience) have all been shown to increase postal survey response rates (Edwards *et al.*, 2002; Roth & BeVier, 1998; Yammarino, Skinner, & Childers, 1991). In addition, respondents to health surveys tend to have a higher income and more education qualifications than non-responders (Sonne-Holm, Sørensen, Jensen, & Schnohr, 1989).

Due to logistic and financial constraints, and because of the relatively good response achieved in the pilot study, follow-up reminders were not included in the research design. Unfortunately, response rate to the survey in the main study (Table 3.2) was substantially less than that achieved in the pilot study (22.5% compared to 30%). In particular the overall response to surveys handed over at the door was much lower than the result recorded in the pilot study (36% compared to 63%). The reasons for this were not explored but may be twofold. With additions and changes made post-pilot, the questionnaire grew from 16 to 20 pages and its length and complexity may have deterred some people from responding. Secondly, I worked with only one research assistant during the pilot study and as such, I was personally responsible for delivering at least half of the survey packs. Five research assistants were employed to help distribute the main survey. Perhaps a personal approach from the researcher elicited a stronger positive response and willingness to respond, rather than from someone acting on my behalf.

Most questionnaires were returned during the first two weeks post-distribution and despite the lack of follow-up reminders, completed questionnaires continued to be received until the end of August, eight weeks after distribution was finalised. Total time for survey distribution and return of completed questionnaires was 16 weeks. At the end of this time, 450 completed questionnaires had been returned.

Apart from completed questionnaires, completed interview participation forms were received from 142 respondents. This response rate was consistent with the pilot study and enabled semi-random selection of interviewees to occur. Table 3.2 shows the pattern of survey distribution and response rate generated in the main study.

It appears that doorknocking and personal delivery of the survey pack, rather than simply leaving it in a letterbox, did increase response rate (36% response compared to 18%). While this overall pattern of response was consistent, the level of response rate varied between neighbourhoods. If personal approach was the most influential factor in the decision to respond, then it would be expected that the response rate in Ashby (20%) would be higher as more than half of the questionnaires were handed directly to a resident at their door. Inner suburban residents (Subiaco and Subiaco Centro) responded best to doorknocking (more than 45% response rate) though the number of

Subiaco Centro residents who were personally approached was very low (only 42). Residents in these inner suburban neighbourhoods also reported higher incomes and more educational qualifications than those in outer suburban neighbourhoods.

Table 3.2: Distribution of survey packs, questionnaire response rate (from doorknock and letterbox delivery) and willingness to participate in interview, in each neighbourhood and overall

	Subiaco	Wanneroo	Ashby	Subiaco Centro	TOTAL
# of survey packs distributed					
Total	500	500	500	500	2000
Hand delivered by doorknock	176	218	266	42	702
Left in letterbox	324	282	234	458	1298
# of questionnaires returned					
Total	148	117	101	84	450
From doorknock	80	64	69	20	233
From letterbox	68	53	32	64	217
Survey response rate (in each neighbourhood and overall)	30%	23%	20%	16%	22.5%
Doorknock response rate	45%	29%	26%	48%	36%
Letterbox response rate	21%	19%	14%	14%	18%
# willing to be interviewed	45	42	28	27	142
% of total respondents	30%	36%	28%	32%	32%

It may be that the combination of personal approach to individuals with higher income and education status generated the best response. From another perspective, interest in the research topic may also influence response. Despite the lowest levels of income and education, the second highest response rate (23%) and the greatest proportion of people willing to be interviewed (36%) were recorded in Wanneroo. As will be seen in Chapter 5, the level of interest in spending time in nature and involvement in conservation activities was highest in Wanneroo and personal interest may have influenced the response rate in this neighbourhood.

Data analysis

Quantitative and qualitative data analysis was undertaken using the methods that will be described in this section, but two issues that emerged during quantitative data analysis must first be discussed.

The first issue related to the mid-point descriptor used in the Likert-type scales included in the survey questionnaire. The pilot study questionnaire included “neither” at the mid-point. A considerable number of mid-point responses to specific questions were

noted during preliminary analysis. This generated a great deal of discussion about whether it was better to use “neither”, “neutral” or “unsure” as the mid-point descriptor in the Likert-type scales that would be included in the main questionnaire. None of the authors of the selected scales detailed what descriptor was used for their mid-point response, though all indicated that either a 5- or 7-point Likert-type scale was used (Bonaiuto *et al.*, 1999; Bonaiuto *et al.*, 2003; Clayton, 2003; Gagnon Thompson & Barton, 1994). Direct approach to the principal authors resulted in no response from one, the other did not remember, and referral to another colleague did not provide any further clarification.

Weems and Onwuegbuzie (2001) note that while there is some research that examines the efficacy of mid-point selection in data analysis and debate whether or not a mid-point should be included in scalar measures, they acknowledge there is little known about the factors that influence mid-point choice. DeVellis (1991) suggests that many respondents do not focus on the precise wording used and any reasonable mid-point response option simply represents the mid-point of the range.

It is difficult to know whether different responses (such as neither, neutral or unsure) implied that respondents did not know, did not care, had no opinion or simply did not understand the question. In the main study, it was decided to follow a Likert-type scale format (as used by the original authors of the selected scales) and include “unsure” as the mid-point descriptor. The selection of “unsure” was based on the assumption that respondents might be less willing to admit they were unsure and select a response that indicated either agreement or disagreement. This study did little to contribute to the discussion about the inclusion or validity of mid-point responses as it was impossible to determine why a mid-point response was selected or whether “unsure” was the most appropriate descriptor to use.

Another concern relating to mid-point descriptors was noted during the interpretation phase of data analysis. Analysis was conducted using descriptive and multivariate techniques (described later in this section) and while there was some evidence of significant relationships, there were several inconsistencies and the strength of relationships between factors was not particularly high. I consulted a statistician from within my university for advice and it was strongly suggested that rather than using the

common practice of simply coding responses from 1 (*strongly disagree*) through 4 (*unsure*) to 7 (*strongly agree*) (DeVellis, 1991) that I recode all responses with mid-point responses coded as 0. In addition, I was advised that responses in somewhat agree and somewhat disagree categories could be amalgamated as semantically, both these descriptors indicated a similar response. The amended data coding system used for Likert-type scales included in the survey questionnaire is show in Table 3.3.

Table 3.3: Coding categories (scores) for responses to Likert-type scale statements presented in attitudes to nature, perceptions of green space quality and neighbourhood attachment scales

Coding categories	Amended coding	Original coding
Unsure	0	4
Strongly disagree	1	1
Disagree	2	2
Somewhat disagree	3	3
Somewhat agree	3	5
Agree	4	6
Strongly agree	5	7

The second issue that needed to be addressed before data analysis could be undertaken related to scoring of the SF-36v2™ health survey. Use of SF-36v2™ includes access to a software-based standardised norm-based scoring system. Scoring in this system calculates a normed t-score with a mean score of 50 (+/-3) in any physical and mental health domain or component summary measure representing average health. Algorithms used in SF-36v2™ scoring are based on US population data collected in 1998 (Ware *et al.*, 2007, pp. 187-188). Exact normed scores for component summary measures are slightly below 50 for both physical health ($M=49.97$, $sd=9.98$) and mental health ($M=49.90$, $sd=10.12$) though it is common practice to use the standardised mean score ($M=50$, $sd=10$) for between population comparisons. It is also usual for the population median score to be higher than the normed mean (Ware *et al.*, 2007), and a pattern of higher median scores was evident in this study. Mean and median scores for this study population are presented in Chapter 7.

A recent study of Australian populations resulted in slightly higher normed t-scores and slightly smaller standard deviation than the US-population based scoring system (Hawthorne *et al.*, 2007). All Australian population t-scores published by Hawthorne and colleagues (2007) use their own scoring algorithms and their factor score weightings differ slightly from those published by Ware and colleagues (2007). While

differences in most domains were relatively small, it was noted that results for the Australian population indicated a slightly higher normed mean for mental health summary scores than found for the US-based population ($M=50.01$, $sd=9.88$ compared to $M=49.90$, $sd=10.12$). It may have been more appropriate to use Australian population algorithms and normed scores within this study, but there is still considerable debate about the validity and use of these algorithms (Hawthorne, 2008). As a result, it was decided to continue to use the algorithms within the scoring software supplied by QualityMetric Incorporated as part of a licensed SF-36v2™ package (Ware *et al.*, 2007).

Quantitative data analysis

The quantitative survey questionnaire included four sections that recorded demographic details, and proximity to different types of green space, and used validated scales to measure perceptions of green space quality, attachment to neighbourhood, attitude to nature and natural environments, and self-reported health. Coding for all questions, including open-ended questions was established. Once all completed survey questionnaires were received, data was entered, checked and cleaned. Cleaning the data included correcting any errors in data entry and ensuring all responses, particularly items that needed to be reverse-coded, were correctly entered. Questionnaire data sets where numerous responses were omitted and index scores were unable to be calculated were identified. Ten (10) incomplete data sets were deleted leaving 440 cases for analysis.

The size of the overall sample population (Table 3.4) was adequate for most statistical analysis procedures when required sample size was calculated using standard confidence interval (5), confidence level (95%) and response distribution (50%) (ABS, n.d.). In addition, the total sample size met external validity requirements (Trochim, 2001) in relation to generalising results to the total population of the Perth metropolitan region (~1.4 million) even though the sample was not generated from suburban areas across the metropolitan area, only from four selected neighbourhoods from inner and outer northern suburbs.

When the overall sample was broken down into neighbourhood location, however, the sample size achieved was not sufficient to maintain a confidence interval of 5 (Table

3.4). A confidence interval >5 indicated greater margin of potential error when results were assessed by neighbourhood location. A similar situation was found for almost all sub-groups (such as when data were grouped by age or income) within the sample population. As such, only those results that apply to the overall sample population could be generalised. Despite this, sub-groups results, particularly those relating to demographic variables and neighbourhood location are discussed throughout the thesis.

Table 3.4: Adequacy of survey sample size, overall and by neighbourhood location†

	Total population	Study population	Confidence interval (CI) achieved‡	Sample size required to achieve CI of 5‡
Perth	1.4 million	440	4.7	385
Total survey sample	2000*	440	4.1	323
Subiaco	500*	144	6.9	218
Wanneroo	500*	114	8.1	218
Ashby	500*	100	8.8	218
Subiaco Centro	500*	82	9.9	218

* Number of households within designated distribution grid that received survey

† Confidence intervals calculated using web-based software provided by the Australian Bureau of Statistics and downloaded from <http://www.nss.gov.au/> on 3 January 2009

‡ With 95% confidence level and 50% response distribution

Quantitative data analysis was conducted using Microsoft Excel 2003, SPSSv14 software and specialised scoring software for the SF-36v2™ health survey. Individual responses to all questions were entered first into an Excel spreadsheet and then formatted to meet SPSSv14 and SF-36v2™ software requirements for scoring and analysis (Pallant, 2001, 2007; Ware *et al.*, 2007; Ware *et al.*, 2000). Descriptive and multivariate analysis techniques were used to determine the probability of difference in perceptions and relationships between groups (Trochim, 2001). Data analysis was undertaken in five steps that included:

1. preliminary descriptive analysis to identify patterns of response (frequency and cross-tabulation);
2. principal component analysis (PCA) to identify underlying and common factors to reduce data to a smaller set of transformed variables;
3. correlation analysis of non-parametric data to determine strength and direction of linear relationships between transformed and other variables (Spearman rho two-tailed test);
4. analysis of variance for non-parametric data to identify significant differences between variables (Kruskal-Wallis and Mann-Whitney U tests); and
5. bivariate logistic regression (forced entry method) to assess probability of demographic and other variable scores predicting health outcomes.

Steps 1 to 4 were conducted for three independent analyses with each set of data relating to attitudes to nature and natural environments (Chapter 5), perceptions of green space quality and attachment to neighbourhood (Chapter 6), or self-reported health (Chapter 7). The fifth step (logistic regression) incorporated all data as this final stage of the analysis process. Assumptions and issues that were considered within each step are discussed below.

Preliminary descriptive analysis

Preliminary analysis of the data included examination of responses to each question through generation of overall frequencies. Cross-tabulations and chi-square testing (using selected variables such as age, income or neighbourhood location) enabled exploration of potential associations identified in the literature. This preliminary analysis allowed primary patterns to be examined and underlying assumptions addressed before secondary statistical analysis could be commenced.

Initial analysis included assessment of response distribution. Normal distribution can be assessed either by visually determining whether the pattern of response forms a bell-curve when graphed or by using statistical measures of normality (such as the Kolmogorov-Smirnov test) and ensuring results fall within accepted parameters (Pallant, 2007; Trochim, 2001). Normality testing was conducted first through visual assessment and confirmed using statistical testing. Very few initial response patterns conformed to accepted patterns of normal distribution and non-parametric analysis techniques were used where appropriate in subsequent steps of analysis.

Non-parametric testing can be less sensitive, and may fail to detect differences that do exist between groups (Pallant, 2007), but as the data simply did not meet assumptions of population distribution required for standard parametric testing, it was decided that this was the best course of action. Non-parametric techniques rely on random samples and techniques that utilise individual cases and the data set in this study met those assumptions (Pallant, 2007). The presence of outliers (scores at extreme ends of the data set) was also assessed as outlying cases might potentially bias results, particularly correlation coefficients (Field, 2000, p. 76). Original data entry was rechecked to ensure these scores were not errors. The decision to remove or retain the small number

of outliers identified in the overall data set was considered at the appropriate stage of each step in the analysis process.

Exploratory factor analysis (principal component analysis)

Exploratory factor analysis was used to minimise the number of variables measuring attitudes to nature, proximity to neighbourhood green space, perceptions of green space quality, and neighbourhood attachment. Simple scoring of the indices, such as calculation of mean scores used in the Environmental Attitude Scale (Gagnon Thompson & Barton, 1994) did not provide statistically supported results that enabled identification of relationships or common traits within survey responses. Scoring the SF-36v2™ surveys, however, incorporates principal component analysis as part of a process resulting in 36 survey questions being scored as ten (10) variables, comprising two composite scores for physical and mental health and eight specific health domain scores (Ware et al., 2007).

Principal component analysis (PCA) calculates the strength of relationship between individual items (such as the individual questions in the SF-36v2™ survey) and extracts factors (or components) grouped according to inter-relational strength (Pallant, 2001). A PCA pattern matrix (one form of correlation matrix) ranks items to indicate strength of relationship within each factor (or component) with a loading of above 0.4 indicating a strong relationship (Field, 2000; Pallant, 2001). Using SPSSv14 to conduct principal component analysis to explore relationships between items in each of the other survey scales, it was possible to identify underlying factors relating to attitudes to nature, proximity to neighbourhood green space, perceptions of green space quality, and neighbourhood attachment.

Comprehensive testing of the SF-36v2™ survey, and reliability reporting provided as part of the scoring output, meant that I could be confident results generated by SF-36v2™ scoring software would be considered valid and reliable (Ware *et al.*, 2007). To ensure that PCA results for other indices would meet assumptions and could also be considered valid and reliable, results of several factor analysis pre-tests needed to be assessed. Reliable PCA requires a data set with more than 300 cases (Tabachnick & Fidell, 1996, p. 640), with at least ten cases for each item included in the factor analysis. In this case there were 440 cases included in PCA, with a maximum of 12 items

included in each analysis set, resulting in more than 40 cases for each item. The strength of relationships also needs to be considered and if correlation coefficients observed in output matrices are not greater than 0.3, PCA may not be appropriate. Two further tests are included in analysis output as an additional assessment of data suitability. For factor analysis to be appropriate, results for the Bartlett's test of sphericity should be significant ($p < 0.5$) and 0.6 is suggested as a minimum value in the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy (Pallant, 2007, p. 181). Results of these tests are included in relevant tables.

As a final consideration, because preliminary analysis had indicated there were significant correlations between some scale items, an oblique rotation rather than an orthogonal approach (which assumes there are no relationships between items) was used to generate pattern and other matrices. Selection of significant principal components (factors) for subsequent analysis was based on examination of scree plots and eigenvalues associated with each factor (Field, 2000). Only factors scoring an eigenvalue >1 were retained for subsequent analysis.

To enable subsequent analysis, item weightings identified in the factor score coefficient matrix (produced as part of the PCA process) were used to calculate new variable scores for each principal component (Field, 2000). These new variable sets are referred to as *transformed variables* and each TV represents a group of items that explain variance within a data set (Jung, 2002). Transformed variable scores for factors relating to attitudes to nature, proximity to neighbourhood green space, perceptions of green space quality, and neighbourhood attachment were calculated through use of factor score coefficients. Transformed variable scores for self-reported health (composite scores for physical and mental health and specific health domain scores) were generated automatically by the SF-36v2™ scoring software. Normality testing conducted for distribution of all transformed variable scores indicated that use of non-parametric testing was necessary for subsequent analysis. Transformed variables were used to conduct subsequent correlation analysis, analysis of variance and were included within logistic regression models.

Correlation analysis (Spearman rho test)

Bivariate correlation analysis identifies the degree (strength and direction) of the linear relationship between two variables (Pallant, 2007; Trochim, 2001). Correlation coefficients (r) are presented as values from -1.0 to +1.0 with negative or positive values representing the direction of relationship. A positive coefficient value indicates that the direction of relationship between both variables is the same: a high score in one variable corresponds to a high score in the other. A negative coefficient value indicates the opposite occurs: a high score in one variable corresponds to a low score in the other. A positive or negative coefficient value of 0.0 indicates no relationship at all, between 0.10 and 0.29 indicates a small (or weak) relationship, between 0.30 and 0.49 indicates medium strength, and between 0.50 and 1.0 indicates large (strong) relationship, with 1.0 indicating perfect correlation (Pallant, 2007).

Correlation testing determined the strength of relationships between transformed variables, selected socio-demographic and other variables. Scatter plots were used to initially assess the general trends within the data and to identify any outliers. A small number of outliers were identified in some scatter plots but as this step of the analysis was essentially exploratory and not confirmatory, all cases were retained. Before commencing correlation analysis, normality testing was conducted (Kolmogorov-Smirnov test) for each transformed variable and as found earlier, very little of the data were normally distributed. Because of the non-parametric nature of the data, Spearman Rank Order analysis (rho) was used (Field, 2000; Pallant, 2007). Within this analysis, a two-tailed test was used as the direction of relationships between variables was not known (Field, 2000).

Analysis of variance (Kruskal-Wallis and Mann-Whitney U tests)

Analysis of variance enables cross-sectional comparison of responses or scores between groups. Both Mann-Whitney U (M-WU) and Kruskal-Wallis H (K-WH) tests enable comparison of continuous variables for a pre-determined number of groups. M-WU tests are used to compare two independent groups (such as male or female) while K-WH tests are able to be used with independent variables containing three or more groups (such as neighbourhood location). Both tests convert scores to ranks and compare the mean rank for each group to determine statistical significance (Pallant, 2007).

While significance level is determined, these tests do not provide information about which categories within a particular variable are statistically different from each other. This can be accomplished by conducting individual M-WU testing between every pair of variables (Pallant, 2007) but this is a time-consuming and exhausting process, particularly in light of the number of variable categories involved in this study. These tests are non-parametric equivalents to a one-way between groups analysis of variance (ANOVA) and ANOVA with Tukey HSD post-hoc testing was conducted to give an indication of where significant variance might exist between different groups in each variable. Results of M-WU, K-WH and Tukey HSD tests are included in relevant chapters.

Bivariate logistic regression (forced entry method)

Logistic regression can be used as a prediction method when there are several independent variables (either continuous or categorical) and a single dichotomous output variable (Harlow, 2005). It is often used in health-focused research to assess associations between individual factors (such as exposure to various risk factors) and a specific health outcome (such as obesity) (Schoeppe & Braubach, 2007). There are limitations in using this type of analysis to determine causality, however, as few associations are linear and the selection of relevant independent variables is critical (Huynen, Martens, & De Groot, 2004).

The principle of logistic regression analysis is the calculation of an odds ratio (OR) which indicates positive (or negative) effect of a variable or group of variables (covariates) on a dependent outcome. Within this procedure, variables that are known to produce a particular effect (such as age or income on health outcomes) can be included in a block entry and the relative contribution of each variable assessed. In this study, all variables were categorical (as odds ratios are predicted based on change between one unit or category to the next) and effect was measured against a constant (1.00) within each variable. Positive effect is indicated by an OR >1.00 and negative effect by OR <1.00. As an example of how to interpret logistic regression results, if a significant OR of 1.50 was found in relation to visiting green space and mental health, it would indicate that when all other covariates are taken into account, people who visited green spaces most often were 1.5 times more likely to record better mental health scores than those who visited least often. This final stage of analysis incorporated all of the

socio-demographic and other variables and all valid transformed variables generated either by SPSSv14 PCA or SF-36v2™ software.

There are several issues that must be considered in order to achieve reliability of results. The first is sample size and whether any categorical predictors include only a small number of responses. As mentioned above, all predictor variables used in this analysis were categorical and frequency analysis was conducted to identify variables with a small number of responses in any category or categories. Where possible, these categories were amalgamated to increase the number of responses. Secondly, while it is expected that there will be some correlation between predictor variables (independent variables) and the outcome variable (dependent variable), it is important that predictor variables are not very highly correlated (at $r=0.9$ or above) (Pallant, 2007; Tabachnick & Fidell, 1996). Multicollinearity between predictor variables was checked before construction of logistic regression models. The presence of outliers also needs to be considered, and in this study, these were automatically removed by SPSSv14 as part of the analysis process.

Other considerations relating to reliability of logistic regression models concern “goodness of fit” and this is indicated when the Hosmer and Lemeshow test returns a non-significant result ($p>0.05$). Also statistical significance and chi-square (χ^2) results provide overall indication of how well the model performs. The lower and upper levels of variance in the dependent variable that is explained by the model are indicated by two tests: Cox and Snell R square and Nagerkerke R square test (Pallant, 2007). All results of these tests were considered and results are reported in relevant tables.

Qualitative data analysis

The process of qualitative data analysis is essentially inductive rather than deductive, focused on interpretivist approaches that aim to understand human action rather than positivist approaches that seek causal explanations (Schwandt, 2003). Qualitative data collection was completed using a semi-structured interview schedule (Appendix 3.4) enabling exploration of interviewees’ understandings, perceptions, viewpoints and personal histories. Analysis of this data allowed deeper interpretation of different perspectives than was possible with the survey data.

To understand the essence of individual and collective stories, rather than simply describing interviewees' point of view, a recursive process of qualitative data analysis was used. This process followed four steps (Green *et al.*, 2007) that included:

1. data immersion;
2. coding;
3. creating categories; and
4. identification of themes.

Creswell (2003) includes a fifth step in his model of inductive research that involves generalisation or development of new theories, based on the research experience or current literature.

Data immersion

Immersion in the data involved familiarising myself with the content of all 25 interviews. Immediately after each interview, I replayed the voice recording and made notes about the interview settings, initial observations and questions that I might choose to explore further in future interviews. This also enabled me to check recording quality before sending the recordings to an external typist to be transcribed. My first read through was done while listening to the voice recordings so I could correct typing errors, add context and comments. Once any corrections were made, each transcript was read again to gain a sense of the content. No formal coding was done at this time, though thoughts and impressions were written in the margins. This step enabled me to focus on overall impressions and observations rather than how particular statements might be specifically coded.

Coding

Qualitative data analysis was supported by use of NVivo7 software and all transcripts were formatted for entry into this program. The NVivo7 software package records categorisation of coded data in “free” and “tree” nodes representing either single or clustered descriptions of contained data. Green and associates (2007, p. 548) describe codes as “descriptive labels ... applied to segments of the transcript”. Essentially, coding is a process of sorting and tagging relevant data and required me to make judgements about what responses and comments were relevant to the research questions. My first step in coding was to identify responses to questions that related directly to the interview schedule and these responses and comments were sorted into

stand-alone groups (free nodes). At the same time, comments and responses to other questions that arose during interview, points of interest and specific issues that emerged from the data were captured and coded into free nodes.

Creating categories

In the next stage, similarities, contradictions and relationships in and between data coded into free nodes were noted. Where appropriate, the contents and descriptions of nodes were amalgamated, expanded, dissected and recoded to form coherent, hierarchical categories (tree nodes). This was not a linear process, and the interview transcripts were revisited and reviewed again and again to ensure that all relevant statements were considered and appropriately coded. A list of tree node coding categories is included as Appendix 3.5.

Identifying themes

Identifying themes means more than simple description and involves providing explanations and interpretations of the data (Green *et al.*, 2007). It is possible to use NVivo7 software to create thematic data maps, but I had very limited proficiency in this aspect of the software program and chose to complete this stage manually. Armed with a large sketch pad and many coloured pens, I examined all of the comments within connected categories, often comparing responses by neighbourhood or from within other groups formed by similar age or family situation. While reviewing the extensive notes, drawings and diagrams that articulated my thought process, I began to write about identified themes, explanations and my interpretations of the data. I found the writing process useful for further clarifying themes and interpretations. As with every stage of the qualitative data analysis, the process was not linear and I constantly referred back to the original transcripts to check context, clarify points of view or answer yet another question that emerged from the data.

Validity of qualitative data analysis

Reliability and validity of data collection and analysis are important issues in qualitative research. Establishing credibility in qualitative work can be challenging as data analysis does not parallel the scientific validity of quantitative work (Olesen, 1994). This study followed Henderson's (1991) suggestions that for a study to be reliable it needed a flexible plan with changes documented, used a second opinion for interpretation in data

analysis, and established an audit trail. In order to gain a second opinion, a close colleague, with experience in qualitative research, was asked to examine several transcripts coded with emergent themes to ensure that my interpretation of significant statements reflected interviewees' points of view. In addition, my research supervisors read all of the transcripts, initial summaries and made numerous comments on interpretations presented throughout the writing process.

A documented audit trail, showing links between the categorisation of raw data and the development of cluster themes was established through use of NVivo7 software. Manual notes, diagrams and sketches of my interpretation process were also recorded throughout the analysis process.

Integrating the data analysis

The primary strength of mixed method research is the integration of all data, enabling identification of relationships, convergence and contradictions between the data sets and forming new interpretations, explanations and meanings (Creswell, 2003; Creswell & Plano Clark, 2007). The final challenge in data analysis was to integrate the findings of both quantitative and qualitative data. Each of the chapters describing the research findings relating to key themes of attitudes to nature, perceptions of green space, neighbourhood attachment and health (Chapters 5-7) concludes with a discussion that made reference to both quantitative and qualitative results. It was not until the analysis of all of the quantitative and qualitative data relating to these key themes was completed that I was able to focus on interpreting the data as a whole and identifying more integrated relationships, explanations and meanings. As recommended by Creswell and Plano Clark (2007) a visual diagram showing relationships between the two data sets were used to guide and clarify the final process of data integration and analysis. In this study, the factors generated during quantitative data analysis and the themes generated through qualitative data analysis proved to be useful starting points to compare findings across the two data sets. Drawing conclusions based on both data sets, however, was easier said than done, though once accomplished, provided comprehensive responses to the primary research questions posed within this study. The figures and models presented in the final chapter of this thesis are the result of data integration and interpretation.

Limitations of the research design

Time and financial constraints limited the study to four suburban locations in Perth, Western Australia. The environment of this city is characterised by its relatively small population, its geographical isolation and the unique natural environments of the Swan Coastal Plain (Seddon, 1972, 1997). Without replication, it cannot be assumed that all of the findings of this study could be generalised to populations in other metropolitan regions. In addition, analysis of the quantitative data was predominately cross-sectional and as such, it is not possible to establish causal relationships, though significant associations can be identified (Sugiyama *et al.*, 2008). Also, selection effects cannot be excluded though they may have been mitigated through statistical controls.

Qualitative data is subjective and reflects individual recollections based on personal experience and perception. The quality of interview data is dependent on honest response from informed and articulate individuals and may not represent the views of the wider population. My own subjectivity must also be considered. Despite my best efforts, some elements of personal bias may have influenced the interpretations and meanings presented in this study.

Limitations relating to subjectivity of quantitative data are also acknowledged. Individual responses to survey questions were based on personal experience and perception. Responses to key indices such as self-reported health and neighbourhood attachment may be influenced by a great number of factors. Personal and family relationships, employment status, living situation and other significant stress factors may do more to determine responses to these indices than individual attitude to natural environments or perceptions of local green space.

Limitations in sampling methods are also recognised. While the final survey sample size (n=440) was sufficient for proposed statistical analysis, the number of respondents within each neighbourhood differed considerably (n=82 to n=144). While the overall response rate provided a large enough sample size to be representative of the general Perth population, the sample size within socio-demographic sub-groups was not sufficient to make generalisations based on these variables. In addition, the relatively low overall response rate (22.5%) has contributed to some population groups being

overrepresented. The possibility of respondent bias was also recognised as people with higher incomes, more educational qualifications and an interest in nature, green space or environmental issues may have been more likely to respond.

These limitations were taken into account during the data analysis process and potential impact on findings is acknowledged and discussed in appropriate chapters.

Chapter 4: The neighbourhoods

This chapter provides background information about each of the neighbourhood locations selected for inclusion in this study, and the people who live in them. To begin this chapter, the geography and history of residential development of the Perth metropolitan region are described, followed by an overview of the history, physical characteristics and the socio-demographic make-up of each suburb. Next, collective census data for the selected neighbourhood within each suburban location is compared to the study population (respondents to the survey questionnaire) to examine the representativeness of the sample. In the final section of this chapter, the interviewees are introduced with their chosen names and some personal information. The interviewees' responses to questions about why they chose to live in their suburban neighbourhood conclude this chapter.

Locations of the selected suburban neighbourhoods (Subiaco, Subiaco Centro, Wanneroo and Ashby) within the northern Perth metropolitan region are illustrated in Figure 4.1. Subiaco and Subiaco Centro are located centrally, approximately four kilometres to the west of the Perth CBD. Wanneroo and Ashby are located approximately 22 kilometres north.

The process of compiling the information presented in the first sections of this chapter needs to be explained. Attempts to access verified, quantifiable data regarding suburban characteristics proved to be somewhat difficult, particularly access to specific information regarding green space. One local government authority did not permit public access to town planning data relating to parks and reserves. The town planning cadastral maps that were available on-line included general descriptions of land use but did not include specific reserve identification numbers. The other local government authority involved in this study was willing to provide me with access to their parks and reserves data though were unsure about the accuracy of the available data set or whether the particular information I wanted could be compiled electronically.



Figure 4.1: Location of Perth in south-western corner of Australia (map from www.biodiversityhotspots.org) and location of selected neighbourhoods of Subiaco, Subiaco Centro, Wanneroo and Ashby within the northern Perth metropolitan region of the Swan Coastal Plain (Google Earth image taken circa 2006 and downloaded 10 March 2009)

Other sources of parks and reserves data were investigated. Some was held by the state Department of Planning and Infrastructure, but was filed according to reserve identification number and without specific information from each local government authority, electronically searching this information was difficult. The state Department of Sport and Recreation also held some records, but only in relation to sporting reserves. Another local research team had compiled an audit of green spaces within the Perth metropolitan area (Giles-Corti *et al.*, 2005), but only included reserves larger than two acres (0.8ha). The audit area did not extend to Wanneroo and as it was undertaken in 1995-96, residential development in Subiaco Centro or Ashby had not occurred. Much of the information regarding the physical characteristics of each selected suburban neighbourhood is based on assimilation of available records including GIS mapping and

aerial photography from Landgate (the state Department of Land Information), Google Earth, street directories and town planning data available from local government websites. During the course of this study, I spent a great deal of time talking to people as well as walking, driving around and photographing these neighbourhoods. I feel I know them well.

Planning for open space and natural environments in Perth

Residential development within the Perth metropolitan area sits on a region referred to as the Swan Coastal Plain (Figure 4.1). European settlement of this region occurred in 1829 with the establishment of the port of Fremantle at the mouth of the Swan River and the development of the Swan River Colony further upriver (Seddon, 1972). Since that time, most urban development has occurred in relatively narrow corridors that run north and south along the coastline, and east towards the Darling Scarp. Current population of the Perth metropolitan area is approximately 1.4 million people (ABS, 2007) and is expected to reach 2.1 million people by 2031 (WAPC, 2000b).

The Perth Metropolitan Region is part of the Swan Coastal Plain Bioregion, itself part of the Southwest Australian Floristic Region, an area recognised internationally as a biodiversity hot-spot where an exceptional richness of endemic species are highly threatened (Myers, Mittermeier, Mittermeier, da Fonseca, & Kent, 2000). Given its sandy soils, the Swan Coastal Plain is a complex system of seasonal and episodic wetlands supported by underground water sources. The most common endemic plant communities found in the northern section of the Swan Coastal Plain are eucalypt forest and banksia woodland (Seddon, 1972) and numerous areas of remnant bushland and suburban parkland surround wetland relics (Environmental Protection Authority, 1993). Urban residential development is now considered a major threat to remaining wildlife habitat and vegetation communities within the Swan Coastal Plain (Grose, 2005).

The Stephenson-Hepburn Plan, published in 1955, provided the blueprint for urban planning within the Perth metropolitan area over the second half of the 20th century. One of its defining features was the inclusion of a planning standard that mandated for allocation of public open space (POS) in all new residential developments. POS allocation was based on proposed residential density and was equivalent to 0.5 acres per

1000 people, or 10 per cent of the land released for development (Grose, 2007). It is suggested that because of substantial changes to patterns of residential density in the Perth metropolitan region since 1955, it is no longer appropriate to apply this standard and increased allocation of public open space and conservation of remnant bushland needs to occur to ensure vital ecosystems services are maintained (Grose, 2009). Despite this, the allocation of only 10 per cent public open space in new residential development is still part of current planning practice. Under the Liveable Neighbourhoods Planning Guidelines, structure plans for new suburban developments must demonstrate that at least ten per cent of gross subdivisible land has been allocated to public open space. A somewhat complicated process of calculating acceptable POS provision allows developers to include restricted use areas such as wetlands, buffer zones and drainage swales within public open space allocations (WAPC, 2004, p. 92).

In order to ensure natural environments were retained within the metropolitan area, the Stephenson-Hepburn Plan also recommended the establishment of the Metropolitan Reserves Scheme (which occurred in 1963). The resultant regional parks system acquired areas of open space for conservation and public recreation purposes (Conservation Commission of Western Australia, 2003) and to “protect the landscape setting of the city” (Grose, 2005, p. 52).

In 2000, in an effort to further protect the unique natural environments found within Perth, the Government of Western Australia endorsed the Bush Forever scheme as a “means of seeking the appropriate protection and management of areas of regionally significant bushland on the Swan Coastal Plain portion of the Perth Metropolitan Region and a balance between environmental, social and economic outcomes” (WAPC, 2000a, p. 1). Despite implementation of the Bush Forever scheme, extensive clearing of bushland for residential development still occurs. Between 2001 and 2005, 1158 hectares of bushland was cleared for residential development in the City of Wanneroo, an amount that accounted for almost one-third of all bushland cleared within the Perth metropolitan area during that time (Perth Biodiversity Project, 2007). The extent of clearing for urban development on Perth’s peri-urban fringe, particularly in areas with under-represented vegetation complexes, threatened ecological communities and wetlands, is now considered an issue of major concern (Horwitz *et al.*, 2008).

Part of the purpose of this study was to explore attitudes towards urban nature and retention of suburban bushland reserves so, where possible, selected neighbourhoods were located close to bushland areas and other natural environments. The survey distribution grids in Subiaco, Wanneroo and Ashby are each immediately adjacent to areas identified as Bush Forever (BF) sites in Figures 4.2 and 4.3. Significant local sites, particularly those directly referred to by interviewees, are labelled within these figures.

The neighbourhoods of Subiaco, Subiaco Centro, Wanneroo and Ashby

Apart from their proximity to urban bushland, differences in socio-economic status and population characteristics, the four suburban neighbourhoods selected for this study were considered representative of traditional and contemporary approaches to residential development in the inner and outer suburbs in Perth. As discussed in the previous chapter, population data for each suburban neighbourhood were derived from within census collection districts that best matched survey distribution grids (Table 4.1). Information about the number of residents and number of households within each survey grid, as well as average house block size and median house price is presented within this table. The boundaries of survey distribution grids for each neighbourhood are illustrated in Figures 4.2 and 4.3.

Table 4.1: Census collection districts (CCDs) aligned with each survey distribution grid, number of residents and number of households in collective CCDs, average house block size and median price in each neighbourhood

	Subiaco	Wanneroo	Ashby	Subiaco Centro
Census Collection Districts (CCDs) in survey grid	5050107	5030604	5030638	5090201
	5090108	5032102	5030639	5090216
	5090109	5032105	5030626	5090319
Number of residents	1458	1609	1574	1478
Number of households	561	646	511	810
Average house block size ^a	500-600m ²	650-800m ²	500-600m ²	300-350m ²
Median house price 2005 ^b	\$721,000	\$338,000	n/a	n/a
Median house price 2008 ^c	\$1,372,500	\$385,000	\$435,000	\$1,372,500

^a Averaged from cadastral maps and information provided by local real estate agencies

^b Propertyvalue.com.au (2005)

^c Real Estate Institute of Western Australia (2008)

The inner suburban neighbourhood of Subiaco (Figure 4.2) was established in 1851. Benedictine monks formed the first community in this area and, in 1885 the state government released land for residential development. Much of this early development

was the construction of worker's cottages for employees of the timber mill that once operated near the railway line. Average house block size in the older, more established area of Subiaco is substantially less than the standard post World War II quarter-acre block, with most measuring only 500-600m² (REIWA, 2008). Over the past two decades, Subiaco has undergone extensive gentrification with an accompanying increase in real estate value and demand for higher residential density met through urban infill and regeneration projects (Montgomery, Saunders, & Chortis, 2003). Demand for homes in Subiaco and Subiaco Centro is reflected in real estate prices. Median house price in 2008 was \$1,372,500, compared to the Perth median price of \$400,000 (REIWA, 2008).

The new neighbourhood of Subiaco Centro is located on the City of Subiaco's northern boundary (Figure 4.2). Originally a light industrial area next to the Perth-Fremantle railway line, redevelopment of this brownfield site began in 1997. Subiaco Centro was the first master-planned development in Perth to incorporate public transport, commercial, residential and recreation areas. It was designed as a mixed land-use, medium/high-density residential estate of 800-900 homes built on an average block size of 300-350m². A new subway train station is adjacent to the retail and commercial precinct and overall design includes a network of bikeways, greenways and civic squares to create a "distinct modern village feel" (Subiaco Redevelopment Authority, 2005).

Outer suburban Wanneroo (Figure 4.3) was first recorded by surveyors circa 1842. It was once recognised as an independent township, though is now considered part of the metropolis of Perth. Until relatively recently, Wanneroo was a semi-rural district with market gardens and light industrial areas surrounded by extensive wetland systems. In the 1970s, many market garden properties along Lake Joondalup were subdivided for residential development. Average block size is 650-800m² though several of the original homes in the neighbourhood sit on substantially larger blocks (up to 4000m²). Median house price in Wanneroo in 2008 was \$385,000, a little lower than the Perth median price (REIWA, 2008).

Over the past decade, much bushland and many more market garden properties surrounding Wanneroo were cleared and re-developed as low to medium density

residential estates. Development of the Ashby estate was approved in 1997. Entry to the first residential neighbourhood in Ashby is located approximately two kilometres north of the old Wanneroo town site (Figure 4.3). Average block size is 450-600m² and new homes in Ashby attract a higher median price (\$435,000) than those in Wanneroo (REIWA, 2008).

Access to services and facilities

The two neighbourhoods of Subiaco and Subiaco Centro are well serviced with good access to public transport (particularly rail), commercial, retail and community facilities. An extensive high-street shopping and commercial district runs from within, and between them. Two government primary schools are located within 500 metres north and south of the Subiaco survey grid, another is located within 500 metres south-west of Subiaco Centro and a technical college is situated on its western border. A major maternity hospital is located between the two neighbourhoods and a large private hospital is adjacent to the north-east corner of Subiaco Centro. A children's hospital is located one kilometre to the east of Subiaco Centro, as is a government high school.

Wanneroo residents are less well serviced in relation to public transport, commercial, retail and community facilities. An established shopping and commercial district is located along Wanneroo Road at the site of the old township, approximately 500 metres to the east of the Wanneroo survey grid area. A government primary school is located only a few hundred metres east of the Wanneroo survey grid, with another private primary school located on the other side of Wanneroo Road. While there are local bus routes, the nearest railway line and access to the metropolitan freeway system are located on the other side of Lake Joondalup, approximately six kilometres by road. The nearest public hospital is located in the City of Joondalup, also on the other side of the lake and a further 5 kilometres north.

There are no community, commercial or retail facilities within a one kilometre radius of the Ashby survey grid, with the closest facilities located in Wanneroo and Joondalup. The nearest government primary school is also located in Wanneroo. There is one private primary school located in Tapping, approximately 500 metres west of the secondary survey grid.



Figure 4.2: Inner suburban survey distribution grids in Subiaco and Subiaco Centro
(Photo: Landgate, WA Department of Land Information GIS data)



Figure 4.3: Outer suburban survey distribution grids in Wanneroo and Ashby
 (Photo: Landgate, WA Department of Land Information GIS data)

Streetscapes

Subiaco house lots are relatively uniform in size with many timber cottages and bungalow-style housing, interspersed with new homes built in a variety of architectural styles (Figure 4.4A). Almost all older homes have well established gardens. Subiaco has relatively narrow streets within the neighbourhood, with wider traffic routes along the southern and eastern borders providing access to commercial and retail strips (Figure 4.5A). Streets follow a classical grid pattern with substantial tree cover and footpaths on at least one side of the road.

In Subiaco Centro's western precinct, many homes overlook the central park and all conform to a particular contemporary architectural design of two- to three-storey narrow homes, most built with a common wall (Figure 4.4B). Major roads into Subiaco Centro are lined with trees (including lemon, coral and London plane trees) but there is little tree cover away from main thoroughfares and the park. Most roads have footpaths on both sides and designated street parking bays (Figure 4.5B). The eastern precinct is dominated by apartment buildings and a retail/commercial area. There is much less street vegetation and greater traffic flow compared to the western side of the neighbourhood.

Wanneroo houses are predominately built of brick with tile roofs, though architecture styles are not uniform. Most are set in large, open gardens with lots of trees, shrubs and other vegetation with tree cover dispersed throughout the neighbourhood (Figure 4.4C). Most roadways are wide with few footpaths or street trees, though there are many trees close to the verge (Figure 4.5C). Several streets end in cul-de-sacs.

In Ashby, houses are very similar to one another in architectural style and are set close together. Houses dominate their blocks with little outdoor space or trees around each home (Figure 4.4D). Except along the main entry ways, there are few street trees and apart from deviations around parks, streets are laid out in a classic grid pattern. Where footpaths have been built, they are usually only on one side of the road. Front garden landscaping is provided as part of the purchase package and there is limited variation in style of garden or diversity of vegetation. Strict covenants imposed by the estate developer cover the size and type of house that can be built, house setbacks, car parking, the height, width and type of materials used in fencing and driveways, the placement of

letterboxes, and positioning of air conditioners, solar water heaters, clothes lines and water tanks to ensure they cannot be viewed from the street (Satterley Property Group, n.d.).



A: Subiaco



B: Subiaco Centro



C: Wanneroo



D: Ashby

0 50 100 200 Meters



Figure 4.4: Aerial views of each neighbourhood (same scale for comparative purposes) with parkland included either in or adjacent to survey distribution grid with dotted lines indicating grid boundaries (Photos: Landgate, WA Department of Land Information GIS data)



A: Subiaco



B: Subiaco Centro



C: Wanneroo



D: Ashby

Figure 4.5: A typical streetscape in each neighbourhood (Photos: M. Carter)

Parks, nature reserves and other green spaces

Parks and green spaces (Figure 4.6) within each neighbourhood are distinctly different. Those in Subiaco and Wanneroo are shady with established larger trees, include multiple places to sit (Figure 4.6 A and C), and in the case of Subiaco contain well maintained gardens that reflect the early European settlement of the area. Wanneroo parks include a greater variety of Australian native and endemic species.

Parks in Subiaco Centro and Ashby contain fewer, smaller trees than those in established neighbourhoods (Figure 4.6 B and D). Apart from remnant trees and new plantings, these parks mostly consist of flat grass lawns, paths and playgrounds. Overall appearance of the central park in Subiaco Centro is manicured with hard landscaped edges and plantings of mostly exotic species. Most Ashby parks are ringed by road and consist of a flat mown lawn with new tree plantings and a colourful playground. One area of parkland slopes down towards the Bush Forever block and this

park contains a substantial number of old, tall eucalypt trees. Differences in the areas, number and type of green spaces that surround inner and outer suburban neighbourhoods were also quite marked.

The inner suburb of Subiaco is adjacent to Kings Park and Botanic Garden (Figure 4.2). This large parkland is more than 400 hectares in total area and comprises more than 320 hectares of bushland, as well as botanical gardens, walk and cycle ways, recreation facilities and picnic areas surrounded by open lawns (Botanic Gardens and Parks Authority, n.d.). Bushland within Kings Park is classified as protected under the Bush Forever scheme (WAPC, 2000a, p. 77). There are also several large neighbourhood parks throughout the locality and areas of remnant bushland to the west of both Subiaco and Subiaco Centro. The large permanent wetland system of Lake Monger is located approximately one kilometre north of Subiaco Centro (Figure 4.2). Lake Jualbup, a seasonal wetland is located within parkland only a few hundred metres to the south east of the Subiaco survey distribution area (Figure 4.2).

Community facilities such as a library, environmental centre and theatre complex are situated in parkland gardens adjacent to the northern border of the Subiaco survey grid. Subiaco Oval, a major football stadium is adjacent to the eastern border of Subiaco Centro. Community club-based sporting facilities (for netball, cricket and hockey) are found within 500 metres of Subiaco Centro's western border, with more sporting facilities (for tennis, soccer, rugby, cricket, football, lacrosse and lawn bowls) located within 500 metres of the southern border of the Subiaco survey grid.

The outer suburb of Wanneroo is adjacent to the eastern section of Yellagonga Regional Park, an extensive lake system reserved in 1975 under the provisions of the Metropolitan Reserves Scheme (Figure 4.3). Much of the remnant vegetation within this locality is representative of the open eucalypt forest and banksia woodland systems that were once common in the northern area of the Swan Coastal Plain (Conservation Commission of Western Australia, 2003). The parklands (2.5ha) along the eastern edge of Lake Joondalup in Wanneroo contain playground areas, walk and cycle ways, and junior playing fields. Conti Road Bushland (Figure 4.3) is a 20ha Bush Forever site, currently classified as a proposed parks and reserve, located immediately adjacent to the western boundary of Ashby (WAPC, 2000a, p. 48). There is no formal walk or cycle

way within this reserve. Tracks are sandy and entry is difficult as almost all of the area, including the adjacent gazetted park (Ashley Park) is fenced with few access points (Figure 4.7).



A: Subiaco



B: Subiaco Centro



C: Wanneroo



D: Ashby

Figure 4.6: A typical park space near or within each neighbourhood (Photos: M. Carter)

Community facilities such as a library, civic centre, aquatic and recreation centre, and theatre complex are situated in parklands behind the Wanneroo shopping district. The Wanneroo Showground, located on the eastern border of the survey grid, provides open space for concerts and community events (such as the annual agricultural show) as well as facilities for football, tennis and lawn bowls. Other community facilities (recreation centre, picnic ground and junior sportsgrounds) are located in Scenic Drive Park along the edge of the lake, adjacent to the western boundary of the Wanneroo survey grid.

There are no sports grounds or other formal recreational facilities within, or near, the Ashby estate. It is proposed that sporting fields and a community centre will be built

just north-west of the Ashby neighbourhood (on an area known as Jimbup Swamp) but at the time of this study, initial plans were still being considered.



Figure 4.7: Ashley Park adjacent to Conti Road Bushland, Ashby (Photo: M. Carter)

Socio-demographic characteristics of selected suburban neighbourhoods

Socio-demographic information was collected in the first section of the survey questionnaire to identify the characteristics of the study population and to enable cross-sectional comparison of survey responses with 2006 Census data. Proportional statistics for socio-demographic data collected through survey and 2006 census are presented in Table 4.2.

Table 4.2 includes several sets of data. The first column (All) includes all of the study population (n=440) and compares survey responses to census data for the population of Perth's metropolitan region. In the remaining columns (Subiaco, Wanneroo, Ashby and Subiaco Centro), survey responses for each neighbourhood location are compared to data from 2006 census collection districts aligned with each neighbourhood's survey distribution grid (Table 4.1).

Gender, age and cultural background

A higher proportion of women responded to the survey (65%) than the proportion of women found in the Perth metropolitan population (51%) or within each survey grid

population (48-52%). This was most evident in Ashby where 73 per cent of survey respondents were female.

With regard to age, the overall study population was relatively similar in composition to the general Perth population, though there is a slightly higher proportion of respondents aged more than 55 years (31% of Perth population compared to 39% of study population). This was particularly evident in Wanneroo where half of all respondents were aged more than 55 years (51%). In Ashby, however, the opposite pattern was seen with the majority of respondents aged between 18 and 44 years (61%).

Most respondents identified themselves as Australian (55%), slightly less than within the overall Perth population (62%). The next biggest group of respondents were British or Irish (25%) and this group was over-represented when compared to Perth's population (12%), particularly in Wanneroo and Ashby (34% and 31% respectively). Within Ashby, however, this result matched the composition of the survey grid population (30% British or Irish). The inner suburban neighbourhoods of Subiaco and Subiaco Centro had the highest proportion of Australian respondents (>60%). In Subiaco, British and Irish respondents were again over-represented (20% of Subiaco respondents were British or Irish compared to 12% within the survey grid population), though in Subiaco Centro, the proportion of British or Irish survey respondents was well-matched to survey grid population (15% compared to 13%). Overall, greater diversity in cultural background was evident within inner suburban neighbourhood respondent and survey grid populations.

Weekly household income and educational qualifications

The survey question about weekly household income generated the highest level of non-response with 33 respondents (7.5%) declining to provide this information. Of those who did answer this question, the proportion of respondents from inner suburban neighbourhoods who reported a weekly household income of more than \$1500 was considerably higher than the proportion of Perth's population (44% in Subiaco and 57% in Subiaco Centro compared to 25% of Perth's population). In Ashby, the proportion of respondents who reported this level of income (21%) was more similar to Perth's population (25%), though less than survey grid population (33%). In stark contrast, only a very small proportion of Wanneroo respondents reported a weekly household

income of more than \$1500 (4%), a much lower proportion than within the survey grid population (16%) and Perth's population (25%). In Wanneroo, the majority of respondents (69%) reported weekly household income levels of less than \$1000.

With regard to education qualifications, a similar pattern of response was evident. Subiaco and Subiaco Centro respondents held substantially more post-graduate degrees (29% and 27% respectively) than respondents in Wanneroo (4%) or Ashby (9%). In all neighbourhoods, the proportion to survey respondents with post graduate qualifications was substantially more than found within the survey grid population. It was also evident that compared to the general population of Perth, there was an over-representation of survey respondents who held a university degree (29% compared to 10%) or post-graduate qualification (18% compared to 3%).

Living arrangements

The overall proportion of respondents who reported living as a couple with no children in the home (42%) was considerably higher than within the general population of Perth (19%). The overall proportion of single respondents (23%) was also higher than within Perth's population (13%). In Subiaco Centro, more than half of respondents (58%) reported being single or living as a couple with no children at home. Conversely, the overall proportion of respondents who reported living as a family with children in the home (34%) was substantially less than within Perth's population (57%).

The overall proportion of respondents who reported living in a detached house (85%) was relatively consistent with Perth's population (78%). Townhouse or apartment living was most common in Subiaco Centro (61%). In Ashby, all respondents lived in a detached house as this was the only type of home available in this neighbourhood.

Most respondents in Subiaco and Wanneroo reported having access to a garden. However, in Wanneroo, most were large in size (72%) and small to medium sized in Subiaco (77%). All Ashby respondents had a garden, with most being small to medium sized gardens (65%). In Subiaco Centro, only a very small number of respondents reported having a large garden (2%), some had small to medium gardens (24%), with most respondents having access only to a courtyard, balcony or common garden (72%).

Table 4.2: Socio-demographic data for ALL survey respondents (% in bold) compared to ABS 2006 census data for Perth metropolitan region, and for respondents in each neighbourhood location (% in bold) compared to census collection district (CCD) data for each survey collection grid

	ALL			Subiaco			Wanneroo			Ashby			Subiaco Centro		
	n=440	%	ABS % PERTH	n=144	%	CCD % n=1458	n=114	%	CCD % n=1609	n=100	%	CCD % n=1574	n=82	%	CCD % n=1478
Gender															
Female	284	64.5	50.6	93	64.6	49.8	71	62.3	49.2	73	73.0	48.2	47	57.3	51.9
Male	156	35.5	49.4	51	35.4	50.2	43	37.7	50.8	27	27.0	51.8	35	42.7	48.1
Age															
<18 years of age (as % of total CCD population)			26.9			23.4			25.3			35.8			9.8
All other age groups represent % of adult population (>18 years)															
18-24	15	3.4	10.2	5	3.5	6.2	3	2.6	10.5	6	6.0	13.5	1	1.2	8.1
25-34	68	15.5	18.6	14	9.7	11.5	14	12.3	15.3	30	30.0	33.5	10	12.2	20.6
35-44	91	20.7	20.6	33	22.9	16.3	18	15.8	17.7	25	25.0	27.5	15	18.3	15.9
45-54	93	21.1	19.4	38	26.4	16.2	21	18.4	19.9	16	16.0	15.0	18	22.0	15.3
55-64	89	20.2	14.7	27	18.8	13.9	26	22.8	19.2	15	15.0	7.6	21	25.6	18.2
65 years and over	83	18.9	16.4	26	18.1	12.4	32	28.1	17.6	8	8.0	3.0	17	20.7	23.3
Non or incomplete response	1	0.2		1	0.7										
Cultural background															
Australian	240	54.5	61.5	87	60.4	64.6	56	49.1	63.6	46	46.0	51.3	51	62.2	57.1
British or Irish	111	25.2	12.4	29	20.1	11.9	39	34.2	20.1	31	31.0	30.1	12	14.6	13.0
New Zealander	15	3.5	2.4	4	2.8	2.3	4	3.5	3.3	5	5.0	3.1	2	2.4	2.2
European	25	5.9	3.9	9	6.3	3.4	7	6.1	1.9	3	3.0	0.6	6	7.3	3.3
Asian	12	2.9	6.2	4	2.8	3.6			1.6	4	4.0	2.0	4	4.9	6.0
South African or Zimbabwean	13	3.1	1.3	3	2.1	0.8	2	1.8	0.5	5	5.0	1.8	3	3.7	1.4
North American (USA or Canada)	9	2.1	0.6	5	3.5	1.4	1	0.9	0.6			0.2	3	3.7	1.8
Other			4.2			3.7			2.6			4.9			4.6
Non or incomplete response	15	3.4	7.5	3	2.1	8.3	5	4.4	5.9	6	6.0	6.2	1	1.2	10.6
Time lived in neighbourhood															
Less than 1 year	98	22.3		19	13.2		9	7.9		55	55.0		15	18.3	
1-5 years	158	35.9		39	27.1		22	19.3		44	44.0		53	64.6	
6-10 years	54	12.3		23	16.0		19	16.7		1	1.0		12	14.6	
11-20 years	53	12.0		30	20.8		21	18.4					1	1.2	
More than 20 years	76	17.3		33	22.9		42	36.8					1	1.2	
Non or incomplete response	1	0.2					1	0.9							

Table 4.2 (continued)	All			Subiaco			Wanneroo			Ashby			Subiaco Centro		
	n=440	%	ABS % PERTH	n=144	%	CCD % n=1458	n=114	%	CCD % n=1609	n=100	%	CCD % n=1574	n=82	%	CCD % n=1478
Weekly household income															
\$1-499	69	15.7	17.0	14	9.7	8.9	39	34.2	16.2	11	11.0	4.2	5	6.1	7.6
\$500-999	108	24.5	22.5	28	19.4	13.6	40	35.1	33.1	31	31.0	12.5	9	11.0	15.6
\$1000-1499	93	21.1	23.8	28	19.4	17.2	19	16.7	26.0	29	29.0	40.5	17	20.7	18.1
\$1500 +	137	31.1	24.8	64	44.4	46.3	5	4.4	15.8	21	21.0	33.4	47	57.3	48.8
Non or incomplete response	33	7.5	11.9	10	6.9	14.0	11	9.6	8.9	8	8.0	9.4	4	4.9	9.9
Qualifications															
Secondary school	122	27.7	55.9	23	16.0	39.2	47	41.2	59.2	38	38.0	59.7	14	17.1	31.9
TAFE or trade	112	25.5	20.1	21	14.6	12.6	42	36.8	25.0	33	33.0	24.9	16	19.5	18.3
University degree	128	29.1	10.1	59	41.0	24.2	19	16.7	5.5	20	20.0	6.5	30	36.6	27.5
Postgraduate degree	77	17.5	3.2	41	28.5	11.5	5	4.4	1.1	9	9.0	1.3	22	26.8	9.4
Non or incomplete response	1	0.2	10.7			12.5	1	.9	9.1						12.9
Living arrangement															
Single, living alone/sharing home	100	22.7	12.8	39	27.1	15.0	25	21.9	11.2	9	9.0	3.9	27	32.9	21.0
Couple, no children living in home	185	42.0	19.3	57	39.6	19.2	47	41.2	26.5	42	42.0	18.4	39	47.6	37.0
Family, children living in home	148	33.6	56.8	47	32.6	42.5	38	33.3	55.4	48	48.0	69.4	15	18.3	26.0
Non or incomplete response	7	0.2	11.2	1	0.7	23.4	4	3.5	6.8	1	1.0	8.3	1	1.2	16.0
Own or rent home															
Own or are buying	357	81.1	67.2	109	75.7	69.5	96	84.2	74.5	93	93.0	89.3	59	72.0	57.0
Rent	82	18.6	24.7	35	24.3	28.4	18	15.8	23.9	7	7.0	8.6	22	26.8	27.4
Other	1	0.2				0.0			0.5			0.0			15.6
Non or incomplete response			8.1			2.1			1.1			1.1	1	1.2	0.0
Type of home															
House	375	85.2	78.1	138	95.8	83.8	105	92.1	93.0	100	100.0	100.0	32	39.0	32.8
Townhouse/duplex/villa	27	6.1	11.9	4	2.8	10.6	8	7.0	7.0			0.0	15	18.3	16.8
Flat/unit or apartment	38	8.6	9.4	2	1.4	5.6	1	0.9	0.0			0.0	35	42.7	50.4
Non or incomplete response			8.1												
Size of garden															
Large yard/garden	148	33.6		29	20.1		82	71.9		35	35.0		2	2.4	
Small/medium yard/garden	227	51.6		111	77.1		31	27.2		65	65.0		20	24.4	
Courtyard and/or balcony	59	13.4		4	2.8		1	0.9					54	65.9	
Common garden or courtyard	5	1.1											5	6.1	
Non or incomplete response	1	0.2											1	1.2	

The level of home ownership within the overall study population was higher than within Perth's population (81% compared to 67%), particularly in the outer suburbs. In Wanneroo and Ashby, 84 and 93 per cent of respondents respectively owned, or were buying their home. In Subiaco and Subiaco Centro, almost one-quarter of respondents lived in rental properties (24% and 27% respectively) and this proportion conformed to survey grid populations.

The majority of respondents (58%) had lived in their neighbourhood for less than five years, particularly in new areas. In Ashby, 55 per cent of respondents have lived in that neighbourhood for less than one year. In contrast, the majority of Wanneroo respondents (55%) had lived in their neighbourhood for 11 or more years.

Representativeness of study population

Table 4.3 provides an overview of selected socio-demographic characteristics of the overall survey population and respondents within each neighbourhood. Full results of cross-tabulation and chi-square testing by neighbourhood location are included as Appendix 4.1.

There are several categories where groups are over-represented within the study population when compared to Perth and survey grid populations. In particular, there was a greater proportion of female than male respondents, especially in Ashby. Overall age was relatively similar to Perth's population, though in Wanneroo, most respondents were older than 55 years of age, and in Ashby, most were less than 55 years of age. There was also an over-representation of British and Irish respondents in these outer suburban neighbourhoods when compared to the overall study population and to the general population of Perth.

Inner suburban respondents tended to report a higher than average weekly household income, especially in Subiaco Centro. The opposite was noted in Wanneroo, where a substantial proportion of respondents reported a weekly household income of less than \$1000. This observation corresponded with educational qualifications, with respondents holding university qualification being substantially over-represented. In

addition, respondents who lived as part of a couple with no children living in the home were also substantially over-represented. The potential implications of these over-representations in relation to study results are discussed in relevant chapters.

Table 4.3: Selected socio-demographic characteristics of Perth's population and for the study populations – overall and within each neighbourhood (with χ^2 test for analysis of variance between neighbourhoods)

		Perth	Overall	Subiaco	Wanneroo	Ashby	Subiaco Centro	χ^2
Gender (% in each category)	Female	51	64	65	62	73	57	0.154
	Male	49	36	35	38	27	43	
Age (median category)		45-54	45-54	45-54	55-64	35-44	45-54	0.000
Cultural background (% in each category)	Australian	62	55	60	49	46	62	0.066
	British	12	25	20	34	31	15	
	Other	26	20	20	17	23	23	
Household weekly income (median category)		\$1000-1499	\$1000-1499	\$1000-1499	\$500-999	\$1000-1499	\$1500+	0.000
Educational qualifications (% in each category)	School or trade college	76	53	31	78	71	37	0.000
	University	14	47	69	22	29	63	
Living arrangement (% in each category)	Single	13	23	27	22	9	33	0.000
	Couple	19	42	40	41	42	48	
	Family	57	34	33	33	48	18	
Own/rent home (% in each category)	Own	67	81	76	84	93	73	0.001
	Rent	25	19	24	16	7	27	
Time lived in neighbourhood (median category)			1-5 years	6-10 years	11-20 years	<1year	1-5 years	0.000

The interviewees in each neighbourhood

Twenty-six individuals contributed their stories, viewpoints and questions during 25 interviews conducted as part of both the pilot and main studies. Here I introduce each of them and provide a snapshot of their personal histories. Demographic data relating to their age and numbers of years living in the neighbourhood were provided by the interviewees as part of the information requested on the invitation sheet and consent

form included in the survey package (see Appendix 3.2). Other data presented in Table 4.4 was collected during interview.

As found for survey respondents, interviewees in inner suburban neighbourhoods tended to hold more educational qualifications than those who lived in outer suburban neighbourhoods. Several interviewees identified themselves as British, even though most had lived in Australia for many years. Three interviewees from Wanneroo and Ashby identified themselves as European, even though one of them (Charlie) was born in Wanneroo.

Not surprisingly, interviewees in established neighbourhoods had lived in their neighbourhood for the longest periods of time. There is some discrepancy in responses given by some of the younger interviewees regarding time lived in their neighbourhood. Both Matt and Tash lived in Wanneroo during childhood. Both had left the area for work or travel but always retained a family base and stated on their information sheet that they had lived in the neighbourhood for 30 and 28 years respectively. Likewise, Luke had lived in Subiaco during childhood, yet stated on his information sheet that he had only lived in Subiaco for one year previously. He explained that he left Western Australia more than ten years ago to work in Sydney and had returned to Subiaco only one year prior to the interview.

Except for Tash, who lived in Wanneroo in a semi-detached duplex with a small garden, all other Subiaco, Wanneroo and Ashby interviewees lived in a detached house with a private large or medium-sized garden. In Subiaco Centro, Sue, Kevin and Eleanor each lived in a townhouse with a private courtyard, with their home sharing at least one wall with their neighbours. Gordon, Andrew and Anya lived in apartments in multi-storey buildings with common courtyard gardens and recreation facilities (swimming pool and BBQ area). Brad lived in a small detached house, with a courtyard garden, just outside of the survey collection grid.

Table 4.4: Characteristics of interviewees from each neighbourhood (presented in order of interview)

aka	Age at time of interview	Years living in neighbourhood	Cultural background	University or professional qualification	Living arrangement
Subiaco					
Michael	47	20	Australian	Yes	Single – one child
Mark	58	25	Australian	Yes	Couple
Jack	82	29	British	Yes	Couple
Luke	32	1	Australian	Yes	Couple
Fiona	42	9	Australian	Yes	Couple
Jess	70	35	Australian	No	Widowed
Wanneroo					
Tash	37	28	Australian	No	Single
Chloe	55	1	Australian	Yes	Single – one child
Matt *	36	30	British born & Aust bred	No	Family – one child
Toni*	39	28	Australian	No	
Charlie	81	70	European	No	Couple
Mary	68	31	Australian	Yes	Couple
Hans	55	2	European	No	Single
Ashby					
Sarah	26	1	Australian	Yes	Family – two children
William	49	20	European	No	Single
Leanne	34	1	Australian	No	Family – one child
Kathryn	42	1.5	Australian	No	Family – three children
Adam	27	0.6	British	Yes	Single
Amber	33	1	Australian	Yes	Family – one child + pregnant
Subiaco Centro					
Gordon	67	1	British	No	Couple
Sue	70	2.6	British	Yes	Couple
Kevin	72	4.6	Australian	Yes	Couple
Eleanor	56	3.5	New Zealander	Yes	Couple
Brad	26	2.5	Australian	Yes	Single
Anya	36	2.6	British	Yes	Couple
Andrew	37	1.3	Australian	Yes	Single

*Matt and Toni were interviewed together

Most interviews began by asking people how and why they came to choose their current neighbourhood as a place to live and to describe what they felt about living there.

Subiaco

In Subiaco, Jess, Jack and Mark had all lived in their homes for more than 25 years. When Jess bought her home in the early 1970s, Subiaco was considered to be a working class neighbourhood and it was less expensive to buy a house than in Perth's western (and more affluent) suburbs where she spent her childhood. Her first reaction to living in Subiaco was horror as she thought of it as "another world". She is now extremely glad she bought when she did as, apart from feeling attached to her home and people in her neighbourhood, the process of gentrification that has taken place in Subiaco over the past two decades means that local real estate has increased substantially in value. Jack also bought his home in Subiaco during the 1970s. He had been living in an adjoining suburb, was looking to buy a house nearby and liked the look of the small Federation-style cottage he found on a corner block. Jack stated that he liked living in Subiaco and "if I had a million dollars tomorrow, I wouldn't move from here".

Mark moved from the country to the city in 1981 to attend university. He felt Subiaco provided lots of open space, parks and greenways and explained his initial attraction this way:

I think I was allergic to living in a really urban place. Subiaco is an old suburb so you have a sense of a bit of space.

Michael continues to rent the house he first moved to when his (now adult) son was still very young. It was near his workplace and he wanted the convenience of having schools and shops nearby so that he was able to walk or cycle rather than having to drive his car. Fiona also moved into a rented cottage with her partner and when they were offered the opportunity to purchase it several years ago, they took it. In the time she had lived there, Fiona had gotten to know her neighbourhood well:

I feel that each street has its own personality and I like meandering through and looking.

For Luke, the choice of neighbourhood was simple. He had lived in Subiaco as a child and when he returned from working in Sydney, newly married with plans to start a family, he knew where he wanted to live. Like all of the Subiaco respondents, Luke

spoke of being attracted to a sense of community, comfortable surroundings and convenience to local businesses, shops and restaurants. Jack had this to say:

Subiaco itself is still a wonderful mixture of young and old and all seem to get on quite well. ... I think I would say that it's a quiet, non-threatening, friendly neighbourhood. And when you've been living here for some time, you build up ... a social network which you take almost for granted. You know the people who own the local delicatessen... your wine shop, where you get your petrol. And you walk in the street and you see people that you don't really know but you've seen them before and you nod and smile. That's what I call a social network and it's irreplaceable. It takes years to build up but it makes you feel safe.

Wanneroo

Charlie's relationship with Wanneroo was the longest-standing of all. He was born only a few kilometres away from his current home when there was little more than a dirt road linking Wanneroo to Perth. His family once owned extensive market gardens in the area and he retains a sizable block with a large vegetable garden.

Mary moved to Wanneroo from the family farm more than 30 years ago and described what it was like then:

We sold the farm and we came to Wanneroo because it was rural. It really was rural ... We thought in moving here we had the benefits of both worlds, we were close to the city so there was employment ... it was lovely, it was rural ...with the nature that goes with it but also the character of the people was very much a village set up.

She also described how things had changed from when they first arrived:

The road up here was limestone. We had power but no phone ...we had water ... there was hardly anything here, there were about four houses in the next street there ... there weren't any lights in the street for a long time ... And when you used to get up in the morning you could really smell the bush. And that lasted for a long time. But you don't smell the bush anymore unless you get up before any of the cars. If you get up at 4 o'clock in the morning you can smell the bush.

Matt lived in Wanneroo as a child, though had lived elsewhere for many years due to work or travel. He bought his house there not long after he and Toni were married. Tash also grew up in Wanneroo. She had moved back and forward several times between her mother's rented duplex and other places depending on her personal or financial situation. Matt, Toni and Tash all spoke of enjoying the open space and proximity to a variety of green spaces.

Access to green space was a major attraction of the area. Newer residents, Chloe and Hans, chose their homes because of the proximity to Lake Joondalup (Chloe) and because of the size of his garden and the open space nearby (Hans). Chloe described her perception of the neighbourhood:

Well it's quite beautiful down by the lake and there's lots of birdlife ... People generally look after their gardens and work in their gardens. It's sort of got a country feel, Wanneroo. I always joke that after I lived here, I moved in, I went up to Coles and bought a checked flannelette shirt so that I'd fit in – because you do see a lot of that. It's a working class suburb, yeah.

Ashby

William had lived in the Ashby area since the 1970s. When adjacent crown land and numerous private market gardens began to be cleared for residential development five years ago, his family chose to retain their block. At first, watching large tracts of bushland and market gardens around him being cleared and new houses being built closer and closer to his home, William became depressed and “felt we’d been invaded”. By the time the interview took place, he was still unhappy but had become resigned to living with fewer trees and less bushland around his home.

I still feel at home here ... [and] the trees that I [can still] see compensate for the trees that I don't see [anymore].

For other interviewees, financial considerations were the key factor in choice of this neighbourhood. Sarah and her husband had a strict budget which determined the location and the type of house their young family could afford. She was very happy that their home was situated across from a park. Amber's husband was not an Australian citizen and visa requirements meant they had to build a new home in order to secure a mortgage. Amber felt that Ashby looked better than other new estates she had visited because there were more trees and parks.

Adam wanted to invest in property, and like Amber, chose Ashby because it was affordable and because it looked better than other estates he had seen. In addition, Adam was able to buy a block directly opposite the Bush Forever site and this gave him great satisfaction.

Leanne's decision about where to build her new home was first determined by wanting to be near her family who lived in a neighbouring suburb. Secondly, she and her

husband found it was less expensive to build a new home than buy an established one they both liked. Leanne's new home was in Tapping, just to the north of the Ashby estate.

Kathryn's reasons for her home choice were somewhat different. When her children were small, she lived in a new estate in western Sydney and found it a welcoming neighbourhood. When her family relocated to Perth, she wanted to build in Ashby as she saw it as a new beginning and thought it would be easier to make friends with all neighbours moving in together. Unfortunately, this has not been her experience.

Where respondents in other suburbs enthusiastically described the attractions of their neighbourhood, Ashby respondents were more reticent and used words such as "nice", "pleasant" and "tidy". It was also described as a "good place for kids", "a bit suburban" and "lacking in life". As discussed earlier, there are no community facilities in Ashby – no shops, community services, schools or public meeting areas – except local parks and playgrounds.

Subiaco Centro

For Eleanor, Kevin and Gordon, the stories of how they came to live in their current home were very similar. All had lived or worked around the Subiaco Centro area and when the redevelopment of the old industrial estate occurred, they either built their own house (Eleanor and Kevin) or bought a recently completed residence (Gordon). Of the younger respondents, Brad was the only one who owned his home – an older house just outside of the new redevelopment area. Anya and Andrew rented apartments in a large block of contemporary units with a shared pool area and outdoor entertainment space.

Proximity to the city and the convenience of shops, restaurants and public transport were important factors in each resident's choice. Sue told this story of how she came to live in Subiaco Centro.

The way we found the place was, my husband hired a car from just up the road and he came home one day and he said, do you know, I was in Subi Centro and it's lovely, shall we just go for a walk? So we came for a walk and lo and behold we saw a For Sale sign and the agent just happened to be here. I persuaded my husband to come and have a look and that was it. It's walking distance to cafés and restaurants, shops, very close to medical centre, dentist, all the health things that we require, and it's walking distance to the cinema and the theatre, and if we

want to, we can still walk up to Kings Park or into the city. So it's easy reach of everything that we require so that we don't have to use the car all the time.

All liked living in a vibrant neighbourhood in the “midst of it”. As Anya said:

That's the best thing really, it's about the proximity really to the city because I like living in the hub of things ... it's a feeling like you're close to things that are happening in Perth.

In addition, neighbourhood design was seen as aesthetically appealing. When asked to describe the neighbourhood, Sue commented that:

Someone described it as toy town. And I said, “Yes, but very nice and only the best toys”. So it actually looks perhaps a little bit French or Italian or European in a way with all the houses close together, it looks a little bit like terraced houses. But everything is very fresh, different coloured paint, different outlook, different style of houses, it's not just the same style being repeated over and over again. There are a lot of individual ideas around.

Overall perceptions of each neighbourhood

In the initial stages of each interview, it was evident that each interviewee had strong personal connections to their home, no matter how long they had lived there. It was also evident that each neighbourhood exhibited its own unique characteristics. Subiaco had a strong community culture and local architecture retained links to the history and heritage of the area. Wanneroo was valued for its space and past connections to rural lifestyles. Ashby was a very new neighbourhood and residents had not yet decided on its personality. Subiaco Centro was not much older, but its architecture had a distinctive style and the neighbourhood lifestyle was seen as vibrant and convivial.

All of these descriptions relate to the coherence and stability of each place, the identifiable characteristics that distinguish each location from its surroundings. Neighbourhood places include natural and built landscapes and are influenced by cultural interpretations and practices. All places will change over time and each is the product of dynamic social and ecological interactions (Cannavo, 2007). In the following chapters, I explore how attitudes toward nature and perceptions of nearby green space influence how people feel not only about their neighbourhood, but about themselves.

Chapter 5: Attitudes to nature and natural environments

One of the primary questions explored in this study relates to people's attitudes to, and definitions of, nature and natural environments. How individuals form values, beliefs and attitudes regarding natural environments is a complicated discussion with human biology (Kellert, 1996; Wilson, 1993), culture and learned experience (Kahn Jr, 1999) and emotional attachment (Milton, 2002) all recognised as important influences. Some authors suggest that no matter how values and beliefs are formed, resultant attitudes tend to be either more ecosystem-centred (ecocentric), human-centred (anthropocentric) or apathetic (Eckersley, 1992; Gagnon Thompson & Barton, 1994; Nisbet *et al.*, 2008). In the first part of this chapter, I present survey respondents' views of nature and natural environments as determined by a Likert-type Environmental Attitude Scale measuring these attitudes (Gagnon Thompson & Barton, 1994).

In the second part, I present qualitative data collected through interviews. This process enabled exploration of individuals' relationship with nature and natural environments (in general) and neighbourhood green space (more specifically), what it meant to "be green" and to care for the neighbourhood environment. The chapter concludes with a discussion of overall findings and how they relate to suggestions in the literature that the formation of particular attitudes and values may be influenced by emotion, experience or education.

Measuring attitudes to nature and natural environments

As discussed in detail in Chapter 3, quantitative data analyses were conducted in the following sequence:

1. generation of descriptive statistics;
2. data reduction through factor analysis (principal component analysis);
3. exploration of correlations between principal components (factors); and
4. identification of differences between factors and other variables (non-parametric analysis of variance).

Using this process of analysis, initial patterns of response were identified and next, the number of individual items was reduced through principal component analysis. The resulting factors were then used to identify relationships between attitudes and to find significant differences in attitudes when groups were compared by socio-demographic

variables or by neighbourhood type and location. Significant and relevant results are discussed in this chapter. Steps undertaken in assumption testing and consideration of suitability of each test were discussed in Chapter 3. Where appropriate, more comprehensive results tables are included as appendices.

Descriptive analysis

The Environmental Attitude Scale (Gagnon Thompson & Barton, 1994) consists of a set of thirty (30) statements grouped and scored to measure ecocentrism (12 items), anthropocentrism (9 items) and apathy (9 items) towards issues relating to natural environments. In this study, survey respondents were asked to record their level of agreement (7-point Likert-type scale from strongly agree to strongly disagree) to a series of statements. Frequencies of overall responses are presented in Tables 5.1-5.3. Cross-tabulation of responses by age, educational qualifications and neighbourhood location was conducted and relevant results are discussed. Full results of frequency analysis are included as Appendices 5.1-5.3.

Prior to data analysis, initial responses were re-coded to reflect a 5-point scale ranging from *strongly disagree* to *strongly agree* with *unsure* removed from the mid-point and coded as zero (0) (see Chapter 3). In addition, responses to items relating to apathy were reverse coded and renamed “care”. This was done to establish consistency in the direction of scoring within each index so that all high scores represented more ecocentric, more anthropocentric or more caring (rather than less apathetic) attitudes to issues relating to natural environments.

Respondents’ level of agreement with ecocentric items (Table 5.1) showed strong positive tendencies with several statements generating more than 70 per cent agreement. The statement regarding nature being valuable for its own sake generated the highest level of agreement (85%). Not all respondents were as confident in response to other statements with a substantial number of *somewhat agree/disagree* responses (>20%) recorded for almost all statements within this index. In most cases, when the proportion of agreement declines, the level of disagreement stays relatively constant (<7.0% in all but one case), and the proportion of *somewhat agree/disagree* and *unsure* responses increase.

Table 5.1: Median, mean, standard deviation and proportion (%) of response for each ecocentric statement listed according to strength of agreement (n=440)

Ecocentrism (Cronbach $\alpha = 0.80$)	Median	Mean <i>sd</i>	Unsure 0	Disagree^a 1&2	Somewhat AorD 3	Agree^a 4&5
Nature is valuable for its own sake	4	4.17 1.0	3.4	1.4	10.5	84.8
It makes me sad to see natural environments destroyed	4	4.07 1.0	1.4	5.0	13.6	80.0
Humans are as much a part of the ecosystem as other animals	4	3.92 1.1	4.3	1.8	18.0	75.9
I enjoy spending time in natural settings just for the sake of being out in nature	4	3.98 1.1	3.2	2.0	21.1	73.6
Being out in nature is a great stress reducer for me	4	3.94 1.1	3.4	2.3	21.1	73.2
Sometimes it makes me sad to see forests cleared for agriculture	4	3.75 1.4	6.8	5.2	21.6	66.4
One of the worst things about development is that many natural areas are being destroyed	4	3.83 1.3	5.2	4.1	24.5	66.1
One of the most important reasons to conserve is to preserve wild areas	4	3.70 1.2	5.5	2.7	28.6	63.2
I prefer wildlife reserves to zoos	4	3.42 1.6	13.2	4.8	22.5	59.5
Sometimes when I am unhappy I find comfort in nature	4	3.48 1.4	8.6	5.7	26.1	59.5
I need time in nature to be happy	4	3.48 1.3	6.4	7.0	32.7	53.9
Sometimes animals seem almost human to me	3	3.09 1.4	9.3	16.1	33.0	41.6

^a Responses for *strongly disagree/disagree* and *strongly agree/agree* were merged for analysis

A less consistent pattern of results emerged from the anthropocentric items (Table 5.2). Only two anthropocentric statements generated majority agreement – the contribution of nature to human pleasure and welfare (86%) and preserving resources to maintain high quality of life (61%). Responses to most items were divided across all categories with a considerable number of responses falling into the *somewhat agree/disagree* category (>30% of responses in the majority of cases) and a high number of *unsure* responses (>35% in one case) was observed.

Results for the care scale (Table 5.3) produced a similar pattern of mainly positive responses (in this case, disagreement with original apathy-orientated statements) to that seen in the ecocentrism index. Two statements relating to opposition to conservation programs and lack of care about environmental problems elicited the highest level of disagreement (>80%). The pattern of response noted earlier, where the proportion of *somewhat agree/disagree* and *unsure* responses increased as the proportion of agreement declined, was also evident here.

Table 5.2: Median, mean, standard deviation and proportion (%) of response for each anthropocentric statement listed according to strength of agreement (n=440)

Anthropocentrism (Cronbach $\alpha = 0.57$)	Median	Mean sd	Unsure 0	Disagree^a 1&2	Somewhat AorD 3	Agree^a 4&5
Nature is important because of what it can contribute to the pleasure and welfare of humans	4	4.25 1.0	2.5	0.7	10.7	86.1
We need to preserve resources to maintain a high quality of life	4	3.49 1.4	9.8	3.2	25.9	61.1
The most important reason for conservation is human survival	3	2.94 1.5	10.9	19.5	33.2	36.4
The thing that concerns me most about deforestation is that there will not be enough timber for future generations	3	2.83 1.5	10.7	24.3	31.1	33.9
It bothers me that humans are running out of their supply of oil	3	2.76 1.5	15.2	16.6	35.0	33.2
One of the most important reasons to conserve is to ensure a continued high standard of living	3	2.68 1.5	15.9	14.8	42.0	27.3
Continued land development is a good idea as long as a high quality of life can be preserved	3	2.33 1.4	16.4	29.5	37.7	16.4
One of the best things about recycling is that it saves money	3	2.39 1.3	13.9	33.0	37.0	16.1
One of the worst things about loss of rainforest is that it will restrict development of new medicines	2	1.75 1.6	35.7	28.6	20.7	15.0

^a Responses for *strongly disagree/disagree* and *strongly agree/agree* were merged for analysis

Table 5.3: Median, mean, standard deviation and proportion (%) of response for each care statement listed according to strength of disagreement (n=440)

Care (Cronbach $\alpha = 0.83$)	Median	Mean sd	Unsure 0	Agree^a 1&2	Somewhat AorD 3	Disagree^a 4&5
I'm opposed to programs to preserve wilderness, reduce pollution and conserve resources	5	4.19 1.1	2.3	5.7	9.1	83.0
I don't care about environmental problems	4	4.15 1.0	1.4	3.2	14.8	80.7
Most environmental problems will solve themselves given enough time	4	3.76 1.4	8.0	2.7	17.5	71.8
I do not feel that humans are dependent on nature to survive	4	3.72 1.5	7.7	8.4	17.3	66.6
Too much emphasis has been placed on conservation	4	3.64 1.3	7.7	3.6	23.0	65.7
Environmental threats such as deforestation and ozone depletion have been exaggerated	4	3.25 1.8	18.2	5.9	17.7	58.2
I do not think the problem of depletion of natural resources is as bad as many people make it out to be	4	3.18 1.7	16.6	6.1	23.2	54.1
I find it hard to get too concerned about environmental issues	3	3.28 1.3	8.4	6.1	40.0	45.5
It seems to me that most conservationists are pessimistic and somewhat paranoid	3	2.78 1.7	19.8	12.5	27.7	40.0

^a Responses for *strongly disagree/disagree* and *strongly agree/agree* were merged for analysis

Cross-tabulation of responses within each index indicated that there were few significant differences associated with age or educational qualifications, though respondents with higher educational qualification were more positive in response to care-related statements. When split by neighbourhood location, respondents in established neighbourhoods (particularly Wanneroo) were more likely to express concern in response to statements about development and loss of nature.

It is difficult to know whether the relatively high numbers of *somewhat agree/disagree* and *unsure* responses found across the Environmental Attitude Scale (particularly for anthropocentric items) were generated through uncertainty about the issues highlighted in the statements, or uncertainty about the meaning of the statements themselves. From a statistical perspective, an alpha coefficient >0.70 indicates acceptable internal consistency (Pallant, 2001, p. 87) and the low Cronbach alpha score ($\alpha = 0.57$) generated by the anthropocentric scale raised some questions.

To establish if this finding might be unique to this study, Cronbach alpha scores were compared to previous results published by Gagnon Thompson and Barton (1994). Similar alpha coefficients were reported for both ecocentric and apathy/care items ($\alpha=0.83$ compared with $\alpha=0.82$ and $\alpha=0.80$ compared with $\alpha=0.78$ respectively). With regard to anthropocentric items, the results were quite different with $\alpha=0.57$ reported in this study and $\alpha=0.67$ reported by Gagnon Thompson and Barton. It is possible that in light of this observation, and the high number of *somewhat agree/disagree* and *unsure* responses recorded for anthropocentric statements that this index within the Environmental Attitude Scale may be less reliable than the ecocentric and care (apathy) indices.

Conversely, these results may be an accurate reflection of the level of personal indecision, ambivalence or lack of certainty about environmental attitudes present in the wider community. Ignatow (2006, p. 443) raises the possibility that generally, people do not have coherent beliefs about environmental issues and “may instead pick and choose environmental problems to care about, more or less one at a time”. As such, it may be reasonable to assume that few people have strongly formed attitudes or firmly held beliefs about environmental issues and the results presented here seem to support this notion.

Measurement of environmental attitude has been used as an indicator of environmental behaviours and potential for involvement in conservation or similar activities (see Clayton & Opatow, 2003; Gagnon Thompson & Barton, 1994). With a majority of positive responses to ecocentric and care statements it might be expected that respondents would also display strong pro-environmental behaviour. Pro-environmental behaviour was explored by one question in the first section of the survey that asked about respondents' involvement in conservation projects such as tree planting or weeding.

Current involvement in conservation activities was reported by only three per cent (3%) of all respondents (Table 5.4) with a further 21 per cent indicating they had been involved at some time, either voluntarily (16%) or not (5%). Almost half of the survey respondents (47%) indicated interest but no actual involvement. It is difficult to know whether this result reflected latent desire to get involved or selection of a socially acceptable response. The remaining respondents (30%) indicated they had never been involved nor wanted to be involved in conservation activities. These results do not appear to support the notion that positive ecocentric or caring attitudes translate into pro-environmental behaviours, or at least, not into volunteering for conservation activities. In addition, cross-tabulation with chi-square testing found no statistically significant differences when groups were split by age, educational qualifications or neighbourhood location. However, there was a significant difference found between groups when responses were split into those from established and from new neighbourhoods ($\chi^2=0.021$).

Table 5.4: Voluntary involvement in conservation activities (overall and % by neighbourhood)

Voluntary involvement in conservation activity	Overall n=437	%	Subiaco % (n=143)	Wanneroo % (n=113)	Ashby % (n=99)	Subiaco Centro % (n=82)
No, never wanted to	130	29.7	28.0	21.2	41.4	30.5
No, but thought about it	204	46.7	48.3	53.1	41.4	41.5
Not voluntarily involved	21	4.8	2.1	5.3	5.1	8.5
Yes, but not now	68	15.6	18.2	15.0	11.1	17.1
Yes, currently involved	14	3.2	3.5	5.3	1.0	2.4

Principal component analysis

Environmental attitude data were next examined using principal component analysis (PCA). Principal components with respective factor loadings (≥ 0.4) are presented in Tables 5.4-5.6. Full results are included as Appendices 5.4-5.6.

Table 5.5: Principal component analysis (PCA) of ecocentric statements showing three final factors and loadings ≥ 0.4

Ecocentrism Pattern Matrix		Factor loading		
		1	2	3
1	I need time in nature to be happy	.850		
	I enjoy spending time in natural settings just for the sake of being out in nature	.849		
	Being out in nature is a great stress reducer for me	.765		
	Sometimes when I am unhappy I find comfort in nature	.707		
2	Sometimes it makes me sad to see forests cleared for agriculture		.869	
	One of the worst things about development is that many natural areas are being destroyed		.829	
	It makes me sad to see natural environments destroyed		.645	
3	Humans are as much a part of the ecosystem as other animals			.820
	Sometimes animals seem almost human to me			.695
<i>Eigenvalue</i>		3.452	1.276	1.040
<i>Explained variance (%)</i>		38.4	14.2	11.6
<i>Total explained variance (%)</i>			64.1	
<i>Cronbach's alpha coefficient (between factors)</i>			0.78	
Extraction Method: Principal Component Analysis (PCA)				
Rotation Method: Oblimin with Kaiser Normalization – rotation converged in 4 iterations				
KMO (0.828) and Bartlett's Test ($p=0.000$)				
Only factor loadings 0.4 and above are displayed				

When PCA was first conducted on ecocentric statements, three items (nature valuable for own sake, important to conserve to preserve wild areas, prefer wildlife reserves to zoos) did not generate any factor loadings ≥ 0.4 . All were removed from further analysis. Final factor analysis of ecocentric items (Table 5.5) resulted in identification of three principal components (or factors) explaining 64 per cent of the total variance. These factors comprised: (1) feeling a positive emotional response (enjoyment, happiness, stress relief, comfort) from spending time in nature; (2) feeling sad to see natural areas destroyed (sad when natural environments destroyed and forests cleared, development destroys natural areas); and (3) seeing humans and nature as one (humans

and animals part of ecosystem and sometimes animals seem human). The third factor, comprised only two items, indicating this factor may be less stable than others identified in the matrix and relevant results treated with caution or ignored (Tabachnick & Fidell, 1996, p. 642). It was decided to retain this factor in the analysis at this stage and reassess its contribution to overall findings once correlation analysis and analysis of variance was completed.

Table 5.6: Principal component analysis (PCA) of anthropocentric statements showing three final factors and loadings ≥ 0.4

Anthropocentrism Pattern Matrix		Factor loading		
		1	2	3
1	One of the most important reasons to conserve is to ensure a continued high standard of living	.771		
	We need to preserve resources to maintain a high quality of life	.696		
	The most important reason for conservation is human survival	.534		
	Continued land development is a good idea as long as a high quality of life can be preserved	.493		-.601
2	The thing that concerns me most about deforestation is that there will not be enough timber for future generations		.793	
	It bothers me that humans are running out of their supply of oil		.775	
3	Nature is important because of what it can contribute to the pleasure and welfare of humans			.792
<i>Eigen value</i>		1.821	1.118	1.023
<i>Explained variance (%)</i>		26.0	16.0	14.6
<i>Total explained variance (%)</i>			56.6	
<i>Cronbach's alpha coefficient</i>			0.51	
Extraction Method: Principal Component Analysis (PCA)				
Rotation Method: Oblimin with Kaiser Normalization – rotation converged in 14 iterations				
KMO (0.637) and Bartlett's Test ($p=0.000$)				
Only factor loadings 0.4 and above are displayed				

Initial PCA of anthropocentric items resulted in one item (recycling saves money) not generating a factor loading of ≥ 0.4 and was removed. The next level of analysis resulted in a second item (loss of rainforest will restrict new medicines) not generating a factor loading of ≥ 0.4 and this item was also removed from the final analysis. Final analysis resulted in three factor groupings emerging from the anthropocentric items (Table 5.6) that together explained 56 per cent of variance. The first two factors collectively explained 42 per cent of variance and grouped statements according to two clear themes. These factors comprised: (1) statements about conservation and maintaining high quality of life (important to conserve to maintain standard of living, high quality of life and human survival, and development good if quality of life

preserved); and (2) concern about future access to natural resources (concerned about not enough timber for future and running out of oil).

The third factor explained a further 15 per cent of variance and comprised two items (nature is important because of contribution to the pleasure and welfare of humans, and continued land development is good when high quality of life preserved) that were negatively correlated to one another. The second and third anthropocentric factors included only two items, indicating possible instability (Tabachnick & Fidell, 1996, p. 342). Due to this observation and concerns about how to interpret the negative relationship between items in the third factor, it was excluded from further analysis. It was decided to retain the second factor (access to natural resources) and reassess its contribution once correlation testing and analysis of variance was completed.

Statements relating to apathy/care about environmental issues generated only one principal component (Table 5.7) which explained 43 per cent of variance.

Table 5.7: Principal component analysis (PCA) of apathy/care statements showing factor loadings ≥ 0.4

Apathy/Care Component Matrix	Factor loading
#Too much emphasis has been placed on conservation	.729
#I do not think the problem of depletion of natural resources is as bad as many people make it out to be	.709
#Environmental threats such as deforestation and ozone depletion have been exaggerated	.687
#Most environmental problems will solve themselves given enough time	.669
#It seems to me that most conservationists are pessimistic and somewhat paranoid	.653
#I find it hard to get too concerned about environmental issues	.647
#I'm opposed to programs to preserve wilderness, reduce pollution and conserve resources	.599
#I do not feel that humans are dependent on nature to survive	.588
#I don't care about environmental problems	.587
<i>Eigenvalue</i>	3.847
<i>Explained variance (%)</i>	42.7
<i>Cronbach's alpha coefficient (between all items)</i>	0.83
Extraction Method: Principal Component Analysis (PCA)	
Only one component extracted – solution cannot be rotated	
KMO (0.889) and Bartlett's Test ($p=0.000$)	
Only factor loadings 0.4 and above are displayed	
# Items reverse coded prior to analysis	

With this stage of factor analysis complete, it was possible to use loadings presented in the factor score coefficient matrices (Appendices 5.4-5.6) and calculate transformed variable scores for each selected factor. These transformed variables (Table 5.8) were used in the next stage of analysis: exploring correlations between attitude and other variables. Based on the outcomes of the PCA pattern matrices, it was assumed that each of the transformed variables within the ecocentrism and anthropocentrism indices would be positively correlated. Further correlation analysis between all of the transformed variables would enable the strength of any significant relationships to be examined.

Table 5.8: Description of transformed variables for environmental attitude

Ecocentrism	
EcoTV1	Positive emotional response (enjoyment, happiness, stress relief, comfort) from spending time in nature
EcoTV2	Feeling sad to see natural areas destroyed
EcoTV3	Seeing humans and nature as one
Anthropocentrism	
AnthroTV1	Conservation is important to maintain high quality of life and ensure human survival
AnthroTV2	Concerned about continued future access to natural resources
Care	
CareTV1	Care about environmental issues

Correlation analysis

Because of the non-parametric nature of the data, relationships between variables were analysed using a two-tailed Spearman's rank order (ρ) correlation. Significant relationships between selected socio-demographic and transformed variables are presented in Table 5.9. Full results are included as Appendix 5.7.

Socio-demographic variables were associated with attitude to natural environments. Weekly household income was negatively related to all ecocentric variables, as was age with care about environmental issues (CareTV1). Educational qualifications and time lived in the neighbourhood were positively associated with care about environmental issues and feeling sad to see nature destroyed (EcoTV2).

As expected, positive correlations were noted between ecocentrism factors (EcoTV1 and TV2) and between these and the care factor (CareTV1). The strength of these

relationships was medium (>0.3 and <0.5) though smaller positive relationships ($r<0.3$) were noted between these ecocentrism factors (EcoTV1 and TV2) and the third ecocentrism factor (EcoTV3) and care (CareTV1). A small positive relationship was also noted between the two anthropocentrism factors (AnthroTV1 and TV2).

Table 5.9: Significant Spearman Rank Order (rho) correlations between selected socio-demographic and transformed variables for attitudes to nature (ecocentrism, anthropocentrism and care)

	Eco TV1	Eco TV2	Eco TV3	Anthro TV1	Anthro TV2	Care TV1
Socio-demographic variables						
Age						-.109*
Weekly household income	-.154**	-.280**	-.151**		-0.97*	
Educational qualifications						.211**
Time lived in neighbourhood		.137**				
Transformed Variables						
EcoTV1	1.000					
Positive emotion from time in nature						
EcoTV2	.400**	1.000				
Feel sad to see nature destroyed						
EcoTV3	.247**	.265**	1.000			
Humans and nature as one						
AnthroTV1	.221**	.188**	.223**	1.000		
Conservation to maintain high quality of life						
AnthroTV2		.186**	.110*	.190**	1.000	
Future access to natural resources						
CareTV1	.442**	.486**	.255**	.185**		1.000
Care about environmental issues						
Bold text denotes correlations >0.3						
* Correlation is significant at 0.05 level (2-tailed)						
** Correlation is significant at 0.01 level (2-tailed)						

Positive correlations were noted between ecocentrism/care and anthropocentrism factors, though the strength of these relationships was small ($r<0.3$). This was somewhat different to the result reported by Gagnon Thompson and Barton (1994). These authors found a small negative non-significant correlation between ecocentrism and anthropocentrism ($r=-0.190$), and a positive non-significant relationship between anthropocentrism and apathy ($r=0.180$). It was expected that ecocentrism and care factors would be positively related, and it seemed unusual to find there was a positive (albeit weak) relationship found here between these attitudes and anthropocentrism. Most literature on environmental attitudes and values places ecocentrism and anthropocentrism in an oppositional relationship (Dutcher *et al.*, 2007).

Analysis of variance

The next stage of analysis investigated differences between variables based on selected socio-demographic variables. As already noted, testing showed that transformed variables were not normally distributed. Analysis of variance was carried out using Kruskal-Wallis or Mann-Whitney U tests and chi-square testing, to determine mean ranking for each and identify significant differences. As a secondary analysis, Tukey HSD post hoc testing was conducted to ascertain how and where significant variance occurred. Significant results for analysis of variance are presented in Table 5.10, and mean ranking and post hoc testing in Table 5.11. Full results for analysis of variance with mean rankings and post hoc testing by neighbourhood are included as Appendix 5.8.

Table 5.10: Analysis of variance between transformed variables for attitude to natural environments and demographic, home-related and other variables with only significant differences reported ($p \leq 0.05$)

	EcoTV1 Positive emotion – time in nature	EcoTV2 Sad to see nature destroyed	EcoTV3 Humans and nature as one	AnthroTV1 Conservation to maintain high quality of life	AnthroTV2 Future access to natural resources	CareTV1 Care about environmental issues
Asymmetrical significance† (p values ≤ 0.05)						
Demographic variables						
Gender	0.000	0.001	0.003			0.029
Age						
Cultural background					0.002	
Weekly household income	0.019	0.000	0.002			
Educational qualifications						0.000
Home-related variables						
Neighbourhood location	0.005	0.000				0.000
Time lived in neighbourhood		0.050				
Living arrangement						
Own or rent home						
Type of home						
Size of garden	0.032	0.000				0.030
Other variables						
Volunteer for conservation activities	0.000	0.000				0.000

†Kruskal-Wallis or Mann Whitney-U test for analysis of variance with χ^2 test for asymmetrical significance

Scores for the transformed variables were compared using several sets of demographic, home-related and other variables. Demographic variables included age, gender, cultural background, income and qualifications. Home-related variables included neighbourhood location (Subiaco, Wanneroo, Ashby or Subiaco Centro), length of time lived in the neighbourhood, living arrangement (single, couple no children, family with children), type of home (house, townhouse or apartment), whether respondents owned

or rented their home and the size of their garden. One other variable measured respondents' participation in conservation activities.

Examination of analysis of variance for demographic variables showed that gender, income and qualifications had some influence on results. Females scored significantly higher in relation to ecocentric and care components. In relation to income and ecocentrism factors, it was the group of respondents with the highest weekly household income (\$1500+) who recorded the lowest ecocentrism scores. Respondents with more educational qualifications (in this case, a post graduate degree) scored significantly higher with regard to care for environmental issues.

While age was not found to be a significant factor in influencing difference in attitudes to natural environments, people who had lived longest in their neighbourhood recorded higher scores in relation to feeling sad to see nature destroyed. Experiencing change within the neighbourhood may elicit "solastalgia" or feelings of sadness, distress or loss for environments that have disappeared (Albrecht, 2005; Connor, Albrecht, Higginbotham, Freeman, & Smith, 2004). Mean ranking of this variable by neighbourhood (Table 5.11) found that mean scores were highest in Wanneroo where respondents had lived longest. Substantial change had occurred over the past decade with large tracts of bushland and market gardens that once surrounded this neighbourhood cleared and redeveloped for housing estates like Ashby. Wanneroo respondents also ranked highest in regard to enjoying spending time in nature and the proportion of Wanneroo respondents who reported having a large garden was more than double that of any other neighbourhood. Perhaps, as was indicated by interview participants, respondents may have chosen to live in Wanneroo because of increased opportunity to spend time in nature and this may explain the higher scores recorded for ecocentric variables and involvement in conservation.

Neighbourhood location accounted for other significant differences within ecocentrism and care factors, though there were no significant differences noted between neighbourhoods for anthropocentric factors (Tables 5.10 and 5.11). In general, results tended to vary not as much between individual neighbourhoods, but either between established and new neighbourhoods, or between inner and outer suburban neighbourhoods. Subiaco respondents recorded the highest scores for care for

environmental issues, with significant difference between responses from this established neighbourhood and the new neighbourhoods of Ashby and Subiaco Centro. Subiaco respondents held the most university and postgraduate qualifications and while it might be simple to attribute this result to education, it does not explain why Wanneroo respondents (with the least education qualifications) ranked second in relation to care about environmental issues, and first for current involvement in conservation projects.

In contrast, respondents in the new neighbourhoods of Ashby and Subiaco Centro scored lowest in relation to spending time in nature, and care about environmental issues and current or past involvement in conservation activities. This observation gives some weight to the notion put forward by Ignatow (2006) that enjoying spending time in nature may do more than education to increase concern for environmental issues and active involvement in conservation. It also supports the finding by Youngentob and Hostetler (2005) that the level of pro-environmental behaviours, attitudes and knowledge reported by residents in new neotraditional-design neighbourhoods was considerably less than residents in both older, more established neighbourhoods.

There was little differentiation in scores for anthropocentrism factors based on demographic, home-related or other variables. Due to this lack of differentiation in results for these two anthropocentrism variables (as well as the third ecocentrism variable related to seeing humans and nature as one), the weak results found in correlation analysis, the concerns raised earlier about internal reliability of the initial anthropocentric scale, and also the stability of two of these variables, all three were excluded from further analysis.

Overall, it was found that some statistically significant differences in ecocentric and caring attitudes to natural environments occurred when groups were split by demographic variables, neighbourhood location, and involvement in conservation activities. Neighbourhood location appeared to be most influential with more respondents from established neighbourhoods (Subiaco and Wanneroo) recording higher mean rankings for all variable relating to attitude to natural environmental (Table 5.11).

Table 5.11: Mean ranking of selected socio-demographic and attitude to natural environments variable scores for each neighbourhood (with χ^2 test and post-hoc testing identifying significant relationships between neighbourhoods)

		Subiaco	Wanneroo	Ashby	Subiaco Centro
	χ^2	Mean rankings† and significant post hoc relationships‡			
Demographic variables					
		3	1	4	2
Age (oldest to youngest)	0.000	>Ashby	>Ashby	<Subiaco <Wanneroo <Subiaco Centro	>Ashby
		2	4	3	1
Weekly household income (highest to lowest)	0.000	>Wanneroo >Ashby	<Subiaco <Ashby <Subiaco Centro	<Subiaco >Wanneroo <Subiaco Centro	>Wanneroo >Ashby
		1	4	3	2
Educational qualifications (highest to lowest)	0.000	>Wanneroo >Ashby	<Subiaco <Subiaco Centro	<Subiaco <Subiaco Centro	>Wanneroo >Ashby
		2	1	4	3
Time lived in neighbourhood (longest to shortest)	0.000	<Wanneroo >Ashby >Subiaco Centro	>Subiaco >Ashby >Subiaco Centro	<Subiaco <Wanneroo <Subiaco Centro	<Subiaco <Wanneroo >Ashby
		2	1	4	3
EcoTV1 Positive emotion from spending time in nature	0.005		>Ashby >Subiaco Centro	<Wanneroo	<Wanneroo
		2	1	3	4
EcoTV2 Sad to see nature destroyed	0.000	<Wanneroo >Subiaco Centro	>Subiaco >Ashby >Subiaco Centro		<Subiaco <Wanneroo
		4	1	2	3
EcoTV3 Humans & nature as one	0.277				
AnthroTV1 Conservation for quality of life	0.542	2	3	1	4
AnthroTV2 – Future access to natural resources	0.058	4	2	1	3
		1	2	4	3
CareTV1 Care about environmental issues	0.000	>Ashby >Subiaco Centro		<Subiaco	<Subiaco
		2	1	4	3
Volunteer for conservation activities	0.012	>Ashby	>Ashby	<Subiaco <Wanneroo	

†Kruskal-Wallis or Mann Whitney-U test for mean rank with χ^2 test for asymmetrical significance of variance
‡Tukey post hoc testing of ANOVA with mean difference significant at $p\leq0.05$ level

[†]Kruskal-Wallis or Mann Whitney-U test for mean rank with χ^2 test for asymmetrical significance of variance

[‡]Tukey post hoc testing of ANOVA with mean difference significant at $p \leq 0.05$ level

These results raised several questions and exploration of the qualitative data provided some potential explanations about relationships between attitude to natural environments and the physical characteristics of each neighbourhood. Did people select their home location based on how important it is to them to spend time in natural areas or whether access to green spaces (or other facilities and services) might affect their

quality of life? Does having access to nearby green spaces affect their level of care about environmental issues? These questions, among other issues relating to attitudes to natural environments are explored in the following section.

Talking about nature and natural environments

In order to better understand the attitudes people held about nature and natural environments, interviewees were asked a range of questions about their understanding of nature, how they felt about green spaces in their neighbourhood and what they valued most about those places. The following discussion explores four main themes of defining nature and natural environments, the importance of urban nature, valuing neighbourhood green space, and involvement in conservation and environmental protection.

Concepts of nature and natural environments are the subject of much debate. Many definitions are complex and contested (Clayton & Opatow, 2003) and some authors feel that nature is greatly devalued in Western civilisations (Marchant, 1983). As part of the interview process in this study, people were asked how they felt about nature and how they would describe it. Almost all said they cared about nature and natural environments but there was little agreement about what they actually considered nature to be.

Defining nature and natural environments

The most common initial response described nature and natural environments as untouched places, or places without people. Leanne described nature this way:

Just trees and animals, that sort of thing, that is nature to me. Just animals being able to run freely through their bushland.

Michael made this distinction clear by first describing what he considered to be nature, and secondly, how he saw an area of local parkland.

Well, nature would be more like an environment um ... untouched. ...Parts of Kings Park and um ... untouched, virgin areas, whereas [Lake Jualbup] is a human recreational resource. [MAY: It's not a natural environment?] No.

Tash made a similar distinction.

Bush and trees, just bush land and sort of trees and birds and... that's my immediate thought, just bushland settings is what I immediately think of when you say nature. ...I think of nature as just untouched bush land whereas I think of like the parks they set up in new residential areas, I don't quite think of that as nature even though there is a couple of trees there and grass, it's more man-made. So no ... I don't really think of them as the same thing. Nature is untouched sort of land that nobody has done anything to.

When Adam was asked what attracted him to bushland areas, he also differentiated between natural and man-made environments:

Oh I think it's because it's natural instead of being man-made or manufactured ... So I like that, I like that it's untouched I suppose, that you can wander around in there and you don't have to look at buildings and cars and things like that, it's nice.

Jess expressed her view of nature and its relationship to the built environment. She particularly liked the way that nature softened the built environment and changed over time.

I look upon like built and natural environment as a kind of almost like ... like the male and female, the buildings are these big, straight, geometric type things and the female side of nature hurries to blow leaves all over the path and create vines... covers and softens the edges over time.

Several interviewees found it difficult to describe nature or natural environments and admitted they had never really thought about it. Jess commented that:

It's not something one talks about and maybe this is something that would be a really good dinner party subject, that you actually brought up these things and say ... how people feel about these things because often we do take them for granted.

Luke found the question interesting.

That's an interesting question and one that I've never debated ever before. But from my point of view it's all nature and you need balance ... I don't think it matters how it's set out. It's being surrounded by green I guess.

Despite (or perhaps because of) his background in environmental science, Brad also struggled with the question of how to define nature, particularly the question of whether urban green spaces were part of nature.

I suppose it has to be, nature is... (pause) yeah, I'm not quite sure how to answer that one either because you can either say that it's something that hasn't been influenced by man or you know, there's still nature across that road in the park there because it's got grass growing and trees and that sort of stuff growing that we all planted and we've obviously influenced that environment but it is still nature.

Sue gave this response to the same question.

Nature would be ... What's nature? Gosh you do ask difficult questions ... nature would be, well I suppose nature includes animals but mainly I would think in this environment nature would be plants, trees, shrubs, these things which are actually growing and growing well, are healthy. That would be nature.

For others, nature was not just about the place but also the experience. Jack spoke about what he found in nature.

It's hard to define isn't it? No, I don't think it is getting away from it all or anything because I'm so contented here I don't have to get away from anything. ... So nothing that I do I feel is an escape, it doesn't need to be, it's just experiencing those nice sensual feelings about the sea or a river or the sounds of birds or sound of running water. A whole myriad of sort of things that make up any particular place.

For William, nature represented a strong connection to land.

Well I reckon being in touch with nature, rural life, I think we're born from plants and trees, birds land there and I think that wind and erosion...and you're sort of, you're not like in the city ... I don't like the city ... I think I'm in touch [with nature] because my Dad was a market gardener and we love the land, we just love the land.

For Eleanor there was no differentiation between nature as either place or experience. She saw herself as part of nature, everything inexplicably intertwined.

Oh definitely, oh yes, we're all intertwined with nature. Absolutely and I think that's why it is so nice to have it. You have that renewed every day where you see that we are all a part of that together, it's so nice to have it there. ... We're all interconnected ... so we can't live without nature, but nature could probably live without us, but we can't live without nature because it's so much a part of us. I mean all the medicines, everything we are comes from nature, every shape, everything, textures, everything that we use, colours, it all comes from nature, so we are, we are all involved, intertwined and that's terrific (laughs).

The viewpoints expressed here describe a range of attitudes and personal connections to nature and natural environments. For some people, nature was represented by places with little or no human intervention. Others they saw themselves as part of nature and felt connection to the land.

These contrasting views about nature make interpretation of the quantitative results discussed in the first section of this chapter more challenging. If individuals see nature in a particular way, what does spending time in nature mean? For those who see nature as “untouched” areas, is this their only point of reference? For those who see any green

area as nature, does spending time in nature include simply walking in a park or looking at a garden? This conundrum became apparent during analysis of the pilot study, and subsequent interviewees were asked about what constituted urban nature and its importance within their neighbourhood. The following section discusses responses to these questions.

The importance of urban nature

While most interviewees commented positively on nearby green space, the place of natural areas in urban environments elicited a great deal of comment, both positive and negative. As discussed earlier, how people value nature takes many varied forms. In response to questions relating to what people valued most about green spaces in their neighbourhood, descriptions of functional, experiential and emotional values (Table 2.1, p. 23) were commonly expressed.

Personal attitude and preference played a substantial role in determining which nearby green spaces were considered attractive places where people liked to visit, be active, seek solace or relax. Negativistic values towards nearby bushland and other natural areas, described by Kellert (1996) as being based on fear aversion and alienation, were expressed by several interviewees. Some indicated preference for the separation of bushland and other natural areas from residential development.

As already mentioned, Michael saw nearby Lake Jualbup as “a human recreational resource” and stated that recent community efforts to replant the banks and restore the seasonal hydrological process of the lake were inappropriate for a suburban area. He was particularly concerned about the lake being left to dry out in summer:

...because it just becomes a bog heap and bog heaps are alright when it's surrounded by bush where you've got animals and insects and plants and so on that need all that bog ... you know as the part of the cycle of things but not in a manicured lawn setting.

For Michael, the aesthetic appeal of an area was paramount. He stated his clear preference for well-tended, more manicured areas and identified a nearby regional park (Herdsman Lake) as being perfect for a metropolitan area because:

... part of it has been left as untouched, as fairly untouched. And then you've got your civilised recreational site over the other side which is your manicured lawns and so on.

Even though he lived in the same neighbourhood as Michael, Mark saw Lake Jualbup and its surrounding parkland quite differently. He felt that it provided a place for people to experience different aspects of natural environments.

There's always something to look at, new things to see, different birds, different levels of the lake. If it has rained you can see that the level of lake has been filled up or you see a great big drying in the summer and watch the weeds popping up as the lake bed is exposed and see where the ducks go. You've got turtles in the water there and you've got kids coming down to look at the turtles, the occasional dog that likes to go in for a swim and people doing different things down there.

Amber, Kathryn, Leanne, Sarah and Toni (all of whom had young children) expressed quite different opinions to these and were more concerned about the safety of their local green spaces, mostly the possibility of encountering snakes or spiders. Perceptions about anti-social behaviour were also raised by several of the women. Toni rarely took her daughter to the park nearest their home because of concerns about broken glass, syringes and other detritus left after “the hoods get there on Friday and Saturday nights and run amok”. Sarah voiced similar concerns about the safety of local bushland, though later in the interview, she spoke about being very happy for her sons to play in bushland areas at the family farm.

I don't reckon that the bushland around Wanneroo is the safest place to go exploring. I probably wouldn't let the boys go off and do that anyway.

Amber said she had no intention of ever letting her daughter play in local bushland and was worried by its proximity to their Ashby home as a snake had recently been found in a neighbour's yard. Leanne was concerned about the wetland area several hundred metres from her home and the potential dangers she saw it presented to children and wildlife.

I just wish they would get rid of the water. I just don't understand... any kid could wander down into there and drown, and how is that allowed...? It should be fenced off or something, I don't know, it's right near a busy highway ... Do they really think they're going to get any sort of native animals back into there and if they do, they're not going to live long are they because they're just going to wander across that road one day, it's not all fenced off on that side ... I just sort of think it's a waste of time. At least get rid of the water and bush it all... even though it's got that fountain in the middle, it's just a mosquito breeding ground.

Despite voicing her concerns about snakes, Chloe felt strongly that trees, bushland and other green spaces in and around Wanneroo needed to be protected, to provide a buffer between areas of residential development, and for its own sake:

I think it's important because it provides like a cushioning effect from just having miles and miles of houses, so it breaks it up, and it's important to help maintain the wildlife and diversity, biodiversity. I think that's important because I mean, parks don't do it, you need bushland to do it, don't you?

Matt felt it was important to him (and his family) to live near bushland, but understood that not everybody felt the same way.

It is important to us anyway. I mean I know... I've met people along the way that they're not fussed. They would rather live in the city so for those people ... it doesn't bother them. They're happy to live in the city. It's always been like that though hasn't it, there's always people who like the bush and there are people who don't. But you need it, it has got to be there, doesn't it?

Matt and Chloe seemed to seek reassurance that bushland needed to be retained within the urban environment. As their interviews progressed, neither was able to adequately express why they felt this was important. Matt admitted he had never really thought about why he felt connected to the bushland around his neighbourhood.

I don't know what the connection is. It's just peaceful, nice scenery really. [MAY: You never really thought about it ... ?] Not really, no. Not until you've asked that question. I've never really thought about it in that sort of way before – just always been a connection. Ever since I was a little kid, my dad used to take me out to the bush and I followed on and kept on doing it and enjoyed it.

Mark expressed concern that it was “a reflection of urban life that we are isolated from our environment” and eloquently expressed his thoughts on why retaining urban bushland was important. Apart from the intrinsic value of green spaces, he felt that people, particularly children, needed to experience bushland environments.

Well I think having intrinsic value, I think it should be looked after just because that's what it is. If it wasn't bush, what would it be? Would it be buildings or an unnatural landscape of exotic species ... I think it's important, it's also important for people's awareness and education to see it, and it can't help but be a source of fascination and relaxation for people to, say go out to Kings Park ... there are people out there walking and looking ... because there is so much there that just grows by itself ...

In Kings Park there's that playground ... It's surrounded by bush so even if [children are] not taking an interest in it, it's there and it's part of the backdrop and they must be aware of it so they must have a sense of what bush is – at least they've seen it – they're not just in a playground which has got walls on each side of it so I think something must rub off there ... at least they will have a sense or memory of what bush is – or maybe it won't mean anything to them – because I think it must be better for them than just an isolated patch of grass surrounded by roads or just being in a concrete playground surrounded by buildings.

Tash also struggled to answer the question about why retaining bushland areas was important. When she did respond, she talked about just wanting to know bushland was part of her neighbourhood. Like Mark, she felt it was important that the community had access to green spaces.

I think knowing that you've got ... knowing that you've got access to be able to get out into nature, as if you were living in the middle of the city you'd have to drive an hour to get into it, but knowing that it's right outside your door, just knowing that it's there to be able to use, is really, really important. Umm ... I'm not being very specific but again it's just knowing that it's around and when you picture where you're living, you sort of picture greenery and trees as opposed to buildings and roads and things. I also do think it is very important for the community, especially kids, to have access to parks and things, that's pretty important.

Apart from these examples, almost all of the interviewees struggled to articulate a response to the question of why it was important to retain areas of bushland, or other natural areas within the city. Almost all found it much easier to talk about why particular local green spaces were important to them. The next section of this chapter explores the personal values that people placed on green space in their neighbourhood.

Valuing private and public green space in the neighbourhood

Early in each interview, questions were asked about the importance of green spaces directly around their home. In most cases, this initiated a discussion of garden space within the confines of their private property. Private green space (or more specifically private gardens) played a substantial role in many interviewees' stories, particularly for older residents in established suburbs.

Private green space was variously described as a place of personal refuge, a space for relaxation or recreation, and as an outdoor living/entertainment area. After living in inner-city Sydney for several years Luke enjoyed the space his garden provided.

We've got quite a small house ... so we've got quite a sizable yard out the back which, we spend a lot of time in our back garden so that's really important for me. There's quite a lot of grass but there's also a lot of plants ... and a couple of big trees in the back garden which is nice. We've got little hammocks swinging and all that sort of stuff so we really enjoy it... after being confined to units for so many years of my life ... it's really nice to have a back garden to walk out into, lie in the hammock, and just spend time outside.

For those who had them, it was obvious from their descriptions that gardens were valued and formed part of their connection to home and neighbourhood. Interviewees

who had lived in their neighbourhood longest expressed the strongest emotions when speaking about their gardens. Charlie, Mary, Jack, Mark, Jess and William had lived in their homes for more than 20 years. For Charlie in particular, his garden was a defining feature in his life. As he watched more residential housing develop in the Wanneroo area, he thought about moving somewhere quieter, but he couldn't leave his garden.

I'd be lost if I never had my veggie garden. I'd be lost. What would you do, sit inside all day?

For others, it seemed the garden was also important to their sense of personal identity. Mary kept a large sprawling garden and saw it as a connection to her rural past, with its water tower, vegetable plots, fruit trees and chicken roost. Mark felt strongly about local conservation and specifically planted areas of flowering native trees and shrubs. He felt it was important that his Subiaco garden contribute to the avian wildlife corridor between nearby Kings, Bold and Shenton parks. Jess's art studio sat at the bottom of her garden under a big tree and gave her a sheltered place to work.

Fiona's connection was very personal. Although she had lived in her Subiaco home for nine years, she had only recently planted a front garden. This project provided emotional release during a difficult time and enabled her to initiate conversations with her next-door neighbour and develop an ongoing friendship. The casual conversations that were initiated with passing neighbours as she worked in the garden were also important to her. She enjoyed the praise and positive comments she received during the resurrection of her front garden.

Several interviewees saw their garden as a means to create a connection to people and places they had left behind. Kathryn's garden included plants that reminded her of past places and events. She had a rose garden, with plants representing each of her children and a good friend who had recently died. She had planted a vegetable patch and selected native species for much of her new garden as it "keeps it into the same atmosphere that we had in Sydney". Apart from wanting to retain personal connections, the establishment of a garden was essential for Kathryn to feel her home was "finished". It was an ongoing project.

Yeah, like we never planned to put any grass out the back, we always ... wanted it just to be garden ... just to me it wouldn't be finished. It didn't look right, does it make sense? I don't know ...

I still keep planting things and my husband goes stop but I say I'm enhancing the value of the property but he just laughs at me. Yeah, no ...there are actually a few things that I want to finish off ...I've put plants in the side on the fence because it looks so boring ... I just didn't want to see a concrete jungle, does that make sense?

Others related a variety of reasons why their private outdoor space was important to them. Hans had grand plans for his garden and wanted to revamp his back yard and fill it with native trees and shrubs to attract more birds and create a place where he could come home and relax. Luke liked the fact that working in his garden helped him feel part of his neighbourhood. He chatted to others while sweeping leaves off the footpath and was friendly with many people in the street.

These observations are not unusual. Aside from the specific health benefits connected with gardening explored earlier, several authors have examined the experience of gardening in Australia since the time of European settlement. Private gardens are cited as places to re-establish connections to earlier homes (particularly by British and southern European immigrants) through landscaping and planting of familiar species, to create places of remembrance, to be productive, self-sufficient by growing vegetables and fruit, or to educate children about nature (Holmes, Martin, & Mirmohamadi, 2008). Some gardeners feel strongly about creating local connections to place and engendering ecological and cultural sensitivities through planting native species, a process of “cultivating a better sense of place as well as cultivating a garden” (Mulcock, 2008, p. 188).

Not all interviewees felt strongly about the need to have their own garden. For Amber, Adam and Sarah, development of a garden was not a priority and outdoor space around their homes largely comprised lawn or paving. For these three interviewees, family and work commitments were more important and none felt they had the time and financial resources required to establish a garden.

For interviewees with little private space, green space around the home was less defined by individual property boundaries. In Subiaco Centro, few interviewees had any private outdoor space except for a balcony or courtyard. Some contained plants in pots or hedging. Sue spoke about needing to see green and flowers around her or “[it] doesn't feel right ... plants give a warmth and a softness and ... furnish a place either inside or

outside”. Sue’s kitchen and living area overlooked the largest park in the neighbourhood and she considered the view to be an extension of her private space. Eleanor saw the park area across from her home in a similar way.

Here I just simply walk across the road; it’s like having a huge backyard. It’s lovely. ...

Kevin felt the landscaped parklands and streetscapes were an essential feature of the neighbourhood. He stated that sufficient public green space needed to be provided as it was well used by residents, like him, who had little private green space.

We’ve space in our little courtyards so you can actually have friends outside ... but if you want to [entertain] large groups of people ... a lot of people just go down to the park. If people have their extended families for birthday lunches or something they just go down to the park under one of the shelters. So it’s an essential part ... it’s compensating for the fact that we don’t have back gardens.

Gordon readily admitted that gardening was not his forté and was happy that his apartment block forecourt included several large garden beds. Andrew and Anya lived in an apartment block with shared garden, pool and BBQ space. With their busy lifestyles, not having to maintain a garden while still having access to semi-private green space, was considered a bonus.

Diversity, type and design of public green spaces substantially influenced how interviewees felt these spaces contributed to the neighbourhood. Mark talked about why he enjoyed the variety of green spaces around Subiaco.

It’s variety, yeah. I think that is important. It’s nice having open space [at Lake Jualbup] even if it is just lawn, that expanse gives some sense that you’re not really hemmed in and I think that’s just nice to walk in ...and yet there are things there which are of interest ...So ... I think...having the variety and Kings Park in itself ... there’s a lot of variety in there – there are a lot of paths and things you can go down and wonder where you are and then just wait and see where you come out. It’s not quite a maze but you can walk in different directions for different lengths ... and you could have a one hour or two hour walk, or an hour long bike ride going round and round.

Other Subiaco interviewees echoed his thoughts. Luke declared that it was rare to find a neighbourhood that offered a “great mix and balance”. With Jess, Jack and Mark, Luke appreciated the diversity of nearby green spaces and felt privileged to live where he did.

I feel very lucky and very privileged to live in an area that does have such an abundance of choice. ... It’s very rare that you find so much bushland so close to your house, so close to the city. Then the other side you’ve got those big parks

where you can run, exercise, play, kick the ball. You've got a river just down the road ... so I feel very privileged to be able to live in an area like I do.

The sense of being privileged to live in a neighbourhood with a variety and diversity of green space was expressed by almost all interviewees in established neighbourhoods. Tash admitted that responding to the survey caused her to think more about the value of her local green spaces.

I often think how lucky we are to have this lake, Lake Joondalup and Neil Hawkins Park and the reserve over this side of lake. I do often think about how lucky we are to have that near us so I do think about it.

It also caused her to think about the impact of her lifestyle on natural environments.

You know I do love nature and you know, thinking about it it's great to have it but I don't do a lot to protect it really. I mean I drive a car that's got some smoke coming out of it, I recycle when I can but I don't go out of my way. So ... even though I still think myself as part of nature I do think because of technology and just lifestyle that we do have a negative impact on nature, yeah.

Involvement in conservation and caring for the local environment

When interviewees were asked about community conservation projects, none were currently involved. Only a few interviewees acknowledged past involvement or interest in conservation issues. Mark had worked with several international conservation agencies as a younger man. He continued to maintain a strong interest in conservation issues and did what he could to incorporate his long held values into his daily life. He regularly wrote submissions or responded to calls for public comment and felt very strongly about issues like use of nuclear power. He described his level of involvement as:

I do things in a quiet way but not as far as going out in the streets to protest. I could probably do more political things.

Toni was proud that she had once been arrested for protesting against nuclear warships in Darwin. She acknowledged that because of her family responsibilities, it was unlikely that she would be that committed to protesting now.

I'm sort of at home raising a kid so I'm limited to what I can do and what I can actually give to this sort of thing, but yeah, within reason. I can't go ending up in jail again. [My daughter] would be going to see jailbird mummy.

Sue had signed several local petitions and participated in community tree planting projects near their previous home. When they moved to Subiaco Centro, she suggested to her husband that they maintain involvement with Men of the Trees but found that “it

tends to be a bit back-breaking when you get older”. Chloe was also concerned about the physical aspects of being involved in local conservation projects and, like Sue, made financial donations to compensate for her lack of hands-on involvement.

Eleanor also signed local petitions and was concerned with the continuing disappearance of green space in the Subiaco Centro area but felt powerless to stop it. Her solution was to work with her husband to plant several hundred trees on their property north of Perth.

To be honest, I've always felt overwhelmed by bureaucracy and I just ... seeing that little patch of green go when it did, you just know that you can't fight any of this stuff, it's all predestined, predetermined. ...I feel good about [planting trees]. That we plant all these trees and you know they will be there hopefully for a long time.

Mary's involvement in conservation was more by default than design. After a serious fire more than a decade ago, the property she and her husband owned north of Perth no longer operated as a viable farm and the paddocks had been left to regenerate. The site now grew abundant wildflowers and several endemic tree species. With her sister, Mary conducted ongoing flora identification and regularly hosted site visits for interested naturalists.

Brad's employment situation provided indirect involvement. His job required him to liaise with land developers to ensure that environmental protocols and guidelines were met and he felt he was doing his best to protect natural environments. In Luke's case, he acknowledged that he had never given too much thought to conservation issues or ever wanted to get personally involved, though might perhaps be more reactive to local issues.

But to be honest, I've never really been ... I may come across as a big supporter of fantastic environment and stuff, but I've never really given too much thought to it. ... I certainly don't think globally in terms of [environmental issues and] that sort of stuff. ... I think I'm more reactive and think more about the stuff within my own local area than I would about anything globally.

Anya was quick to respond with “No” when asked about being involved in conservation projects and when asked if being considered green made her uncomfortable, she replied:

No, I just don't ... I would like to say yes but I think I'm honest in saying that I'm not really. I would like to be, I'm putting ... I'm going to ... I'm convincing my partner to put solar panels on our house for instance, and I will put in a ... I

want to put in a water tank so I will do my bit, but I'm just ... I'm a bit of a townie really.

For most interviewees, the idea that they might be considered a conservationist or a “greenie” generated similar comments to this response given by Andrew.

Not really, I wouldn't describe myself as a greenie but I am conscious of the environment and conscious of wanting to do the right thing so I would sort of say, I'm not a closet greenie. But aah ... No I would probably never say that I'm a greenie but I would say yeah I am conscious of the environment and wanting to do the right thing.

Michael gave a somewhat different response when asked if he would describe himself as a “greenie” or as someone interested in environmental issues. He was very clear about disassociating himself from what he saw as politically motivated green philosophy.

Yes I am but I don't follow the green party type philosophy at all. [MAY: So sorry, that means yes, you're interested in conservation issues?] Yes, but it's not the populist anti-business, anti- ... you know it's not left wing, I'm not of a left wing point of view with that. ... Well, my family has been really proactive in the environment on the farming side. They're farmers and thousands and thousands of hours has gone into environment improvement on farms which most people don't know that farmers do.

Leanne used the example of protesting against logging old growth forest to illustrate her level of interest.

That sort of thing I don't have a passion for but I do have an opinion on, you know. I wouldn't go and chain myself to a tree or live in a tree or things like that but understand why they do it, understand that that is the only way to get across to people sometimes that these trees should stay ...

In Amber's case, she was not at all interested in conservation, but was glad that other people were. Sarah found herself in a difficult position and looked almost guilty when asked about whether she was interested in environmental issues.

No, no, my mum is. She thinks I'm terrible. I ... I feel so sad if forests get knocked down but I wouldn't tie myself to a tree and obviously, I've bought a block that has been developed ... So it would be a bit hypocritical for me to get on my high horse but I love it if nature is preserved or they reserve an area and it's old growth. I don't try and particularly campaign to save any animals or whatever, my mum does ...

In almost all cases, time and inclination were the two factors that determined people's involvement in conservation or activities to protect natural environments. Heinz admitted that:

I see the people are planting little trees and that, and no I haven't been involved because I just don't have the time.

Fiona readily acknowledged that she used time as an excuse when asked about her involvement.

More time. But that's a bit of a cop-out because I don't think time would be an issue, if you were passionate about something, time isn't the issue.

To determine what might spur people to get passionate, interviewees were asked what it would take for them to become actively involved in conservation issues. Change to significant local assets seemed to be the common denominator in determining whether people were willing to take a stand and become actively involved. In all cases, the prospect of losing access to local green space (particularly areas that were important to each individual) through further development, prompted a positive response – though there were still reservations expressed about how much time and effort each would invest.

At the time the interviews were being conducted a local issue was creating a great deal of interest in the inner suburbs. Almost all of the Subiaco and Subiaco Centro interviewees made comments about a proposal to remove many of the large trees from Mueller Park to make way for extensions to the neighbouring sports stadium. It was not viewed favourably. Jess was particularly concerned that such a proposal would even be considered and thought that such action might cause her to get involved in community action.

That would be an absolute sacrilege if they allowed that to be pulled down and put an enormous stadium there. The impact on those people who live nearby would be just...not... partly the loss of the park but partly to have that huge building like jammed packed in on them, I can't imagine how anybody could even think about it. And I think that if it gets to the point, there will be a lot of people who are ready to go and lie in front of the bulldozers ... Oh I would think about it for [that park]. Because it's got huge mature trees and it's irreplaceable, a big open green space like that in the middle of a central residential area.

Apart from Jess's vehemence, most interviewees expressed moderate support for local action – even when it involved areas they valued. Tash's comments were representative of the circumstances it would take for most interviewees to initiate protest or action.

If somewhere I went frequently ... if that was to be knocked down and there was a protest, I would probably go and protest, you know. But apart from that, I'm not really... No, I don't actively sort of do anything about it, no. [But] if it was

somewhere that I particularly go a lot like ... along the lake, if they were talking about filling in the lake, I'd probably do something about that. But I don't know how far I would go with it. I wouldn't spend all my time invested in that either (laughs).

Chloe was the only interviewee who explicitly acknowledged that getting involved in local conservation issues was not just about people.

[If they were going to bulldoze the lake] I'd be down there with my signs and laying in front of the bulldozer, yeah. Because it would be really, really wrong. There are very few wetlands around and that's one of the few. And you know, it's important to retain it ... because it's part of the ecology, yeah, and because I like it, yeah. And because of all the other things I've said, you know, the social aspects for people who live around here. But you know, there are lots of ducks and birds and animals and things that live down there that need it.

Discussion

As discussed in the first part of this chapter, survey respondents expressed strong support for some statements relating to ecocentric and care statements, but when it came to anthropocentric statements that asked for respondents' opinions about the interrelationships between people and nature, more indecision was evident in the responses. I initially concluded that this was most likely related to the unreliability of the anthropocentric measurement scales (which may still be the case) rather than direct evidence of indecision or ambivalence on the part of respondents. As the interviews progressed, however, I began to consider that perhaps ambivalence about how to respond to these statements was an indication of people's overall attitude to natural environments.

Several authors have voiced concerns that increasing disassociation between nature and people is an artificial effect and the result of a perceived divide between urban (civilised) and rural (agricultural) life (Barlett, 2005; Benton-Short & Short, 2008; Hinchliffe, 2007; Register, 2002). Further, these same authors argue that if steps are not taken to recognise the importance of connections between people and urban nature, it will be to the detriment of urban communities. This is seen as critical by Louv (2005) who is particularly concerned that generations of children will not experience nature within their local neighbourhood. If this occurs, it is asserted they will have little opportunity to develop positive attitudes or understanding of the intrinsic value of nature (Kahn Jr, 1999; Kahn Jr & Kellert, 2002).

Interviewees seemed to have little trouble identifying with the idea of nature being important but few had a clear vision of what constituted nature or were able to state why they thought it was important. Most relied on the romantic view of nature being somewhere apart from the urban environment, untouched by humans and a place where wildlife lived and the cultural construction of these views is discussed in much current literature. Milton (2002) writes at some length about personal connections to nature, the place of emotion in determining attitude and the notion that attitudes to nature in western societies are culturally driven. Perhaps as Hinds and Sparks (2008) suggest, it is affective connection – or emotional affiliation – that is the best predictor of environmental attitude. Emotional connection may change depending on individual experiences or circumstances resulting in attitudes that are fluid rather than fixed. Statements used to measure ecocentric attitude in this study often expressed an emotional response to natural environments – enjoying spending time or feeling sad to see a forest cleared – and affective connection may explain why most ecocentric and care items generated predominately positive responses,

There appears to be some disparity between quantitative and qualitative findings as the survey results demonstrated positive response to ecocentric statements and care for environmental issues, while interviewees expressed more anthropocentric views. This observation supports the suggestion by Ignatow (2006) that generally, people may not have coherent beliefs about environmental issues and will pick and choose a position based on cognitive, emotional or spiritual perspectives. Ignatow acknowledges the diversity of environmental worldviews and further suggests these are shaped by social position, education, cultural models and personal interaction with nature. Despite the generally ecocentric views evident in quantitative data, survey respondents and interviewees with the highest socio-economic status tended to have the least direct contact with nature, and also tended to be more anthropocentric than ecocentric in their attitude to nature and natural environments.

Within this study, most interviewees were initially very reticent when it came to discussing their own relationship with natural environments. For some, it was only when they were actively encouraged to speak about places that were important to them that most were able to articulate their vision of nature, generate an opinion or express their attitude towards natural environments. Many of these responses related to physical

features and the aesthetic appeal of trees and birds, evoked personal emotional connections, or recalled past experience (experiential and emotional values). Most interviewees saw “nature” as areas that were visually attractive and provided opportunities for recreation or relaxation (anthropocentric attitudes). Only a few – mostly older – interviewees spoke of valuing nature as something more than a resource that contributed to their quality of life (ecocentric attitude).

This was particularly evident when it came to questions about involvement in conservation activities or caring for nature within local neighbourhoods. A very small proportion of survey respondents indicated they were currently involved in conservation activities (though almost half indicated they had thought about it) and none of the interviewees were currently involved, though some had past experience. As mentioned earlier, Sarah had a young family and was open about feeling guilty that she was not more involved in environmental issues and conservation projects but was able to assuage those feelings by declaring that her mother did enough to make up for her own lack of effort. Like Sarah, most of the interviewees indicated they would like to be involved if they were more physically able, had more time, were less involved in their work and raising their children, or simply had the energy to focus on issues outside of their home environment.

It is perhaps this last aspect that is most telling. While all interviewees seemed aware of the existence of global environmental issues, the extent of actual focus for most was their home and immediate surroundings. When asked about environmental action, several referred to saving water, recycling or thought that planting more trees and local species would be good. Very few interviewees seemed able or willing to articulate their opinions about broader environmental issues or spoke of being conscious of the potential impact of their actions on biodiversity or ecosystem health within the wider neighbourhood. In fact, for most interviewees, the idea that they might be considered to be a “greenie” or would express strong views and take part in ecological activism did not fit with their personal identity. A few interviewees, however, did acknowledge providing donations or contributing to political discussion or action.

When all is considered, perhaps the reported responses to statements about attitudes to natural environments were not so surprising. Dutcher and colleagues (2007) found

respondents in their study scored high for environmental connection and concern but few reported little actual involvement in pro-environmental behaviours; the same pattern of response here. In a study of place identification and sustainable behaviour, Uzzell and colleagues (2002) found little difference in environmental attitudes, values or behaviours and suggest that people often express support for pro-environmental behaviours but only undertake pro-environmental action if it does not involve personal sacrifice.

This observation highlights the emerging concern that current attitudes to natural environments may be influenced by the strong public messages of the environmental movement (Pooley & O'Connor, 2000). At the time the interviewees were being conducted, Al Gore's climate change polemic, *An Inconvenient Truth* (Gore & Guggenheim, 2006), was just beginning to be shown in local cinemas. One interviewee (Sue) made direct reference to the film and acknowledged that until she had seen this movie, she had not thought about how trees or green spaces might ameliorate the effects of climate change. Sue remembered that one of the tips suggested by Gore to combat global warming was to keep planting trees – a simple action that she was happy to endorse. Pooley and O'Connor (2000) suggest that while people are increasingly ecologically concerned, they often have little understanding of their role and responsibility for environmental problems. As such, people may have little concept of how to adopt attitudes or behaviours that are deeply ecosystem-centred, rather than simply being influenced by social norms or expectations, or concern about human-centred or resource-based issues (Uzzell *et al.*, 2002).

It was also evident from responses given by several interviewees that being concerned about environmental issues, and particularly being considered a “greenie”, meant being aligned to pro-environmental politics, and was not simply a reflection of emotional or experiential attachment to nature. At the time the study was being conducted, Australia was governed by a conservative neo-liberal political party that strongly supported an entrepreneurial, aspirational, consumption-driven society (Gleeson, 2006). With the pervasive political position being disdain for environmental issues, and for those “greenies” who expressed concern for environmental degradation, it may well be that some interviewees felt uncomfortable being personally associated with what might be considered a pro-environmental political position.

From the survey and interview data discussed in this chapter, it would appear that, in general, people most valued the experiential and emotional aspects of nature and natural environments. While most people were aware of environmental issues, few have a clearly defined attitude or could readily express their opinions, particularly when it came to issues that explored more philosophical relationships between people and nature. Most interviewees admitted they had never thought about how to define nature or their own attitude towards natural environments; it was simply something they took for granted. It would also seem that few of the people interviewed would willingly devote time and energy to being proactive about dealing with environmental issues except if those issues or problems affected their immediate surroundings and could potentially impact their quality of life.

Chapter 6: Neighbourhood green space

The influence of green space on perceptions of residential quality and neighbourhood satisfaction is a relatively new area of study. Several authors have studied parks and other green spaces in inner city neighbourhoods and found they can positively influence perceptions of neighbourhood safety, residential satisfaction and social interaction (Bonaiuto *et al.*, 2003; Coley *et al.*, 1997; Hur & Morrow-Jones, 2008; Taylor *et al.*, 1998). Others have explored relationships between people and favourite places (Korpela & Hartig, 1996; Korpela *et al.*, 2008) and the potential health benefits of regularly visiting these areas. Research has also focused on economic outcomes as positive perceptions of green space can significantly increase real estate value in residential areas (Austin & Kaplan, 2003; Crompton, 2005; Geoghegan, 2002; Ryan, 2005). Following on from the previous chapter where general attitudes and perceptions to nature and natural environments were examined, in this chapter I explore the specific attitudes and perceptions people held about private and public green spaces in their neighbourhood.

As with the previous chapter, data came from two main sources – the survey and interviews. Survey questions asked about proximity to different types of green space, perceived quality of neighbourhood green space, how often and why people visited nearby green spaces, and whether they identified a favourite area (or areas) of public green space. Questions about neighbourhood attachment enabled examination of people's reported attitudes and commitment to living in their neighbourhood. These questions and related issues, including how people defined their neighbourhood, were further explored through interview. In the first section of this chapter, I discuss the results of the survey, and in the next, explore data collected through interviews. The links, meanings and inferences that emerged from the data are discussed in the concluding section.

Measuring perceptions of neighbourhood green space

Questions in the neighbourhood section of the survey asked respondents to: identify what types of green space were within easy walking distance (up to 500 metres) of their home; indicate whether or not they had a favourite area of public green space, and if so,

to describe what type of green space it was; and specify how often they visited nearby green space. Next, two scalar indices measured perception of quality of neighbourhood green space and neighbourhood attachment.

As with quantitative data discussed in the previous chapter, several stages of analysis were undertaken. In the first section of this chapter, these data analysis stages are presented in the following sequence:

1. generation of descriptive statistics;
2. data reduction through factor analysis (principal component analysis);
3. exploration of correlations between principal components (factors); and
4. identification of differences between factors and other variables (non-parametric analysis of variance).

Significant and relevant results are discussed in this chapter. Steps undertaken in assumption testing and consideration of suitability of each test were discussed in detail in Chapter 3. Where appropriate, more comprehensive results tables are included as appendices.

Descriptive analysis

Proximity and diversity of green space

Survey respondents were asked to identify which of seven types of green space were within easy walking distance (up to 500m) of their home. Frequency of response and results of cross-tabulation by neighbourhood location are presented in Table 6.1.

Disparity between perceived and actual distance (Redlick, Jenkin, & Harris, 2001) and between other objective measures of neighbourhood characteristics commonly occurs (Ball et al., 2008; McGinn, Evenson, Herring, & Huston, 2007). Before entering into exploration of this data, it is important to note that reported proximity to different types of green space reflected individual perceptions and not necessarily the physical landscape of each neighbourhood.

Overall, the types of green spaces most often reported as being within 500 metres of their home were parks and gardens (91% of respondents), play and social green spaces (86%), followed by and sports and recreation facilities (68%). The proportion of respondents who reported proximity to bushland, green corridors and private yards with

large trees was 60 per cent in the case of bushland and 59 per cent for green corridors and private yards with large trees. Fewer than 20 per cent of respondents reported living within 500 metres of market gardens, farms or vacant land.

Table 6.1: Proportion of respondents, overall and in each neighbourhood, who reported proximity (within 500 metres of home) to different types of neighbourhood green space

Type of green space†	$\chi^2‡$	Overall n=440	%	Subiaco % (n=144)	Wanneroo % (n=114)	Ashby % (n=100)	Subiaco Centro % (n=82)
Parks and gardens <i>including mown grass parkland with trees, formal public and/or botanical gardens</i>	0.000	398	90.5	97.9	81.6	87.0	93.9
Play and social green spaces <i>including play grounds and meeting/hanging out areas</i>	0.666	377	85.7	84.7	83.3	89.0	86.6
Sports and recreation facilities <i>including sports ovals, playing fields, golf courses and other sports areas, cycle and walk paths</i>	0.000	301	68.4	77.1	88.6	26.0	76.8
Bushland <i>including bushland, wetlands and bush areas around rivers or lakes</i>	0.000	265	60.2	65.3	87.7	65.0	7.3
Green corridors <i>including footpaths and verges, road and rail corridors, rights of way</i>	0.001	261	59.3	65.3	57.9	44.0	69.5
Private yards and/or gardens with large trees	0.000	261	59.3	80.6	72.8	33.0	35.4
Market gardens, farms or vacant land	0.000	86	19.5	1.4	14.9	64.0	3.7

†Green space descriptions adapted from Tzoulas & James (2005)
‡ Chi-square result from cross-tabulation analysis by neighbourhood location

Cross-tabulation of results by neighbourhood location identified several significant differences in reported proximity to green spaces, particularly between established and new neighbourhoods. A higher proportion of Wanneroo respondents reported proximity to bushland than respondents in any other neighbourhood, while Subiaco Centro respondents reported least proximity to bushland areas and private yards with large trees. Ashby respondents reported least proximity to sport and recreation facilities, green corridors or private gardens with large trees, and most proximity to market gardens and farms.

Perceptions of green space quality

Perceptions of quality of neighbourhood green space were measured by respondents' level of agreement (or disagreement) with a series of positively and negatively framed statements (using a 7-point Likert-type scale). As with previous scales, initial responses were re-coded prior to analysis to reflect a 5-point scale ranging from *strongly disagree* to *strongly agree*, with *unsure* removed from the mid-point and coded as zero (0). Median and mean scores, standard deviation and frequency of responses are presented in Table 6.2. Full results of frequency analysis are included as Appendix 6.1.

Some researchers have described finding high levels of residential satisfaction in neighbourhood surveys as a common phenomena (Michelson, 1977 cited in Talen & Shah 2007) as responses are subjective and reflect personal perception, recollections and experience. In addition, DeVellis (1991, p. 69) suggests that use of a mild tone, may result in a higher than intended level of agreement. Results reported here support these views as the majority of responses to statements were positive (median ≥ 4). Negatively worded statements tended to generate more *unsure* and *somewhat agree/disagree* responses than positively worded statements.

Responses to statements relating to green space quality (Table 6.2) showed that the majority of respondents agreed that in their neighbourhood, there were places people could meet (92%), green spaces were in good condition (90%), there were places they can go to relax (88%), areas were well equipped for visiting (86%), and many areas were open to the public (85%). Despite this level of positive responses, fewer respondents reported there were enough areas where children could play freely (63%) and or that areas of neighbourhood green space were too small (58%).

There was also less agreement with statements relating to access to bushland and disappearance of green space. Only 57 per cent of respondents agreed there was enough bushland in their neighbourhood, with 60 per cent of all respondents able to visit bushland without having to travel outside of their neighbourhood. The statement that "*many areas of green space in the neighbourhood are disappearing*" generated a spread of responses. The highest proportion of respondents disagreed with the statement (40%), approximately one in four respondents agreed (21%) or somewhat agreed/disagreed (26%) with the statement, and the remainder were unsure (14%).

Table 6.2: Median scores and proportion (%) of overall response to perception of green space quality statements listed according to strength of agreement or disagreement (n=440)

Perception of green space quality [†] (Cronbach $\alpha=0.78$)	Median	Mean <i>sd</i>	Unsure 0	Disagree ^a 1&2	Somewhat AorD 3	Agree ^a 4&5
There is at least one park in this neighbourhood where people can meet	5	4.40 0.8	0.9	.09	5.9	92.3
Areas of green space in this neighbourhood are in good condition	4	4.33 0.8	0.7	0.5	8.9	90.0
There are areas of green space in this neighbourhood where I can go to relax	5	4.33 0.9	1.6	0.9	9.5	88.0
Areas of public green space in this neighbourhood are well-equipped for visiting (good access points, pathways)	4	4.25 0.9	1.4	1.8	10.9	85.9
There is enough bushland in this neighbourhood	4	3.44 1.5	8.6	13.6	20.5	57.3
			Unsure 0	Agree ^a 1&2	Somewhat AorD 3	Disagree ^a 4&5
#Many areas of green space in this neighbourhood are private or closed to the public	4	4.09 1.2	6.1	1.4	7.3	85.2
#There are not enough areas of green space in this neighbourhood where children can play freely	4	3.50 1.4	7.0	9.8	20.0	63.2
#Going to an area of bushland means travelling outside of this neighbourhood	4	3.50 1.5	4.1	21.8	13.9	60.2
#Areas of green space in this neighbourhood are too small	4	3.53 1.3	4.5	9.8	27.3	58.4
#Many areas of green space in this neighbourhood are disappearing	3	2.83 1.6	14.1	20.7	25.5	39.8

[†]Statements adapted from Bonaiuto, Fornara, & Bonnes (2003)
[#] Items reverse coded prior to analysis
^a Responses for *strongly disagree/disagree* and *strongly agree/agree* were merged for analysis

Analysis of results for cross-tabulation by neighbourhood location indicated that respondents in inner suburban neighbourhoods were more likely to agree that green spaces were in good condition, well-equipped for visiting and there were places they could go to relax more. Respondents in new neighbourhoods provided less positive responses to statements relating to green space size, play areas and access to bushland. These respondents were more likely to agree or be unsure that green spaces were too small, that there were not enough areas where children could play freely and not enough bushland in the neighbourhood. It was also more likely they had to travel outside of their neighbourhood to visit bushland.

Neighbourhood attachment

As with perception of green space quality, neighbourhood attachment was measured by respondents' level of agreement (or disagreement) with a series of positively and negatively framed statements. Median and mean scores, standard deviation and frequency of responses are presented in Table 6.3. Full results are included as Appendix 6.2.

Table 6.3: Median scores and proportion (%) of overall response to neighbourhood attachment items listed according to strength of agreement or disagreement (n=440)

Neighbourhood attachment† (Cronbach $\alpha=0.82$)	Median	Mean <i>sd</i>	Unsure 0	Disagree ^a 1&2	Somewhat AorD 3	Agree ^a 4&5
Living in this neighbourhood is important to me	4	4.07 1.1	3.2	2.3	15.5	79.1
I feel like I belong in this neighbourhood	4	3.79 1.4	7.5	2.5	18.9	71.1
This is the perfect neighbourhood for me to live in	4	3.60 1.4	7.7	5.7	24.3	62.3
It would be very hard for me to leave this neighbourhood	4	3.35 1.5	8.6	13.0	28.2	50.2
			Unsure 0	Agree ^a 1&2	Somewhat AorD 3	Disagree ^a 4&5
#I do not identify with the people in this neighbourhood	4	3.38 1.5	11.6	4.5	23.9	60.0
#I have little in common with other people in this neighbourhood	3	3.01 1.55	16.6	6.1	28.6	48.6
#I would willingly live in another neighbourhood	3	2.91 1.7	17.0	16.1	23.9	43.0
#I have a different life-style to most other people in this neighbourhood	3	2.65 1.6	20.0	15.5	26.6	38.0

†Statements adapted from Bonaiuto, Fornara, & Bonnes (2003)
Items reverse coded prior to analysis
^a Responses for *strongly disagree/disagree* and *strongly agree/agree* were merged for analysis

The level of strong positive response noted in the green space quality scale was not as evident here. While the majority of respondents agreed that living in their neighbourhood was important (79%) and they felt like they belonged (71%), other statements generated less positive response. In particular, negatively framed statements regarding having little in common with others, having a different lifestyle, or willingly living in another neighbourhood generated disagreement from less than half of the respondents (49%, 38% and 43% respectively). All of the negatively framed statements generated substantial levels of *unsure* (11-20%) and *somewhat agree/disagree* (24-29%) responses.

Results of cross-tabulations indicated there were some significant differences ($p \leq 0.05$) associated with age, income and neighbourhood. When responses were split by age, older respondents were more likely to agree that living in their neighbourhood was important, it was perfect for them and it would be hard to leave. Cross-tabulation by neighbourhood location indicated that respondents in Subiaco and Subiaco Centro (the neighbourhoods with the highest weekly household income) were most attached to living in their neighbourhood. Respondents in Ashby reported the least positive responses.

Favourite areas

Identifying a favourite area in the neighbourhood is often associated with place attachment (Henwood & Pidgeon, 2001). As well as being asked about proximity and the quality of green spaces near their home, survey respondents were asked if they had a favourite area of public green space in their neighbourhood. Most respondents (75%) indicated they did have a favourite area (Table 6.4). Cross-tabulation by neighbourhood location identified significant differences ($p=0.000$) between proportion of *Yes* responses in Ashby (57%) and all other neighbourhoods (71-85%).

Table 6.4: Identification of favourite area of public green space in neighbourhood (overall and % by neighbourhood) with results of cross-tabulation and chi-square testing by neighbourhood

Identify favourite area ($p=0.000$) ‡	Overall n=440	%	Subiaco % (n=144)	Wanneroo % (n=114)	Ashby % (n=100)	Subiaco Centro % (n=82)
Yes	330	75.0	81.9	85.1	57.0	70.7
No	110	25.0	18.1	14.9	43.0	29.3

‡ Chi-square result from cross-tabulation analysis by neighbourhood location

Respondents who selected *Yes* were asked to describe the type of place and three examples of green space descriptions were provided in the survey questionnaire (patch of bush, quiet park with old trees, and footy oval). These were included to encourage description of the type of favourite area, rather than asking people to name a specific place. This technique was partially successful in that most respondents provided a description rather than a place name. However, a number of respondents (approximately 10%) used one of the descriptors provided – particularly “quiet park with old trees” or a slight variation. In addition, one in four Subiaco respondents simply wrote “Kings Park” making it difficult to know if they were referring to its bushland

areas or its lawns and botanical gardens. To further complicate any attempts to quantify these responses, several respondents described more than one type of area.

In order to assess what types of places people most favoured, descriptions were collated according to similarity. The resultant qualitative analysis found that the types of areas most favoured by respondents were described as bushland or other natural areas that provided views of water, and parks and grassed areas with old or large trees. To a lesser extent, areas that provided areas for children to play and for other recreational pursuits such as walking and cycling were described. This finding is supported by earlier studies where open forest and parkland were consistently rated as the most attractive and preferred landscapes (Kaplan & Kaplan, 1995).

Visiting nearby green spaces

One further question asked survey respondents to specify how often they usually visited nearby green spaces. Previous research demonstrated that the majority of park users travel by foot and proximity plays a major role in the rate of visitation (English Nature, 2003; Giles-Corti *et al.*, 2005). A distance of approximately 500 metres from home that could be walked in no more than five to ten minutes was regarded as the ideal range (Coles & Bussey, 2000).

Table 6.5: How often people usually visited nearby green space (overall and by neighbourhood)

Visit nearby green space ($\chi^2=0.012$) ‡	Overall n=440	%	Subiaco % (n=144)	Wanneroo % (n=114)	Ashby % (n=100)	Subiaco Centro % (n=82)
More than once a week	250	56.9	63.2	61.1	42.0	58.5
More than once a fortnight	76	17.3	17.4	15.9	21.0	14.6
More than once a month	46	10.5	7.6	11.5	18.0	4.9
Less than once a month	67	15.3	11.8	11.5	19.0	22.0

‡ Chi-square result from cross-tabulation analysis by neighbourhood location

More than half of respondents (57%) usually visited nearby green space more than once a week (Table 6.5). A further 28 per cent visited at least once a month. Nearby green space was not regularly visited (several times a year or less) by the remaining 15 per cent of respondents. Cross-tabulation by neighbourhood location identified significant differences in visitation rate ($p=0.012$), particularly between Ashby respondents and those in all other neighbourhoods.

Principal component analysis

Principal component analysis (PCA) reduced the number of variables in each index (proximity/diversity, green space quality and neighbourhood attachment) to a smaller number of factors (based on principal components) that could be used for further analysis. As in the previous chapter, these factors (transformed variables) were used to explore correlations and analyses of variance. Relevant PCA results are presented in the Tables 6.6-6.8 with further results included in Appendix 6.3-6.5.

Proximity and diversity of green space

Analysis of proximity to different areas of neighbourhood green space (Table 6.6) resulted in the identification of three groupings of green space type explaining 63 per cent of total variance. These factors comprised: (1) areas with trees and connective green spaces (private gardens with trees, bushland, sport and recreation facilities, and green corridors); (2) peri-urban green space (market gardens and bushland); and (3) parks and social green spaces (parks and gardens and play/social spaces).

Frequencies of response reported for proximity to different types of green space (Table 6.1), indicated there were parallels between the pattern of response and factor groupings. Association between proximity to parks (parks and gardens) and to social green spaces (play/social spaces) was strong and these areas were commonly reported as being within 500 metres of home (>80% of respondents). Proximity to connective or large spaces with trees such as bushland, sports fields, green streetscapes and private yards with large trees was reported by fewer respondents, particularly those in new neighbourhoods. Within the factor analysis pattern matrix (Table 6.6), a negative relationship was evident between these two factors, indicating that where respondents reported the highest level of proximity to parks and social green spaces, they were less likely to report proximity to areas with trees and connective green spaces.

In the second factor identified by PCA, two items (proximity to market gardens and bushland) generated significant loadings (≥ 0.4). Proximity to peri-urban type green space (market gardens, farms or other vacant land) was not commonly reported, except in Ashby where 64 per cent of respondents lived near a market garden (Table 6.1). While this factor accounted for 18 per cent of explained variance within the model, this

variance was strongly influenced by the response rate from people living in Ashby. It was excluded from further analysis.

Table 6.6: Principal component analysis (PCA) of proximity to different types of neighbourhood green space

Proximity to different types of neighbourhood green space (within 500m of home)		Factor loading		
Pattern Matrix		1	2	3
1	Private yards with large trees	.794		
	Bushland	.599	.522	
	Sport & recreation facilities	.551		
	Green corridors	.534		
2	Market gardens, farm, vacant land		.879	
3	Parks and gardens			-.816
	Play and social space			-.729
<i>Eigen value</i>		2.061	1.240	1.079
<i>Explained variance (%)</i>		29.4	17.7	15.4
<i>Total explained variance (%)</i>			62.6	
Extraction Method: Principal Component Analysis (PCA)				
Rotation Method: Oblimin with Kaiser Normalization – rotation converged in 16 iterations				
KMO (0.622) and Bartlett's Test (p=0.000)				
Note: Only factor loadings 0.4 and above are displayed				

Perceptions of green space quality

Principal component analysis of perceptions of green space quality statements (Table 6.7) resulted in identification of three factors explaining 60 per cent of total variance. These factors comprised: (1) retention of green spaces and bushland (green areas [not] disappearing, enough bushland, do [not] have to travel out of neighbourhood to go to bushland area); (2) useability (good condition, well-equipped for visiting, places to relax and meet others); and (3) not having enough public green space (no places for free play, not open to the public, areas too small). Within the second and third factors were grouped, not only by theme, but also according to whether statements were positively or negatively worded.

Within the factor analysis pattern matrix (Table 6.7), a negative relationship was evident between the first two factors (retention of green spaces and useability) and the third factor (not enough public green space) indicating that where respondents perceived that green spaces were useable and bushland was being retained, they were less likely to report that their neighbourhood did not have enough space.

Table 6.7: Principal component analysis (PCA) of green space quality items

Perceptions of green space quality Pattern Matrix		Factor loading		
		1	2	3
1	#Many areas of green space in this neighbourhood are disappearing	.845		
	There is enough bushland in this neighbourhood	.828		
	#Going to an area of bushland means travelling outside of this neighbourhood	.480		
2	Areas of green space in this neighbourhood are in good condition		.847	
	There are areas of green space in this neighbourhood where I can go to relax		.752	
	Areas of public green space in this neighbourhood are well-equipped for visiting (good access points, pathways)		.701	
	There is at least one park in this neighbourhood where people can meet		.560	
3	#There are not enough areas of green space in this neighbourhood where children can play freely			-.812
	#Many areas of green space in this neighbourhood are private or closed to the public			-.762
	#Areas of green space in this neighbourhood are too small			-.567
<i>Eigen value</i>		3.482	1.523	1.006
<i>Explained variance (%)</i>		34.8	15.2	10.1
<i>Total explained variance (%)</i>			60.1	
Extraction Method: Principal Component Analysis (PCA)				
Rotation Method: Oblimin with Kaiser Normalization – rotation converged in 9 iterations				
KMO (0.808) and Bartlett's Test ($p=0.000$)				
Note: Only factor loadings 0.4 and above are displayed				
# Items reverse coded				

Neighbourhood attachment

Analysis of neighbourhood attachment statements (Table 6.8) resulted in the identification of two principal components explaining 64 per cent of total variance. These factors comprised: (1) feelings of belonging (hard to leave, perfect neighbourhood, important to live in this neighbourhood, would not willingly live elsewhere and feeling of belonging); and (2) identifying with others (having similar lifestyle, having much in common and identifying with people in the neighbourhood). As with the previous index, statements in each factor tended to be grouped by theme and according to whether they were positively or negatively worded.

Table 6.8: Principal component analysis (PCA) of neighbourhood attachment items

Neighbourhood attachment Pattern Matrix		Factor loading	
		1	2
1	It would be very hard for me to leave this neighbourhood	.842	
	This is the perfect neighbourhood for me to live in	.811	
	Living in this neighbourhood is important to me	.780	
	#I would willingly live in another neighbourhood	.737	
	I feel like I belong in this neighbourhood	.727	
2	#I have a different life-style to most other people in this neighbourhood		.820
	#I have little in common with other people in this neighbourhood		.814
	#I do not identify with the people in this neighbourhood		.619
<i>Eigen value</i>		3.772	1.361
<i>Explained variance (%)</i>		47.1	17.0
<i>Total explained variance (%)</i>		64.1	
Extraction Method: Principal Component Analysis (PCA)			
Rotation Method: Oblimin with Kaiser Normalization – rotation converged in 4 iterations			
KMO (0.839) and Bartlett’s Test (<i>p</i> =0.000)			
Note: Only factor loadings 0.4 and above are displayed			
# Items reverse coded			

Unlike the attitudes to natural environments factors identified in the previous chapter, few problems were noted with interpretation or stability of factor analysis results and all identified factors, (excluding one proximity/diversity factor discussed earlier) were retained for further analysis. Transformed variables representing diversity of neighbourhood green space, perceptions of green space quality and neighbourhood attachment are presented in Table 6.9. Transformed variables relating to attitudes to natural environments (identified in the previous chapter) were also incorporated into the next stages of analysis.

Correlation analysis

Correlation analysis was used to explore the strength of relationships between all transformed variables representing proximity and diversity, green space quality, neighbourhood attachment and attitudes to natural environments (Table 6.9). Full results are included as Appendix 6.6.

Table 6.9: Description of transformed variables for proximity/diversity of neighbourhood green space, perceptions of green space quality, neighbourhood attachment and attitudes to natural environments

Proximity to different types of neighbourhood green space (within 500 metres of home)	
ProxTV1	Trees and connective green spaces (private gardens with trees, bushland, sport and recreation facilities and green corridors)
ProxTV3	Parks and social spaces (parks and gardens and play/social spaces)
Perceptions of green space quality	
GSQ TV1	Retention of green spaces and bushland (green areas [not] disappearing, enough bushland, do [not] have to travel out of neighbourhood to go to bushland area)
GSQ TV2	Useability (good condition, well-equipped for visiting, places to relax and meet others)
GSQ TV3	Not enough public green space (no places for free play, not open to the public, areas too small)
Neighbourhood attachment	
NA TV1	Feelings of belonging (hard to leave, perfect neighbourhood, important to live in this neighbourhood and would not willingly live elsewhere)
NA TV2	Identify with others (having similar lifestyle and much in common)
Attitudes to natural environments (from Chapter 5)	
EcoTV1	Positive emotion (enjoyment, happiness, stress relief, comfort) from spending time in nature)
EcoTV2	Feel sad to see natural areas destroyed (sad when natural environments destroyed and forests cleared, development destroys natural areas)
CareTV1	Care about environmental issues

The PCA pattern matrices indicated how correlations might occur within factor sets (such as already seen between attitudes to natural environments factors). As expected, a small negative relationship was noted between proximity to trees and connective/ green spaces (ProxTV1) and parks/social green spaces (ProxTV2). Within green space quality factors, a medium strength negative relationship was noted between retention of green spaces and bushland (GSQ TV1) and not having enough space (GSQ TV3), with a smaller negative relationship between green space useability (GSQ TV2) and having enough space. A small positive relationship was noted between neighbourhood attachment factors of feelings of belonging (NA TV1) and identifying with others (NA TV2). Outside of the factors sets, medium strength correlations were evident between: (a) proximity to trees and connective green spaces (ProxTV1) and retention of green spaces and bushland (GSQ TV1); and (b) green space useability (GSQ TV2) and feelings of belonging (NA TV1).

Table 6.10: Significant Spearman Rank Order correlations between transformed variables for proximity to neighbourhood green space, perceptions of green space quality, neighbourhood attachment and attitudes to natural environments

	ProxTV1 Trees/green spaces	ProxTV3 Parks/social spaces	GSQ TV1 Retention of green & bushland	GSQ TV2 Useability	GSQ TV3 Not enough space	NA TV1 Belonging	NA TV2 Identify
ProxTV1 Trees and connective green spaces	1.000						
ProxTV3 Parks, gardens and social spaces	-.206**	1.000					
GSQ TV1 Retention of green spaces and bushland	.376**		1.000				
GSQ TV2 Green space useability	.170**	-.269**	.170**	1.000			
GSQ TV3 Not enough public green space	-.154**	.134**	-.417**	-.295**	1.000		
NA TV1 Feelings of belonging in neighbourhood	.185**	-.203**	.146**	.349**	-.143**	1.000	
NA TV2 Identify with others in neighbourhood	.103*	-.147*	.177**	.121*	-.165**	.213*	1.000
EcoTV1 Positive emotion from time in nature	.218**			.232**		.118*	
EcoTV2 Sad to see nature destroyed	.108*						
CareTV1 Care about environmental issues	.182**			.133**	-.120*		
<i>Italicized text</i> denotes negative correlation							
Bold text denotes correlations >0.3							
* Correlation is significant at the 0.05 level (2-tailed)							
** Correlation is significant at the 0.01 level (2-tailed)							

Several other small correlations were noted. As discussed in the previous chapter, it is difficult to determine from the data collected in this study whether these relationships are (more than just statistically) significant or the result of the relatively large sample size, and as such should be treated with caution. Several small positive relationships occurred between: (a) gain positive emotion from spending time in nature (EcoTV1) and proximity to trees and connective green spaces (ProxTV1), green space useability (GSQ TV2) and feelings of belonging (NA TV1); (b) green space useability (GSQ TV2) and retention of green spaces and bushland (GSQ TV1); (c) feelings of belonging (NA TV1) and proximity to trees and connective green spaces (ProxTV1) and retention of green spaces and bushland (GSQ TV1); and (d) care about environmental issues (CareTV1) and proximity to trees and connective green spaces (ProxTV1), and green space useability (GSQ TV2).

Small negative relationships were evident between: (a) not enough space (GSQ TV3) and proximity to trees and connective green spaces (ProxTV1) and retention of green spaces and bushland (GSQ TV1); (b) feelings of belonging (NA TV1), identify with others (NA TV2) and not having enough space (GSQ TV3); and (c) care about environmental issues (Care TV1) and not having enough space (GSQ TV3).

Despite the relatively weak relationships found here, some of the relationships identified above are explored in the literature. Relationships between spending time in nature, proximity to nearby nature and feeling of neighbourhood attachment have been explored by several authors (Henwood & Pidgeon, 2001; Kaplan *et al.*, 2007; Kaplan & Kaplan, 1995; Ryan, 2005; Williams & Patterson, 2008). Hinds and Sparks (2008) discuss the role of affective connection and positive engagement in determining positive attitudes to natural environments. In considering current literature and findings from this study, it would seem that proximity to areas of green space with trees, retention of neighbourhood green spaces and bushland, and gaining positive emotional experiences from time spent in nature may be most influential in establishing perception of neighbourhood green space useability, neighbourhood attachment, and care about environmental issues. It also seems that perceptions of not having enough public green space in a neighbourhood are detrimental to developing feelings of attachment and care about environmental issues.

Analysis of variance

Like factors discussed in the previous chapter, transformed variables representing proximity/diversity, quality and neighbourhood attachment were not normally distributed. Again, analysis of variance was carried out using Kruskal-Wallis or Mann-Whitney U testing. Secondary analysis, using Tukey HSD post hoc testing showed where significant variance occurred. Results of relevant Kruskal-Wallis, Mann-Whitney U and post hoc testing are discussed here. Significant results for analysis of variance are presented in Table 6.11, and mean ranking and post hoc testing in Table 6.12. Full results for analysis of variance with mean rankings and post hoc testing by neighbourhood are included as Appendix 6.7.

This analysis was conducting using socio-demographic, home-related, transformed and other variables discussed in Chapter 5 as well as all new transformed variables identified in this chapter (proximity/diversity, green space quality, neighbourhood attachment, identification of favourite area of public green space and how often people visited nearby green space).

Demographic variables had relatively little influence on variance for perception of green space factors. Overall, females recorded higher scores than males in all factors, though no significant difference was noted in results except in assessment of green space useability. Respondents who identified themselves as Australian lived near more parks and social spaces compared to respondents who identified themselves as British or other cultural background. People with higher weekly household income and more educational qualifications were most attached to their neighbourhood.

With regard to home-related variables, some significant differences were noted. Further analysis showed that the pattern of responses to variables such as living arrangement, type of home and size of garden was often linked to neighbourhood location. These results may simply reflect the dominant characteristics of housing and living arrangements found within each neighbourhood.

Table 6.11: Significant variance ($p \leq 0.05$) between proximity to neighbourhood green space, perceptions of green space quality, neighbourhood attachment, attitudes to natural environments and other variables

	ProxTV1 Trees and connective green spaces	ProxTV3 Parks and social spaces	GSQ TV1 Retention of green spaces and bushland	GSQ TV2 Useability	GSQ TV3 Not enough public green space	NA TV1 Feelings of belonging	NA TV2 Identifying with others	EcoTV1 Positive emotion – time in nature	EcoTV2 Sad to see nature destroyed	CareTV1 Care about environmental issues
Asymmetrical significance‡ (p values ≤ 0.05)										
Demographic variables										
Gender (Mann-W U)				0.041				0.000†	0.001†	0.029†
Age						0.010	0.012			
Cultural background		0.001								
Weekly household income	0.025	0.000				0.031	0.000	0.019†	0.000†	
Educational qualifications		0.003		0.027						0.000†
Home-related variables										
Neighbourhood location	0.000	0.000	0.000	0.000	0.003	0.000	0.000	0.005†	0.000†	0.000†
Time lived in neighbourhood	0.000		0.000		0.008	0.000			0.050†	
Living arrangement			0.003				0.000			
Own or rent home (Mann-W U)			0.018		0.002	0.021				
Type of home	0.017	0.012	0.000		0.002		0.050			
Size of garden	0.000	0.000	0.000					0.032†	0.000†	0.030†
Other variables										
Volunteer for conservation activities	0.001							0.000†	0.000†	0.000†
How often visit green space	0.000	0.010	0.006	0.006		0.017		0.006		
Favourite area (Mann-W U)	0.000	0.000	0.033	0.001		0.000	0.008	0.000	0.000	0.010
‡Kruskal-Wallis and Mann Whitney-U test for analysis of variance with chi-square test for asymmetrical significance								†As reported in Table 5.10		

For example, most significant difference occurred between responses from Ashby and all other neighbourhoods. Compared to other neighbourhoods, more families with children lived in Ashby; most owned or were buying their home; and almost all lived in a free-standing house with a small garden. In contrast, 42 per cent of Subiaco Centro respondents lived in apartments with less than 30 per cent having access to their own garden. In established neighbourhoods, there was more diversity in type of home, living arrangements and more green space, perhaps explaining why most variance between established and new neighbourhoods related to aspects of proximity and space.

With regard to green space proximity, diversity and quality, established neighbourhoods (Subiaco and Wanneroo) had more trees and large green spaces and more bushland had been retained. Access to large areas of green space was limited in new neighbourhoods (Ashby and Subiaco Centro), particularly in Ashby. Only one in four Ashby respondents (26%) reported that they lived within 500 metres of any type of public sports areas or physical activity facilities such walk/cycle trails compared to more than three in four (77-89%) respondents in all other neighbourhoods. Apart from the bushland area adjacent to the estate, the largest areas of green space in Ashby were privately owned market gardens.

Respondents from established neighbourhoods also reported the presence of more private gardens with large trees. Only one-third of respondents in new neighbourhoods (33% in Ashby and 35% Subiaco Centro) lived within 500 metres of a private garden with large trees (compared to 81% in Subiaco and 73% in Wanneroo). In terms of having enough space overall, it was again respondents in established neighbourhoods who recorded the most positive scores (green spaces were not too small, were open to the public and there were places where children could play freely).

With regard to other socio-demographic variables, there was a clear split between established and new neighbourhoods with regard to time lived in their current home, which in turn was positively associated with age. Wanneroo respondents had lived in their neighbourhood longest and tended to be older with one in two (50%) aged over 55 years, compared with 37 per cent in Subiaco, 23 per cent in Ashby and 46 per cent in Subiaco Centro.

Table 6.12: Mean ranking by neighbourhood location of transformed variable scores for proximity and perceptions of green space, neighbourhood attachment and other green space-related variables (with results of χ^2 and post-hoc testing)

	(<i>p</i> value)	Subiaco	Wanneroo	Ashby	Subiaco Centro
Mean rankings† and significant post hoc relationships‡					
Proximity to different types of neighbourhood green space					
ProxTV1 – Trees and connective green spaces	0.000	2 >Ashby >Subiaco Centro	1 >Ashby >Subiaco Centro	4 <Subiaco <Wanneroo	3 <Subiaco <Wanneroo
ProxTV3 – Parks and social green spaces⌘	0.000	2 <Subiaco Centro	3 <Subiaco Centro	4 <Subiaco Centro	1 >Subiaco >Wanneroo >Ashby
Perceptions of green space quality					
GSQ TV1 – Retention of green spaces and bushland	0.000	1 >Ashby >Subiaco Centro	2 >Ashby >Subiaco Centro	3 <Subiaco <Wanneroo >Subiaco Centro	4 <Subiaco <Wanneroo <Ashby
GSQ TV2 – Green space useability	0.000	2 >Wanneroo >Ashby	3 <Subiaco <Subiaco Centro	4 <Subiaco <Subiaco Centro	1 >Wanneroo >Ashby
GSQ TV3 – Enough public green space⌘	0.000	1 >Ashby >Subiaco Centro	2	4 <Subiaco	3 <Subiaco
Neighbourhood attachment					
NA TV1 – Feelings of belonging	0.000	1 >Wanneroo >Ashby	3 <Subiaco	4 <Subiaco <Subiaco Centro	2 >Ashby
NA TV2 – Identifying with others	0.000	1 >Wanneroo >Ashby	4 <Subiaco	3 <Subiaco	2
Favourite area nearby	0.000	2 >Ashby	1 >Ashby	4 <Subiaco <Wanneroo	3
How often visit green space	0.006	1 >Ashby	2	4 <Subiaco	3
Mean rank‡ of demographic and attitudes to natural environment variables (from Table 5.11, p. 115)					
Age (oldest to youngest)	0.000	3	1	4	2
Weekly household income (highest to lowest)	0.000	2	4	3	1
Educational qualifications (highest to lowest)	0.000	1	4	3	2
Time lived in neighbourhood (longest to shortest)	0.000	2	1	4	3
EcoTV1 – Positive emotion from spending time in nature	0.005	2	1	4	3
EcoTV2 - Sad to see nature destroyed	0.000	2	1	3	4
CareTV1 - Care about environmental issues	0.000	1	2	4	3
Volunteer for conservation activities	0.012	2	1	4	3
†Kruskal-Wallis or Mann Whitney-U test for mean rank with χ^2 test for asymmetrical significance of variance					
‡Tukey post hoc testing of ANOVA with mean difference significant at $p \leq 0.05$ level					
⌘ Takes PCA negative correlation in into account and ranking reversed					

Significant differences were noted between perceptions of quality of green space reported by respondents in inner and by those in outer suburban neighbourhoods. Inner suburban respondents reported more proximity to parks and social spaces and scored significantly higher for green space useability – perhaps indicating that more emphasis had been placed on green space design and function in those neighbourhoods. This supports previous research conducted in Melbourne, where residents of areas with higher socio-economic status reported nearby green spaces incorporated more amenities (such as picnic tables and drinking fountains), contained design elements such as water features, paths, lighting and signage, and were more likely to have trees for shade than public parks in less affluent neighbourhoods (Crawford *et al.*, 2008).

Inner suburban respondents also recorded higher mean ranked scores in relation to neighbourhood attachment factors, particularly feelings of belonging. Issue relating to income and ability to choose preferred neighbourhood environment may play a role here. Subiaco and Subiaco Centro respondents were the most positive about living in their neighbourhoods and were significantly better placed in terms of overall income and educational qualifications.

It is also suggested that temporal experience (time lived in the neighbourhood and amount of time spent in the neighbourhood on a daily basis) is a primary determinant of neighbourhood attachment (Bonaiuto *et al.*, 1999; Bonaiuto *et al.*, 2003). As such, it was expected that Ashby respondents would score lower than respondents in other neighbourhoods as only one respondent had lived in this neighbourhood for more than five years. In addition, there are limited local services and very few local employment opportunities which may directly effect on the amount of time people spent in their neighbourhood.

However, if a temporal experience is determinant of neighbourhood attachment, then Wanneroo respondents would be expected to have recorded more positive responses than observed. As already noted, unlike inner suburban neighbourhoods where neighbourhood attachment was highest, socio-economic status in Wanneroo was relatively low and this may play a significant role in determining feelings of attachment.

Apart from neighbourhood location, responses from those respondents who were able to identify a favourite area of public green space nearby and those who visited green spaces most often, also generated significant variance. Respondents who identified a favourite area of public green space in their neighbourhood were mostly from established neighbourhoods and scored consistently higher across almost all green-space related variables. Likewise, more respondents from established neighbourhoods regularly visited nearby green space (>once per week) and also recorded consistently higher mean ranked scores across factors relating to proximity/diversity and green space quality.

In the case of Ashby, there was strong indication that identifying a favourite place might play a role in perceptions of neighbourhood green space. In this neighbourhood, fewer respondents (57%) identified a favourite of public green space compared to more than 70 per cent of respondents in all other neighbourhoods (Table 6.4). Likewise, fewer Ashby respondents (42%) visited green areas more than once per week compared to all other neighbourhoods (59% in Subiaco Centro, 61% in Wanneroo, and 63% in Subiaco) (Table 6.5). Ashby respondents recorded lower mean rankings for almost all factors related to proximity/diversity, green space quality and neighbourhood attachment (Table 6.12). When results from the previous chapter were considered, having a favourite place and how often people visited green spaces positively influenced mean ranked scores for attitudes to natural environment, particularly factors relating to ecocentrism and care. Again, Ashby respondents recorded consistently lower mean rankings for ecocentrism and care.

From these results it could be surmised that respondents who lived in an established neighbourhood were more likely to live in closer proximity to areas with trees and connective green space, feel there is enough green space within the neighbourhood, identify having a favourite place nearby, visit green areas more often, gain pleasure from spending time in nature and are more likely to care about environmental issues. The implications of these findings are discussed later in this chapter, and in future chapters in relation to self-reported health.

Talking about green space in the neighbourhood

In the previous chapters, interviewees' views about their neighbourhood choice and attitude toward natural environments were described. In each interview, people were asked about the presence, and importance attached, to green spaces around their home. The following section explores in more detail their perceptions of neighbourhood green space and other aspects that influence their relationships with public green spaces.

In the first section of this chapter, several key groupings relating to proximity, diversity and quality of green space and neighbourhood attachment were discussed and explored through factor analysis. Within these often overlapping categories, a wider range of themes emerged from the qualitative data and each of the following is discussed in turn. Themes focus on preference and attractive green spaces, access to diverse neighbourhood green spaces, green space and neighbourhood attachment, and green space and neighbourhood design.

Preference and attractive green spaces

Several authors have explored how the organisation of a landscape contributes to individual perceptions of its usefulness and attraction (Kaplan & Kaplan, 1995; Ozguner & Kendle, 2006). Individuals express preference for a variety of landscapes and green space features that meet different needs and several factors play a role in determining individual choice and attachment to particular types of places (Kaplan, 2001, 2004; Kaplan & Kaplan, 1995; Kaplan, Kaplan *et al.*, 1998; Kaplan, 1995). These features are described as coherence (logical placement and order), legibility (accessibility and ease of orientation), complexity (diversity and visual richness), and mystery (concealment and promise encouraging exploration).

Through examining how interviewees described their preferred areas of local green space, differences in perceptions, values, attitudes and preference for either mystery and exploration or safety and security became more apparent. Individual descriptions of preferred areas stretched along a continuum of perceptions of orderliness and human intervention (high level of orderliness or intervention ↔ low level of orderliness or intervention). No matter what their description, the places considered most attractive

matched individual preference for levels of coherence, legibility, complexity and mystery.

Several interviewees voiced strong opinions regarding preferred public green spaces. Michael chose to visit well-maintained “civilised recreational site[s]” and of all the interviewees, was the most vehement in expressing his dislike for Western Australian bushland.

I don't really like Western Australian type bush, it's a bit scrubby for me and I don't know, it's in my genes. ... I don't find Western Australian bush attractive so I wouldn't go and stand under bottlebrushes in the sand ...

Despite Michael's personal preference he acknowledged that it was simply his opinion and that it was important to retain diverse places for all people to enjoy.

Yeah I think it's important to have wildlife type of reserves – like Lake Monger on the other side there where you've got ... bird watching clubs and it's a swampy reedy type of setting. I mean part of it has been left as untouched, as fairly untouched. And then you've got your civilised recreational site over the other side which is your manicured lawns and so on. So, that's actually a pretty perfect sort of set up cause you can feed the ducks on one side and over the other side you can be more secluded.

Others voiced similar views. Eleanor, Sue and Anya all found local bushland hard and unattractive compared to softer, greener vegetation found in their birth countries of New Zealand and Britain. Sue much preferred to walk through the park across from her home.

It took me such a long time to adjust to the Australian bush. I found it very harsh and dry and lots of flies and I didn't find it a great pleasure to walk through, so I prefer the soft greenery and the variety that there is in the park.

Amber, Kathryn, Leanne and Fiona expressed little interest in visiting local bushland areas though they were happy to see them as part of the neighbourhood view. For all of these interviewees, the most attractive spaces were well laid out, managed and maintained with expansive lawns, lots of big trees to sit under and places for people to meet or watch others go by.

Andrew preferred green spaces that provided a mix of features.

I think there needs to be a mix. I mean you don't just want a plot of land that's been left to overgrow with a few tracks through it. I think there needs to be a mixture of native bush land and so forth and some cultivated nice feature area,

botanical areas and things like that which are points of interest. You want a few different sorts of things to break up the space.

There is an important distinction, however, between what might be described as *civilised* and *manicured* or *sanitised* green spaces. Several interviewees preferred their green spaces to appear welcoming, manicured, well-maintained and well-tended. On the other hand, too much intervention resulted in sanitised green spaces were seen as clinical and boring with all risks removed. They held little interest or attraction for most interviewees and Andrew described one of Subiaco Centro's parks as:

... just too clinical. There's not enough little differences, nuances ... I wouldn't go there ... You've got a green space but it's pretty much just green space, it's not really [an interesting] space.

When asked what type of green spaces she preferred, Tash replied that it depended on her purpose. She liked to see well-maintained gardens while she was driving around the neighbourhood and sought bushland areas when she wanted to go for a walk or to relax.

I like both actually. ... I like ... in a residential area, I like it to look tidy and managed I think ... when they sort of build nice little areas with little grassed areas here and garden beds here and there's a little bridge, I really like that look. But having said that ... Neil Hawkins Park – the majority of that is just natural bush land and I would prefer that to go out and relax in. So it depends on what I'm doing, if you're just sort of driving past through a suburb or along a street, I think I like the sort of managed gardens but if I was going for relaxation or to just go walking and stuff, I would probably prefer the more natural bush land. But I think overall to look at, I prefer the sort of managed gardens, yeah.

Descriptions of interviewees' preferences for particular types of green space were often directly linked to why places were visited or viewed. Put simply, interviewees who preferred more natural looking areas were more likely to venture into bushland (perhaps seeking mystery and exploration), whereas those who preferred more maintained (or areas that Michael described as "civilised") green spaces were more likely to visit open, lawn areas with large shade trees and garden beds, perhaps seeking tranquil, ordered surroundings.

Kevin's description of Kings Park was linked to his use of this site and his perception was quite different to other interviewees. He was a keen bushwalker and when asked about whether he walked through the bush areas of Kings Park, he replied:

No I don't know why, it's just I never really thought about it in terms of walking in the bush. No, I've never regarded it as a native bush park actually. ... The parts that I frequent are parts that are turned into modern parks if you like.

Several inner suburban interviewees nominated Kings Park as an example of their preferred type of green space because it provided a mix of bushland and manicured lawns and gardens. Andrew found it attractive, not only for its vegetation, but because there were numerous destination and activity points around the park, enabling constant exploration and discovery.

I think it's that feel of bush land, that feel of bush land in there, it's got some great destination areas like it's got the natural amphitheatre where they have concerts, I've been to a couple of concerts there, that's great, that adds to the vibrancy of the space. It has that little water garden and that children's picnic area ... Yeah, it's got that fantastic view of the city which you can't beat. ... I mean, if you look at all the major parks around the world, they're all pretty similar aren't they, that they've all got ... a couple of destination places, they've got a bit of a natural feel to them ... and there's a lot of vibrancy within them. ... I think it's really critical.

Jess, Mark, Mary, Hans, Matt and Adam professed preference for the look of more natural areas as there was more variety, complexity and choice of paths and experiences. This group held the strongest opinions regarding the intrinsic values of urban bushland and were most likely to venture into unknown areas. Within this group, lack of orderliness and less obvious human intervention influenced which areas people found most appealing. As an example, Adam was comfortable tramping along the sand tracks through the local bush with only his dog for company. He particularly liked the fact that tracks were ill-defined and felt he was free to choose where he walked.

You can walk around it how you want, if you want to go left you can go left, if you want to go straight on, you go straight on, if you want to go around the outside, you can, there's no sort of one big road and that's it around it.

While not wanting to see all areas managed and controlled, Jess acknowledged that some degree of maintenance was necessary to ensure places “can be used and appreciated by people”.

I think it's difficult to keep a wild area unless there are pathways through it because otherwise if people just had to scramble through the bush, they probably wouldn't use it so much and it is perhaps a fire hazard and things. But the fact that Kings Park has got so many pathways through it... people can go safely through those areas and not get lost, well not often. So I suppose maintaining wild also means some sort of maintenance, not just left deserted so that it becomes a hazard. I think if it's left there as a place for recreation it must have simple, simple pathways that people can walk or ride through. That would be my thinking.

Experiencing nature in neighbourhood green spaces

In all neighbourhoods, easy access to green spaces that provided some contact with nature in a range of environments generated the greatest enthusiasm. Apart from activity opportunities (such as walking or cycling), entry into areas of bushland and other natural environments inspired comments about taking people away from the “busyness” of city life and providing a place of relaxation and contemplation.

Andrew felt that neighbourhood green space was highly desirable, especially in neighbourhoods near the city centre. He wanted to be able to experience nature near where he lived.

I think in general ... most people would like a good lush parkland close to their urban environment. I think most people would like that. I couldn't see any reason why people would say no as long as it didn't compromise their other needs. Some people might say well if you want that, you can move out to the country [but] you know, there are some people that ... don't want to move out to the country – like myself. They want to live near a city but they also want to access a bit of privacy and nature in a green space when they can.

Andrew spoke of the importance of areas with bushland as places to escape the urban lifestyle and for people to interact within different spaces. Again he mentioned Kings Park as a place that provided a variety of opportunities for visitors.

Well I think it's a feeling of being away from the urban lifestyle of... this is nice, this is a different environment, I'm away from the hustle and bustle of the city, I can't see any cars, I can't see any roads, can't see any buildings, it's just ... just wanting to be away from it, the space is the main thing. ... From my own personal perception it is somewhere for me to retreat to and have a place to just get away from it.

[In Kings Park] you can go for a walk and you feel like you're not in the city and I mean that's part of having green spaces in urban areas is that you can get away from it. ... I think Kings Park has got it ... it really is the only parkland that I think there is a lot of interaction between the space and the people using it.

Jess regularly walked in Kings Park and described why she liked that particular area so much. Like Andrew, she saw bushland as a place to escape the noise and traffic and perhaps more importantly, a place of restoration with links to the past, present and future.

You only have to walk like a hundred yards in and you can't hear the traffic anymore and then it's just the quietness of the bush. It's amazing how quickly you leave all that behind.

I suppose I find it quite restorative ... it's like the bush is there today and tomorrow and long after I'm gone, and so it's a kind of continuum of the trees that fall and lie on the ground and ... things going on underneath them. ... I think it is the continuum really of the fact that that goes on and it's forever changing slightly in different ways.

Luke enjoyed the seasonal diversity offered by Kings Park. He found the unpredictability of what he might see and experience during each visit to be personally fulfilling.

I think to a degree it's a little bit of uncertainty and I think nothing's ever the same. I mean if you go to Rosalie Park, [it] is the same as I remember it as a young kid and it hasn't changed at all over 20-25 years whereas every week that I go into Kings Park, it's different. I see something different and whether it's different types of flowers or different things sprouting up or different greenery or colour – you know, even dryness and all that sort of stuff, and I think it's just the amazing diversity that you get out of bushland that you probably don't get out of manicured and maintained parks. I think that's sort of nice, I think in a life that can sometimes become quite predictable, it's nice to put yourself in that position where things are different all the time.

Apart from many bushland areas to explore, the diverse public faces of Kings Park with its manicured lawns, botanical gardens, large playgrounds, shaded picnic areas, cafés and restaurants received a great deal of attention from inner suburban interviewees, particularly those interviewees who regularly walked or cycled within its boundaries. It was seen as a significant regional asset and generated several emotive comments, such as this statement from Jack:

You feel free when you get to Kings Park and you walk along that avenue ... and you look out over that river and it's breathtaking still to me. Lovely. It's wonderful.

Other large spaces of inner suburban bushland or wetland were also mentioned. Lake Monger was a little over one kilometre away from Subiaco Centro. It was most often nominated by younger interviewees from this neighbourhood (Anya, Andrew, Brad) as a place where they regularly walked, ran and cycled around the perimeter of the lake. Gordon also visited regularly and explained why he enjoyed walking there more than walking around the neighbourhood.

I think rather than just walking around the streets, it's nice to take a walk around an area that you can enjoy and I mean, it's hard not to enjoy walking around somewhere like Lake Monger. You know you see the wildlife and it's really just a pleasant walk. As opposed to walking around... treading the streets... I think you feel as though you're more energised walking around areas like that.

Several interviewees from Wanneroo and Ashby interviewees were equally enthusiastic about Yellagonga Regional Park, and most specifically the parklands around Lake Joondalup. These areas provided opportunities to walk, cycle, exercise dogs, chat with other local residents and places to picnic and barbeque with family and friends. In Wanneroo, the lake provided wildlife habitat and open space. Its status as a protected area was valued in a neighbourhood experiencing encroachment from nearby commercial and residential development.

In the newer residential developments, local parks were less likely to incorporate areas of bushland or natural features. In Subiaco Centro, one park forms the centrepiece of the western side of the neighbourhood and contains a number of design aspects including a lake, water feature, playground and barbeque facilities – or as described by Brad, “ultra-manicured, engineered-type green space”. Sue lived cross from this park and was much more enthusiastic in her description. She particularly liked the diversity of trees and flowering plants incorporated into its design.

[The park] is particularly lovely because there are the trees and a great variety of trees ... that has been developed with considerable thought and there's a great variety of trees, lovely trees, and there are some fragrant trees, perhaps the magnolias or something over there, gardenias, and there are also some very colourful plants. There are the clivea, the orange one, and azaleas and some camellias, and there's always the lavender...

The other major park on the eastern side of Subiaco Centro did not attract such enthusiastic descriptions. This area had expansive lawns with a few large trees, garden beds, a playground with nearby barbeque area, and a skate ramp. Eleanor enjoyed the fact that her house overlooked this park and saw it as a small part of the sweeping view towards Kings Park from her third storey window. Andrew dismissed it as “pretty much a green really, that's more or less like a lawn than a park”.

This type of description was also commonly used by Ashby interviewees to depict their local parks. Apart from the largest park that retained a number of older trees, most parks in the neighbourhood consisted of an expanse of lawn, newly planted trees and garden beds. Some contained a children's playground and a gazebo with barbeque area. Leanne was most unhappy, particularly with the size and design of parks in her Tapping neighbourhood. She described her local parks as being crowded with children and too

small to walk with the dog. She wanted parks with lawn and trees to sit under – just like the “beautiful parks” in Ashby.

You can't do much in [the parks here]. [The dog] wouldn't be happy running around in that little park, it's too small for him ... That's why we don't go there, he would just run off into the houses or something...[and] it's not inviting enough I guess. There are not enough trees yet, I mean the trees are there, they're little but, I guess in Ashby the parks, they've left a lot of bush trees, they've left the trees where here they have just cleared everything.... You just need a nice lawn to sit on and shady trees to sit under. So we love the Ashby parks, they've got so many over there and they're big.

Amber saw the Ashby parks somewhat differently. She often went to nearby playgrounds (there were three parks with playgrounds within easy walking distance) but also chose to drive to parks where there were more opportunities for her daughter to play with other children.

Usually when I go to the park, particularly if I take her in the middle of the day, there are no other kids there. So I actually quite often drive her to Neil Hawkins Park in Joondalup because there's always children there. Because a lot of mothers [and] mothers' groups ... go there and have picnics ... I quite often take her there because she'll find a little friend and play for hours and I just sit under a tree and relax so I sometimes actually drive her to a different park [where] I know [there are] children because there is often no-one at our parks, and that's not as much fun for her.

Several Ashby interviewees spoke of leaving their neighbourhood to visit areas around Lake Joondalup, with the most popular area (Neil Hawkins Park) located on the eastern side of the lake – at least ten minutes drive away. Amber spoke of why leaving the estate to go to green spaces outside of the neighbourhood was sometimes stressful.

We go out of our little estate and onto a busy road and then drive for miles ... I find outside of the immediate area of our suburb not that nice and quite stressful. It's a busy road, there's accidents, it's sitting in a traffic jam and you can't get anywhere basically without going on Wanneroo Road and ... half the time you go out your front door and then perhaps get onto a yukky stressful area and drive past the stinky chicken factory.

Leanne also spoke about leaving the neighbourhood to find green space that was large enough (and safe enough) for her dog to run. She acknowledged that having access to green space was not something she had considered until she had moved from an older, more established neighbourhood into her new home. She described her Tapping neighbourhood as “block full” of houses, with access to local parks only considered as an “afterthought”. Even so, the lack of green space did not particularly concern her and she felt she had found ways to adapt.

To be honest, we never thought of it when we moved here. It's just something that I've noticed and [my husband]'s noticed as well, that "Gee, we miss parks". ... It was just something that we thought of afterwards, "Yeah, not too many parks around here is there?" ... It's not a big deal, it's just that we notice. ... [And it's] just something that we've adapted to. We just ... walk the streets, we do this big loop around Tapping and we go for a walk, that's all. You know, [there are] busy streets either side so you just get used to it.

Despite the problems associated with dealing with traffic while walking around the neighbourhood or driving to visit green space in other areas, the tract of bushland immediately adjacent to the Ashby estate (and in easy walking distance of all Ashby interviewees) was largely ignored by interviewees and described as an unsafe place to be avoided. There were no formal walking tracks or trails and the lack of easily accessible entry points deterred most people. It was also surrounded by fencing and Sarah described it as looking uncared for, and as a place where it was likely that she, or her children, might encounter people involved in illegal behaviours.

See if something was fenced off like that, I'd be hesitant to let my little kids go in there cause I think people who dump their car bodies in there are still hanging around ... Like I'd just be thinking it's a bit suss ...

Adam was the only interviewee who regularly walked in this area (often with his girlfriend and her dogs) and he stated that he had never met anyone else while walking in there, though he knew from footprints that others used the area. He also acknowledged that the sandy irregular tracks meant that it was not an easy place to walk. People need to be prepared and he was not surprised that few local residents chose to walk there.

You really have to get kitted up to go for a bit of a walk around it, you can't just chuck your thongs on and go for a walk or you'll lose them.

I've never ever seen anyone else in there, no. I either go on my own or there will be two of us and the two dogs so no, we've never come across anyone else walking in there.

It is apparent that for several interviewees, the appeal of neighbourhood green spaces was determined by its ability to provide areas of "useable space". Jack was particularly proud that many green areas within Subiaco were well used by the community.

That is what I'm proud of in Subiaco that they have retained these green spaces. I also go on my little scooter to [Lake Jualbup] down the road here ... – and of course what I like about it is that it's used. It's no good having a nice open space that isn't made use of. But [Lake Jualbup] you've always, even when the kids are at school, you've always got people there walking, jogging, or kids on the swings, using that and that's what it is all about.

In Ashby, several respondents spoke of the difficulty of accessing “useable” space. Amber found walking to nearby parks to be uninspiring and was disappointed there were no larger areas where she could go for a long walk or cycle.

There are quite a lot of little parks nearby which is lovely for the kids but yeah, I would like somewhere where ... if I want to, go for a bike ride or a walk. There's nowhere here. You walk around the houses or you get in your car and drive somewhere ...

There's good footpaths but it's walking past people's houses ... It's not very exciting, it's not relaxing, it's boring. I don't know ... I find it a bit boring walking past houses and... I actually think it translates to being less active because I don't go for a walk here because it's boring.

Amber was happy that sections of local bushland remained but wanted these areas to include walk trails she could use.

I like it where it's usable and where you can actually use it ... although there should be a bit of a balance. I think some sections should be left untouched but in terms of affecting my happiness and my lifestyle, I like something that I can use and go to and whether it's you can go for a walk there because they've built good walk trails... or there's a lake you can walk around. I would rather that than just leaving a lake with bush land around it and you can't even get to the lake. I kind of think what's the point?

Amber named a wetland area in a nearby suburb that exemplified her perception of usable green space.

You can walk all the way around it and where you're walking you don't have to walk right by the bush so you feel safer because you're more exposed,... it's less likely someone's going to jump out at you if you're walking along. And there's a lot of people as well... I mean certainly as a woman and with young children I like to go somewhere where there's a lot of people around so you feel safer. I don't want to go somewhere when I'm the only person there...

Concern about feeling alone or unsafe in bushland areas was also expressed by Chloe and Sarah. Chloe only liked to enter bushland areas with well-marked paths and obvious entry points that confirmed pedestrian access was encouraged. She described a nature reserve about twenty minutes drive from her home where she felt welcome and safe.

Places like Craigie [Open Space] are really good for me because they're very small enclaves of bushland and they're quite well looked after and there are pathways. I think it's the pathways that are the things that attract me, I don't want to just walk through bush.

Feeling safe within bushland and other green spaces was not only mentioned by women. Andrew was not keen to venture onto his favourite running track around Lake Monger

after dark as he was concerned about lack of security and who he might meet along the way. He stated that tracks through inner suburban parkland areas should be well lit at night.

I still run through there but it's not very nice to run through there when it's dark. It's just the safety, that there could be anyone there, that's all. I just think ... tracks and things like that through parklands need to be well lit, especially at night, I just think it's from a security/safety perspective. I like to use it [but] ... it has been a consideration because when we do the run, we go 'oh no it's too dark to go [to Lake Monger] for a run now' and we might go for a run through the city so we'll run around the back streets.

Apart from Andrew's concerns about Lake Monger and lack of lighting, very few inner suburban interviewees expressed any concerns about their safety within the neighbourhood or in local green spaces. Perhaps as was found in inner city neighbourhoods in Chicago, regular use of local green spaces by residents increased feelings of safety and security (Kuo, Bacaicoa *et al.*, 1998). While many of the fears expressed by interviewees in outer suburban neighbourhoods were related to possible interactions with snakes or spiders, there may well be an association between increased use and heightened perceptions of safety and appeal. Amber and Chloe's comments about preferring to visit green spaces with obvious, well-used walking trails, and other interviewees' comments about enjoying interaction with others while in local green spaces, lend credence to the notion that the more often visited by more people, the safer and more appealing an area is perceived to be.

Green space and neighbourhood attachment

Jack was very attached to his neighbourhood and local social network. He talked about the importance on community use of public green spaces within Subiaco.

I walked up to get a paper yesterday through the little park here at the top of the street ... and there were parents and children there on the swings, on the grass, people sitting and reading, there was a little family party obviously for children and adults where they were barbecuing and so on. And I thought, this is what community is about.

Most Subiaco interviewees expressed a great deal of pride in their suburb. Luke saw there was a relationship between how Subiaco looked and how much people cared about that neighbourhood.

I think a lot of people feel an affinity with their suburb no matter where they live, but I feel especially lucky to live in Subiaco where there's a sense of pride and a

sense of care about how the suburb looks and feels ... and everybody's quite proud.

Jess spoke of how she felt about living in an attractive, friendly and nurtured suburb.

I've got a garden and I've got space around me and it's my own little area, I suppose. So although the house is small ... I like the house and I like the street that I live in with big street trees, I like living close to Kings Park, I like my proximity to things. So an inner city suburb in this sense pleases me but also because Subiaco has a special feel I suppose ... where it has quite a lot of older houses and a lot of people have done things to their houses and somehow it feels a very family friendly and rather nurtured suburb. And I would hate to leave (laughs) they will carry me out!

A feeling of having space around the neighbourhood was valued by several interviewees, particularly those in established neighbourhoods. When Hans was asked what was best about his Wanneroo neighbourhood, he replied:

The open space. The houses are not like a chessboard ... and this is probably the quietest suburb I ever lived ... I love it here, you know, I've got birds, I can hear kookaburras and I've got Tweetie every morning at five o'clock... Tweetie is my pet bird somewhere, I never seen it, it goes 'be-be-bip, be-be-bip' every morning alright, and this is how I like to wake up.

Toni gave a similar response to the same question.

It's green. It's what you can see. Look around you, there's palms, over here is a jacaranda and at the right time of year ... you sit over there and all you can see is this purple mass. It's beautiful. You look around and ... we get ducks come for the pond, we get all the birds coming in ... it's green and it's not cluttered and it's not shoved together, and you can breathe. You know, you're not looking at a sea of roofs, you're looking at trees and that's why we like it.

Most interviewees in established neighbourhoods expressed feelings of being lucky and very fortunate to live where they did. Several interviewees felt green space was an integral part of neighbourhood character and heritage. Jack spoke emotively of the joy and pride he felt about living in Subiaco.

I can see a view here say across the river or to Kings Park ... and feel a whole mixture of things. I certainly have an uplifting feeling, a feeling of elation, of pride because we've retained it, of thankfulness that I live here.

Tash appreciated having easy access to a variety of green spaces in her Wanneroo neighbourhood.

I think the area that I live in Wanneroo here with the lake down there is... I think it's really special and I think we're really lucky to have it, so even though ... I don't go out bushwalking every other day or anything – I do really enjoy getting out in nature and enjoying what nice greenery we do have.

I often go over to Neil Hawkins Park and I often think how lucky we are to have this lake, Lake Joondalup and Neil Hawkins Park and the reserve over this side of lake. I do often think about how lucky we are to have that near us.

Not everybody expressed enthusiasm for neighbourhood green space. William and Charlie preferred their own space – their private gardens – and had little interest in local green areas except for places to hold family picnics. Through their family farming and other work-related interests, both were involved in changing the local landscape to establish market gardens. Both expressed regret that the early market gardeners had cleared so much of the local bushland, and that now, more was being cleared through development. Charlie particularly missed having large areas of bushland around his home as he could no longer go bird shooting. Both Charlie and William were very attached to their homes, particularly their private gardens and these areas played a major role in cementing their attachment to their neighbourhood.

Amber offered a somewhat different point of view. She was particularly concerned that her neighbourhood offered few opportunities for walking or to meet other people.

[I like to know] that I've got somewhere to go, that even if it is walking ... down to the café and get a cappuccino and walking home again, I actually would love to be able to do that again. ... Because I think sometimes when you're home with children it's a bit isolating and boring and it's nice to have somewhere to go whereas here all I can do is get in the car and go to the shops and I'm sick of the shopping centres.

In the other new neighbourhood of Subiaco Centro, lack of opportunity was not a factor in determining perceptions of neighbourhood attachment. Access to a range of services including local shopping, cafes, convenient public transport and a variety of public green spaces within relative proximity contributed to interviewees' satisfaction with their neighbourhood. Unlike Amber, Subiaco Centro interviewees were able to walk around their neighbourhood and several felt this contributed to a sense of belonging and interaction with others. Sue commented that despite the close proximity of the houses, it was a quiet, friendly neighbourhood and an easy place to live.

Surprisingly quiet because the houses are so close together ... The neighbours are friendly, very pleasant, very friendly but we're not in and out of each other's houses but on a nice chat basis. ... It's just very easy to live in, very easy reach of everything that we want, can even walk to the gym.

Kevin walked every day and felt very comfortable moving around the neighbourhood. He stated that the trees included in streetscapes and pockets of green space contributed

to his enjoyment of the neighbourhood. He had little private green space within his own home and liked the fact that trees throughout the neighbourhood softened the built environment. Without these features, he felt he might probably choose to live elsewhere.

I guess if there was no streetscape at all and we just had pavement, it would be a lot less attractive to us to live here, and we would probably look elsewhere, I don't know. I walk basically down here to Centro Square ... and then past Mueller Park and all those other parks ... so there is a lot of vegetation along there ... and I cross over to Hay Street [where] there are trees but it's predominantly shops. [With the trees] I guess it's a softening of the harshness of buildings and things like that. ... It's just ... something you treasure I guess – and particularly if you haven't got significant greenery in your own back garden. I mean we've got a lot of green [plants] in [the courtyard] but we haven't got trees and lawn and stuff like that which you would normally have in a conventional garden and house.

For younger interviewees in Subiaco Centro (Andrew, Brad and Anya), convenience and access to the city and nearby green areas were major factors in their choice of neighbourhood. Anya felt there a strong sense of community within Subiaco Centro.

It's very central, it's near to the vegetable market, it's near to the train station, that's all really. There is a feeling of community there. [One] of the best things really, it's about the proximity to the city because I like living in the hub of things. ... It's a feeling like you're close to things that are happening in Perth.

Despite enjoying living there, Anya did not plan to stay. She wanted to start a family and did not see this neighbourhood as a place to raise her children. She was building a new home in the established suburb of Mt Hawthorn, a little further away from the city. Anya described why she and her husband had made the decision to move out of Subiaco Centro.

Because I want some space (laughs). Mt Hawthorn is a much more leafy district and ... there's one strip of shops but there's a lot more housing, therefore you can see people's gardens and trees and you know, there's a feeling of more green around you. ... We are hoping to start a family so I want some space to have children and let them run and I think that's really important. I think children who are kept in apartments, it affects their sociability and their socialisation. I think that it is important that they are able to be let out and do child things like play... It's about private space partly but also it's that part that's really hard to describe, it's that feeling of being in a nice place (laughs).

Green space and neighbourhood design

Issues relating to neighbourhood design and changing neighbourhood landscapes were discussed by a number of interviewees. The small size of gardens in new

neighbourhoods and the difficulties associated with new growing trees, and the removal of old trees from established neighbourhoods, generated a great deal of comment from some interviewees. Hall (2007, p. 7) found lack of private garden space and tree coverage visibly differentiated older and newer neighbourhoods and noted what he described as “the disjunction between space and time” where, unlike older neighbourhoods, there was little evidence of gradual change over time. Homogeneity of design is clearly evident and this uniformity is being cited as one of the major detriments of contemporary urban planning (Beatley, 2004).

In both Subiaco Centro and Ashby, the disjunction between space and time identified by Hall (2007) is visible. Residential development in these neighbourhoods began with an essentially blank slate – the demolished industrial sites in Subiaco Centro and the cleared market gardens and bushland in Ashby. As such, designed green space in the form of parks and streetscapes was a key feature of the new neighbourhoods and made a strong contribution to their aesthetic appeal. At the time the interviews were conducted, the first stage of development in Subiaco Centro was more than five years old, and building of the second phase (to the west of the original development) was well underway. A green streetscape was incorporated in each stage of the development and this now meant that many of the longer-planted trees were beginning to mature. Brad observed:

It's looking more established. It's sort of gone from that “we've just finished the development and put in a heap of semi-mature trees” to the “they're now actually growing of their own volition” and ...taking their own shape ...

Others also recognised that street and park trees needed to grow before they reached their full design potential. Eleanor was very happy with the design of the green spaces near her home and that a process of maturation would occur over time.

I'm very happy with it, I mean these trees will grow eventually and I know it's a whole new area so it's going to take time for things to grow and mature, but I'm very happy with it just the way it is.

Sue's front window looked out over the park and towards the second stage of development. She described that area as devoid of “nature” and was particularly concerned that the trees and green spaces that characterised her part of the neighbourhood were not being as well incorporated into the new stage of development. Like Kevin, she felt that with few Subiaco Centro homes containing large private

gardens, public green space was very important to maintaining neighbourhood ambience.

The new houses up on the hill – they're huge, they're filling the whole block and are very high – and there's no nature in those streets, they haven't got a front garden, there are no street trees, there's just no nature and I think that's what is important around here. ... I'd say that none of the gardens have big areas to look after and so the trees on the nature strip and the hedges [are needed to give] softness and warmth and a good feeling to the place.

In addition, there was considerable concern expressed about the loss of an area of lawn that once grew between the railway station and the main road. This area was developed for a restaurant complex and although it was known that it would be developed at some stage, the community fought to have it retained as open space. Almost all of the Subiaco Centro interviewees spoke of being concerned by its loss and how this small green area gave an impression of space as people entered the neighbourhood. Anya spoke of why this area had been important to her and why she felt it was sad that all that was left was a little patch of grass near the train station.

Well because that was really used by everyone daily. ... This piece of land was something you could walk out in your lunch hour and go and sit [when] I wanted to go and get some contact with nature ... you go up and sit and eat your lunch on the grass and you feel sort of refreshed from it and then you can move on. I mean it's quite sad ... If I'm eating my sandwich or something at the weekend, I will go and sit on this one little green patch left now by the station in front of the shops, a little hump, and quite often there's like five or six people just sitting on that one little patch. It's got one tree in it I think and a little patch of green ... [and I think] why sit there, why not sit on the benches and the concrete you know, but people prefer to go and sit on grass.

The impression of openness provided by green space was also noted in Ashby. Amber, Adam, Sarah and Kathryn all bought in their neighbourhood because they preferred how it looked compared to similar-priced estates. Seeing street trees along the two main entry roads, a number of neighbourhood parks, and proximity to bushland, market gardens and vineyards, substantially added to their initial attraction to the Ashby estate.

Adam talked about his first impressions of the Ashby estate as being very positive. He had not experienced this response in many other estates he had visited.

I just like it a lot more. I like the way it's on a hill so I like the natural aspect to the land, the lay of the land, I like being down here... and ... they've positioned blocks so if there are parks, most of the houses look out onto the park instead of looking away from it. I just think ... this was a lot nicer, it seemed that wherever you went there was a park in here when you were driving around ... I don't know,

maybe it's just the area [of the estate] that I'm in and [I'm] fortunate to have quite a few parks nearby but a lot of the other places I looked at it was one big park and that was really it, or there would be none at all.

Kathryn had also chosen to buy into the Ashby estate because the location of their block meant they had a view of the lake. When the house was completed, however, mandatory fencing height and style within the estate meant that her view was obstructed.

Once the fences [went] up, you lose your view. So we did actually ... ask if we could go down in the corner, if we could bring it down so we could still get the view, but we weren't allowed to because we [would be] impinging other people's properties so ... The council wouldn't let us do it because people behind us, you could see into their property so... So yeah, that was disappointing but at least ... we sit out the front and look at the view anyway ... We sit out there of a Sunday night or a Saturday and have a glass of wine and watch the sun go down, which is really nice.

Apart from mandatory fencing, front of house landscaping was also provided as part of the Ashby purchase agreement and each resident was required to complete their front garden within a specified time. Most front yards were of similar design and included the same types of plants. Kathryn liked the fact that everybody's front garden was planted as she felt this kept the suburb "tidy" and made it look "finished".

Amber also described her initial impression of the estate as more attractive than other estates she had visited. She particularly liked the trees and landscaping at the entry to the estate.

One of the reasons why we chose [to buy in this estate], it's got a nice entry whereas some of the others didn't ... well it did have more trees and ... appeared nicer when we were looking at the land ... and actually chose this one because it had more parks and greener, more trees and ... we actually decided it looks a bit nicer, it had the nice tree-lined street when you came in...

Not long after Amber moved into her home, the small park that was part of the estate entry area was cleared for more housing and a limestone fence built across the front of the estate. Amber expressed her disappointment that one of the attractive aspects of entering the estate no longer existed.

Oh it was beautiful, it used to have a lovely thing that said The Grove Estate and it was all landscaped and like an entry to the estate. But that was only temporary [and now it's] houses backing onto Wanneroo Road. ... There were little signs on the turf saying 'temporary landscaping only' so we did know the turf was going to go and stuff but we thought they would still leave the estate entry and the landscaping, and they would just have the houses on the turfed section. ... We

thought they would keep the nice entry to the estate but it's all gone and they've put a road and everything.

In addition to the entry landscaping being cleared, the bushland area to the north of the estate was also cleared for more residential development. William had lived in the area for many years and his home was one of the few that had retained a garden with several large trees. He was particularly unhappy about the way that all of the trees and large tracts of bushland had been cleared and thought more should have been retained. He described feeling like his home was being invaded as more and more of the surrounding area was cleared.

It all got bulldozed and the machines were working ... day in day out they cleared ... everyone was going mad, why clear all those trees, you know, like here there are only one or two, I mean, they shouldn't be allowed, you know. ... So I think I would accept like ten per cent of your natural land be left bush, untouched, you're not allowed to clear it, you're not allowed to touch I ...

When the bulldozers came next door I got depressed ... But then I thought it's not our land to complain but we felt we'd been invaded because we were on a dead-end street.

Others found Ashby and similar new suburbs to be unattractive. Matt remarked:

I don't know sort of why but we like the older suburbs where there is a bit of space and greenery around because we always look at the new suburbs and go, 'nah, couldn't live there'.

Mary felt that Ashby was too neat and she did not like its uniform appearance. She described her surrounding neighbourhood, with large trees and residents' casual attitude to gardening.

There are some nice little corners where they have got a lot of trees. [There are a] lot of people not bothering about their gardens which you know, people say, 'Wanneroo is scruffy' but I don't really mind. I would rather have that than neat!

In Subiaco, most concern focused not as much on the general appearance of the neighbourhood, but the disappearance of established gardens and trees. Demolition of old houses and rebuilding of larger homes and contemporary gardens with few (if any) trees was particularly concerning. Mark said:

I don't like to see wall-to-wall bricks or huge houses filling the blocks. I like to see trees, yes, even like roses, but everything in its place. But I do like to think that people are thinking about their relationship with the environment here ... There should be more grevilleas and bird attracting things which would be more in keeping with local habitat.

Mark and Jess described the new (mostly two storey) homes in the neighbourhood as out of place in the streetscape, and not in harmony with the predominately single-storey cottage and bungalow type housing that was historically built in Subiaco. In addition, Fiona and Jess were particularly concerned with neighbouring houses that overshadowed their gardens, reduced light to windows and blocked their view of the sky.

This phenomenon was not restricted to inner suburban neighbourhoods. In Wanneroo, Mary also expressed concern about disappearing trees. She was not happy that more and more contemporary homes with little outdoor space were encroaching into her neighbourhood.

I feel quite strongly about what's happening. I'm quite happy for people to move into Ashby, [but] what is happening now is the value of the land and the properties have gone up in Wanneroo and we're getting people moving in here which are more typical of the new suburbs and taking the trees down!

She also spoke of the nostalgia she felt as she noticed that more trees were disappearing from her neighbourhood, and worried that little would be done to stop it.

It's silly really, you look up the street and think, 'oh there was a tree there' and it's gone. I sort of feel it's a trend that nobody is going to stop.

Old trees were highly valued by many interviewees. Jess, William, Mary, Mark and Brad all spoke of older trees providing a sense of continuity and connection to the past. Sarah liked the fact that the park across from her Ashby home retained many old olive trees and gum trees. She was particularly happy that her boys could climb them rather than a “big red and blue thing with a yellow slide” so common in other neighbourhood parks. She also favoured a play area near Lake Joondalup because:

It's got a big, massive outdoor play area with huge trees. It's behind a little heritage listed old building.

Brad spoke of old trees giving a neighbourhood a “sense of establishment”. Mark saw the trees in Subiaco as representing its history, culture and architectural heritage and spoke of Subiaco being “a real mosaic of different things”. Jess was enthusiastic about how her street was lined with “a cathedral of trees”.

When asked how she thought her street would look like without trees, Jess replied:

It would seem so bald, it would just be bald. I suppose in a sense, gardens and greenery have a softening effect on often quite harsh buildings and built

environments. Oh, I can't imagine the street without trees. If you go down a street that doesn't have street trees and think of a street that does have street trees, and it's chalk and cheese. The whole feel of the street is different ...

Interviewees in new outer suburban areas faced just that situation. In Ashby, Tapping and surrounding developed areas, the landscape was cleared of almost all vegetation and very few large trees now grew outside of allocated parklands. Few Ashby residents had a large tree or trees within a 100 metre radius of their home.

In stark contrast to the other homes in her street, Kathryn's front garden contained a young jacaranda tree. Despite interest in her own garden, she took little notice of the gardens around her. When asked whether other people in the neighbourhood had planted any trees, she replied that she hadn't really looked and that:

You don't even think of that ... yeah ... even in this street there's not many people [planting trees] ... they've got more gardens than trees.

Sarah was very keen to see more local trees but acknowledged that growing new trees in her neighbourhood was difficult.

I think it's harder to do in smaller blocks and estates more and more are building smaller blocks and subdividing a lot smaller. ... So when you've only got a [small] block... and you're building a family home on it ... where could you put a massive tree? ... You can't fit a massive tree and you kind of rely on the kerb trees but half the people pull theirs out to put their driveways in. ... We've got street trees almost all up our street that the council put in. ... Every house just about has a tree in front of it and they're an okay size but they are brand new trees still. I don't know how big they are going to grow.

Apart from space, concerns that trees might damage property or cause extra work – like sweeping leaves – stopped some interviewees from planting them on their property. Leanne wanted to extend her garden and plant trees for shade. She joked that her plans for a bigger garden area and trees on the front verge were currently stalled because of the “precious” lawn tended by her “lawn addict” husband.

The lack of trees in new developments, and their disappearance from older neighbourhoods, emerged as a major concern regarding neighbourhood design. Several interviewees expressed the opinion that by clearing all of the original vegetation and levelling the landscape, particularly in new developments on the urban fringe, there was little to distinguish one new area from another. Brad described the end result.

You go from having natural bushland to a massive big sandpit. Eventually you'll have limestone blocks put everywhere, and leveled sand everywhere and then it just becomes one of those ... I don't know, cookie cutter type suburbs where every house kind of looks the same and everyone's trees are all this big [using his fingers to indicate small in size] and you know, I find those areas quite depressing.

The inclusion of diversity of places, people and opportunity to interact with others seemed to be an important aspect to good neighbourhood design. The following comments from Michael sum up the aspects of living in Subiaco that he felt made it special.

Well, I think it's probably the right size community – I don't know how many people there are here but you've got a great cross-section of people ... And as they go down the road, younger children see the older people walking around. ... Children as they grow up can experience every age group and every stage of life pretty well and learn from that. Also it's great because... it actually has a community feel about it. It's not a nondescript big flat suburb which you could very easily get lost in and lose your identity. It's like a town and it's surrounded by things that are different ... It is ... a whole on its own.

[And] there is the natural type of environment of Kings Park where you've got the natural sand and bottlebrushes you can choose to swat off the flies (laughs) if one chooses that kind of interaction ... And if you're in the mood for lying around reading a book and falling asleep in the sun you can do that in a more cultivated artificial grass park.

Because if you live in Subiaco, people say the yards are so small, we haven't got enough room to kick a football around [so] you make use of the parks. We lived in a terrace house and there was a park across the road ... and the kids just came out of the woodwork, and they all started to meet each other, developed friendships, parents used to go down and you bumped into parents, affairs started up (laughs) people caused divorces ... You talked about what you were going to have for dinner that night ... (laughs).

He also acknowledged that taking part in this research project had encouraged him to look at his neighbourhood a little differently.

Since I answered the questionnaire, as I ride through little areas on my way to and from work, I'm taking note of [all the different spaces] ... even though it might be a tiny tiny little park squeezed between two cul de sacs ... you see kids playing and their parents out playing with them every single day. Just that little space to play. Or there are several places just in the two kilometres from home to work where I always see kids playing and the parents all have smiles on their faces.

Discussion

As discussed in the first part of this chapter, there were some statistically significant correlations between attitude to natural environments and perceptions of green space diversity and quality, though these relationships were relatively weak. The interviews gave people opportunities to describe their neighbourhood and bolstered the idea that there is a significant link between what people think (their attitude), what they see and feel (their perceptions), and what they like (their preference) about green space. It was very clear that an individual's attitude to natural environments, particularly in relation to ecocentrism and care, strongly influenced preference and perceptions. Those people who expressed greater understanding of natural systems and spoke of enjoying spending time in nature were more inclined to seek out green spaces that provided complexity and opportunities for exploration. Those who professed little connection to nature and saw bushland areas as untidy, uninviting or unsafe, tended to prefer visiting green spaces that they saw as well-managed, civilised (though not too sanitised or clinical) and designed for people to enjoy.

It also became apparent that there was a link between preference for particular types of green space, why people chose to live in a particular neighbourhood and the level of personal attachment to that neighbourhood. This was most apparent in Wanneroo where all of the interviewees expressed strong emotional connection to the nearby lake, bushland and expanses of green space that characterised the physical environment of that neighbourhood. In addition, all spoke of the attraction of open space within the neighbourhood and chose to retain large areas of private green space around their own homes. Similar outcomes have been found in other qualitative research exploring attachment to neighbourhood in outer urban, open space communities where contact with nature was a feature of everyday life (Ryan, 2005).

The survey data indicated that while most Wanneroo survey respondents valued neighbourhood green spaces and identified a favourite area of public green space, it did not reflect the same level of positive attachment to neighbourhood that was described by the interviewees. Wanneroo survey respondents scored lower than other neighbourhoods in relation to identifying with others and (except for Ashby) in feelings of belonging. This is perhaps an outcome of the type of statements that were presented

in the survey. Almost all of the statements relating to neighbourhood attachment focused on relationships between respondents and other people within their community and not as much on respondents' relationship with their neighbourhood as a place or physical setting. Previous research has found that dissatisfaction with neighbourhood is more often related to social considerations such as the behaviour of neighbours, rather than physical aspects (Talen & Shah, 2007). This distinction between attachment to place or people was mentioned by Hans and Chloe who both felt they had little in common with their neighbours, but specifically chose to live and stay in this neighbourhood because of its physical characteristics.

Subiaco represented the most appealing neighbourhood. Survey scores were consistently ranked either first or second in all factors relating to ecocentrism, care for environmental issues, diversity, green space quality, identification of favourite place, visiting green space and neighbourhood attachment. In addition, Subiaco interviewees spoke in glowing terms about what attracted them to their neighbourhood. More than anything else, the diversity of people and places, especially their proximity to Kings Park, contributed to positive perceptions of green space quality and neighbourhood attachment. All Subiaco interviewees spoke of feeling they were part of a caring, nurturing community.

While many of these same aspects of neighbourhood attachment were spoken about by interviewees in Subiaco Centro, their attitudes to green space were somewhat different. Along with interviewees from Ashby, most expressed attitudes to natural environments that were more people-orientated than ecosystem-centred. This was reflected in the survey results as Subiaco Centro and Ashby respondents scored lowest in relation to ecocentrism and care for environmental issues.

Within Subiaco Centro, few interviewees seemed concerned with the lack of immediate access to bushland or other natural areas and most spoke of areas like Kings Park or Lake Monger as being close enough to be considered part of the neighbourhood. It was not the diversity of green space or the retention of bushland that contributed to the appeal of their neighbourhood, but perceptions of green space useability and the opportunity it provided for them to be physically active or to interact with other people. Subiaco Centro survey respondents scored highest in relation to proximity to parks and

social green spaces and perceptions of green space useability. As mentioned earlier in this chapter, the attention given to green space design within this affluent neighbourhood may contribute to this outcome.

Ashby respondents scored lower than other respondents in almost all aspects of the survey. Apart from recording lower scores in relation to attitude to natural environments, they also recorded the lowest scores for green space useability, having enough space, identifying a favourite area of public green space nearby, visiting green space and feelings of belonging. How Ashby interviewees spoke about their neighbourhood reflected these results. Only Adam spoke with any affection for the bushland area adjacent to the estate; others regarded it as unsafe and unwelcoming. In relation to neighbourhood attachment, with the exception of William who had lived in the district for more than twenty years and Leanne whose family lived in surrounding suburbs, all other Ashby interviewees spoke of their desire to live elsewhere (with Subiaco being named by Amber as her preferred neighbourhood) and their expectation that they would not be living in this neighbourhood long-term. The perceived lack of useable green space, the lack of diversity and choice, not only in green space, but also in architectural and landscape design, and the lack of access to services and community facilities with a corresponding lack of opportunities for community interaction, were identified as unfavourable aspects of living within this neighbourhood.

Diversity of community services and facilities, including green spaces, appears to be crucial in terms of meeting the varied expectations of what constitutes an attractive and appealing neighbourhood. For those people with a strong connection to nature, the diversity and quality of green space played an important role in neighbourhood choice. For others who paid less attention to issues relating to natural environments, their initial focus in choice of neighbourhood was determined more by affordability, convenience and access to services and community facilities. For this latter group, while access to diverse green space might be a secondary consideration, it was obvious that spaces that were perceived as useable and matched their preference, made a substantial contribution to positive perceptions of neighbourhood appeal.

As discussed earlier, most interviewees stated that they had not specifically thought about the presence of green space within their neighbourhood and most often took these

areas for granted. In spite of this, or perhaps because of it, there seems to be one aspect that was common to all. No matter what an individual's attitude to natural environments, no matter whether they preferred bushland to parkland or gardens, it seemed that when green areas (and particularly favoured green areas) began to disappear or they could not find a local area that met their needs, only then did most people begin to take notice and consider the value and importance of green space within their neighbourhood.

Chapter 7: Health and neighbourhood green spaces

Exploring relationships between perceptions of green space and health was the principal focus of this study. As discussed in earlier chapters, a healthy ecosystem contributes to human health and well-being through the provision of services and benefits. While the cultural benefits of ecosystem services (providing sites for recreation, inspiration, education and aesthetic appreciation) are highly valued in many societies, exploration of the health benefits they provide and the relationship between positive environmental conditions (such as the provision of good quality urban green space) and well-being are relatively recent additions to public health literature (Frumkin, 2001). Part of the difficulty experienced in assessing the cultural benefits of ecosystem services may be due in part to these benefits being “materially less tangible than those captured by conventional health indicators or standard economic valuation measures” (Millennium Ecosystem Assessment, 2005a, p. 5). This study provided an opportunity to assess relationships between the cultural ecosystem services, perceptions of neighbourhood surroundings and self-reported health.

In this chapter I explore relationships between self-reported health and the socio-demographic, home-related, transformed and other variables identified in the previous two chapters. The specific purpose of this analysis was to determine if variables such as age, income and neighbourhood location, and green space-related variables representing attitudes, proximity, perceptions and attachment would contribute to significant variance in self-reported health scores.

In the second part of the chapter, I explore interviewees’ understandings of possible relationships between proximity and perceptions of green space quality and health. Perceptions relating to the health of neighbourhood surroundings are also considered. As in previous chapters, the links and inferences that emerged from the data are discussed in the concluding section.

Measuring health

The health assessment data collected in this study asked only about individual health with respondents completing a comprehensive self-reported health survey (SF-36v2™).

Scoring software provided through licensed use of the SF-36v2™ survey applies factor analysis to calculate normed t-scores for each of eight physical and mental health domain scales (Ware *et al.*, 2007; Ware *et al.*, 2000). In addition, the scoring software calculates physical and mental health component summary scores (PCS and MCS) based on prescribed factor loadings (Ware *et al.*, 2007; Ware *et al.*, 2000). This process was discussed in Chapter 3 and the grouping of domain scales (health outcomes) into their respective component score category is presented here in Table 7.1. A table showing the allocation of specific survey questions to each domain scale is included as Appendix 7.1.

Table 7.1: SF-36v2™ physical and mental health domain scale descriptions

SF-36v2™ domain scales*	Description
Physical Health	
Physical function	Assesses presence and extent of physical limitation
Role physical	Reflects problems with work or other activities as a result of physical limitations
Bodily pain	Assesses intensity and extent of interference to normal activities due to pain
General health	Incorporates a general health rating and respondents' expectation of health
Mental Health	
Social function	Assesses impact on physical or mental problems on social activities
Role emotional	Assesses mental health limitations on work, accomplishment and care taken in performance
Vitality	Captures subjective well-being
Mental health	Assesses anxiety, depression, loss of control and psychological well-being
*(Ware <i>et al.</i> , 2007; Ware <i>et al.</i> , 2000)	

As with quantitative data discussed in previous chapters, several stages of analysis were undertaken. In the first section of this chapter, these stages of data analysis are presented in the following sequence:

1. generation of descriptive statistics;
2. exploration of correlations between health scores and all variables;
3. identification of differences (using non-parametric analysis of variance) between health scores and all variables; and
4. logistic regression analysis using odds ratios to assess predictability of influence of all variables on health outcomes.

As discussed in Chapter 3, it was not necessary for me to use SPSSv14 to conduct the data reduction stage of analysis (principal component analysis) as this was calculated within the SF-36v2™ scoring software. When correlation and analysis of variance

testing was undertaken, all relevant transformed and other variables identified in previous chapters were included. To complete the data analysis, regression analysis was used to identify significant relationships between specific variables and self-reported health.

Descriptive analysis

Descriptive statistics for individual questions were generated during the initial stage of analysis, but only the frequency of responses relating to general health (Table 7.2) and reported health transition score (Table 7.3) are discussed here. Descriptive results for each of the eight domain scales and component summary scores are presented later in this chapter (Table 7.4).

The first question in the SF-36v2™ questionnaire asks respondents to say, in general, if their health is excellent, very good, good, fair or poor (Table 7.2). Overall, the majority of respondents (65%) considered their general health to be *very good* or *excellent*. Less than ten per cent of overall respondents considered their general health to be *fair* or *poor*. Cross-tabulation indicated there was some significant difference in perceptions of self-reported health between neighbourhoods ($p=0.041$) with more Wanneroo respondents assessing their health to be *good* or *fair* rather than *very good* or *excellent*.

Table 7.2: Rating of general health status for overall survey respondents and within each neighbourhood

In general, would you say your health is ...?	Overall n=439 %		Subiaco % (n=144)	Wanneroo % (n=113)	Ashby % (n=100)	Subiaco Centro % (n=82)
Excellent	86	19.6	19.4	16.8	19.0	24.4
Very good	197	44.9	50.7	31.9	50.0	46.3
Good	117	26.7	22.2	35.4	26.0	23.2
Fair	33	7.5	6.3	14.2	4.0	4.9
Poor	6	1.4	1.4	1.8	1.0	1.2

The overall results in all domain scales indicate that most survey respondents recorded above average scores (>50). The range of scores, however, is wide with an average of 45 points between upper and lower scores in all domain scale (Table 7.3). This caused some initial concern, though further examination of the data showed that relatively few respondents recorded outlier scores more than two standard deviations (20 points) above or below the normed t-score of 50. I considered removing outlying respondents from the data set but found that in all except three cases, where one summary score was

outside the two standard deviation range (<30 and >70), the paired summary score (PCS or MCS) was within the range of normal scores (>30 and <70). Removing data relating to respondents with outlier PCS and MCS scores made negligible difference to overall results and I decided to retain all respondent data in the analysis.

Table 7.3: Median and mean for SF-36v2™ domain scale t-scores and component summary scores

SF-36v2™ ^a	Median <i>n=440</i>	Mean ^b	<i>sd</i>	95%CI	Range	
					Lower	Upper
Domain scales t-scores						
Physical functioning	54.93	52.02	7.28	51.34-52.70	14.94	57.03
Role physical	56.85	51.63	8.08	50.87-52.38	17.67	56.85
Bodily pain	55.36	52.00	8.86	51.17-52.83	19.86	62.12
General health	52.93	51.79	9.40	50.91-52.67	18.61	63.90
Social functioning	56.85	51.37	8.48	50.58-52.17	13.22	56.85
Role emotional	55.88	51.11	8.12	50.35-51.87	9.23	55.88
Vitality	52.09	52.49	9.53	51.60-53.39	20.87	70.82
Mental health	52.82	52.08	8.68	51.27-52.89	7.77	64.09
Component summary scores						
Physical Health (PCS)	54.14	51.90	8.57	51.10-52.70	14.95	70.71
Mental Health (MCS)	54.29	51.56	9.44	50.67-52.44	7.15	67.32

^a Ware *et al.* (2007) and Ware, Kosinski, & Dewey (2000)

^b t-scores calculated using scoring software supplied by QualityMetric™

A related anomaly was noted. Research into the validity of self-reported health measures suggests that assessment of perceived physical health tends to accurately reflect observed function (Lee, 2000; Miilunpalo, Vuori, Oja, Pasanen, & Urponen, 1997) but people often adopt defensive mechanisms and deny psychological distress when asked to self-report their mental health status. It is further suggested that scores at the lower end of self-reported scales (representing poorer mental health) are more likely to be valid than those in upper levels (Shedler, Mayman, & Manis, 1993).

In this study, the composition of summary scores for physical (PCS) and mental (MCS) health is determined by the SF-36v2™ scoring system and results for the general health question contribute only to physical health component scores, not mental health component scores (see Table 7.1). One respondent stated that in general, her health was excellent, yet she recorded an extremely low mental health component score (MCS=7.15). Her physical health component score was high (PCS=62.07), suggesting

that she had only considered the state of her physical health when responding to the question about her general health status. Similarly, another respondent stated his health was very good and while he recorded the highest overall physical health component score (PCS=70.71), his mental health component score was also very low (MCS=14.80). Overall, ten cases demonstrated this pattern: health reported as excellent or very good with PCS greater than 50 yet MCS less than 30. In a further six cases, the reverse pattern was noted: respondents reported their health was fair or poor and recorded low physical health component scores, yet recorded high mental health component scores.

There were not enough instances of this pattern to draw any firm conclusions about the process of self-assessment used by individual respondents in providing self-reported health data, but enough to suggest that for some people, overall health was associated more with their physical health status than with their mental health. To overcome this, it is suggested that studies exploring health and neighbourhood attributes include several health dimensions as individual perceptions of different aspects of their health may not correlate (Bowling *et al.*, 2006; Collins *et al.*, 2009).

Correlation analysis

The next stage of data analysis explored correlations between all health domain scales, component scores for physical (PCS) and mental (MCS) health, socio-demographic, transformed and other variables identified in previous chapters. Only significant correlations are presented in Table 7.4. Full results are included as Appendix 7.2.

The strongest correlations occur with a negative relationship between age and physical health and a positive association between age and mental health. This inverse association (older age is associated with decreased physical health and increased mental health) was also noted in a recent Western Australian population study (Crouchley, 2007). In that study, it was found that while older people reported the greatest decrease in physical functioning, those people aged 45 years and older who did not report any chronic medical conditions, recorded higher mean scores in all mental health domain scales.

Table 7.4: Significant Spearman Rank Order correlations between health outcomes, socio-demographic variables, transformed and other variables

	Physical health					Mental health				
	PCS	Physical function	Role physical	Bodily pain	General Health	MCS	Social function	Role emotional	Vitality	Mental health
Socio-demographic variables										
Age	-.338**	-.485**	-.202**	-.194**	-.098*	.384**	.126**	.154**	.180**	.257**
Weekly household income	.183**	.253**	.201**	.180**	.114*		.149**	.156**		
Educational qualifications	.114*	.135**		.127**						
Time lived in neighbourhood	-.181**	-.257**	-.182**	-.103*		.122*				
Transformed variables										
ProxTV3 Parks/social spaces †					-.129**		-.096*		-.122*	
GSQ TV2 Green space useability					.155**	.133**		.105*	.139**	.144**
GSQ TV3 Not enough green space †									-.111*	
NA TV1 Feelings of belonging				-.108*	.128**	.201**		.102*	.138**	.151**
NA TV2 Identify with others								.102*		
EcoTV1 Positive emotional response from spending time in nature							-.179**	-.098*		
EcoTV2 Feel sad to see natural areas destroyed			-.117*	-.115*			-.119*			
Other variables										
How often visit green space	.098*	.119*	.094*		.150**			.112*	.126**	
Bold text denotes correlations >0.3 and <i>italicized text</i> denotes negative relationship * Correlation is significant at the 0.05 level (Spearman rho 2-tailed) ** Correlation is significant at the 0.01 level (Spearman rho 2-tailed) † Inverse factor coefficient scores										

The positive correlation noted here between physical health, weekly household income and educational qualifications supports literature on socio-economic disadvantage and lower levels of overall physical and mental health (Demakakos, Nazroo, Breeze, & Marmot, 2008; Wilkinson & Marmot, 2003). The negative association noted between physical health status and the length of time respondents had lived in their neighbourhood may also be explained by increased age.

Other significant correlations between health scores and other variables were evident, though associations are relatively weak ($r < 0.30$). Perceptions of green space useability (GSQ TV2) were positively associated with general health, mental health and vitality. Physical and emotional function, general health and vitality were positively associated with how often people visit nearby green areas. In addition, feelings of belonging (NA TV1) were positively associated with general health, vitality, emotional role and mental health.

Interpretation of the pattern of negative correlation noted between two specific transformed variables and health outcomes was less straight forward. Results suggest there were negative associations between: (a) proximity to parks and social spaces (ProxTV3) and general health, social functioning and vitality; and (b) not having enough space (GSQ TV2) and vitality. What appears at face value, however, to be a negative association actually represents a positive relationship between higher scores for proximity to parks and gardens, having enough space and better general health and vitality.

In explanation it must be remembered that these transformed variables (ProxTV3 and GSQ TV2) were negatively correlated to other items within their factor pattern matrix (Table 6.7). As a result, the factor score calculated using the factor coefficient matrix is inversed. High scores are more likely to be negative (< 0.0) rather than positive (> 0.0). Scores relating to proximity to parks were both positive and negative, ranging from -1.54 (highest score) to +0.28 (lowest score). Scores relating to not having enough space were all negative and ranged from -6.49 (highest score) to -0.18 (lowest score). All health domain scale and component scores were positive (> 0.0). In future research, this situation would be taken into account and the data adjusted prior to analysis.

As discussed in previous chapters, it is important that all correlations are noted but weaker results need to be treated with caution (Pallant, 2001). However, several of the relationships observed here are supported by current literature. The link between increased physical activity (and its importance to maintaining health) and access to attractive larger areas of public open space is well documented (Bedimo-Rung *et al.*, 2005; Giles-Corti *et al.*, 2005). Several other studies highlight the complementary social, emotional and physical health outcomes of activity in green spaces (Pretty *et al.*, 2003; Pretty *et al.*, 2005; Pretty & Ward, 2001). Mental health benefits can be attained from spending time relaxing in favourite green spaces (Korpela & Hartig, 1996; Korpela *et al.*, 2008). Still more research demonstrates links between neighbourhood attachment and mental health (Ellaway *et al.*, 2001) and between neighbourhood attachment, experience and attitudes to natural environments (Ryan, 2005).

While it is important to identify correlations, this process does not explain how associations might occur. The next stage of analysis was undertaken to explore what significant differences existed between categorical groups based on socio-demographic, home-related, transformed and other variables.

Analysis of variance

Kruskal-Wallis H and Mann-Whitney U tests rank mean scores based on categorical grouping. Before this next step of analysis could be undertaken, it was necessary to create categorical groups within each of the transformed variables. SPSSv14 software was used to split transformed variables into thirtiles (three even groups) and these groups were categorised by low, medium or high scores. Significant differences found between variables scores and health scores are presented in Table 7.5. Full results for analysis of variance with mean rankings and post hoc testing by neighbourhood are included as Appendix 7.3.

With regard to socio-demographic factors, age accounted for most variance between health scores. Gender proved to have little influence on perceived health status, except where men reported better general health than women. Weekly household income was significantly associated with physical health, social function and role emotional scores. Post hoc testing using selected socio-demographic and other variables was conducted (though full results are not reported here). This confirmed that most difference in

physical health scores occurred between the group of respondents who reported a weekly household income of \$200-499 and those whose income exceeded \$1000 per week. Wanneroo respondents ranked lowest in all physical health domains, and socio-demographic data identified this group as older and with the lowest median income compared to respondents in all other neighbourhoods. It is very likely that low physical health scores in this neighbourhood were associated with age and income.

Significant differences in social function and role emotional scores were noted between the two highest income groups, those respondents who reported a weekly household income of \$1000-1499 or more than \$1500. No specific explanation for this finding emerged from the available data. In addition, the data provides no clear explanation why Australian and British respondents in this study reported lower physical health status than respondents from any other cultural background. Previous research, however, suggests that cultural differences (particularly in relation to diet) and immigration selection processes in Australia have resulted in better than average levels of health reported in some immigrant populations, particularly people from southern Europe, and East and South-East Asia (Powles & Gifford, 1990).

Living arrangements proved to be significant in relation to both physical and mental health status. Previous research has shown correlations between family status and mental health. Married people report better health than single people living alone, though couples without children are often “better off” than parents with children living at home (Ross *et al.*, 1990, p. 1059). In this study, respondents living in a family with children tended to record lower mental health scores than those living as a couple with no children living at home.

There also appeared to be some relationship between health status and whether respondents owned or were buying their home or lived in a rental property though differences relating more specifically to physical health may also be influenced by age. Respondents who lived in rented properties tended to be younger (65% aged less than 45 years) and overall, recorded higher mean scores for physical health. The inverse relationship was noted for mental health scores. The majority of those respondents who reported owning or were buying their own home were aged over 45 years (66%) and overall, recorded higher mean scores for mental health.

Table 7.5: Analysis of variance (with only significant results where $p \leq 0.1$ included) between all health scores and socio-demographic, home-related, transformed‡ and other variables using Kruskal-Wallis and Mann Whitney-U test with chi-square test for asymmetrical significance

	Physical health †					Mental health †				
	Component score (PCS)	Physical function	Role physical	Bodily pain	General Health	Component score (MCS)	Social function	Role emotional	Vitality	Mental health
Socio-demographic variables										
Gender (Mann-W U)					0.001					
Age	0.000	0.000	0.000	0.001	0.026	0.000	0.027	0.023	0.000	0.000
Cultural background	0.008			0.032	0.028					
Weekly household income	0.001	0.000	0.000	0.001			0.021	0.005		<i>0.058</i>
Educational qualifications		0.040		<i>0.055</i>						
Home-related variables										
Neighbourhood location	0.025	0.001	0.001	0.015				<i>0.071</i>		
Time lived in neighbourhood	0.003	0.000	0.005			0.013				
Living arrangement	0.030	0.000			<i>0.055</i>	0.000		0.034	0.003	0.000
Own or rent home (Mann-W U)	0.045	0.003			<i>0.052</i>	0.000	0.032	0.001	0.011	0.000
Transformed variables (low, medium or high score)										
ProxTV3 Parks and social spaces			<i>0.076</i>		0.006	<i>0.076</i>	<i>0.058</i>		0.018	
GSQ TV2 Green space useability					0.006	<i>0.050</i>			0.007	0.042
NA TV1 Feelings of belonging				0.031	0.028	0.000	0.024		0.023	0.011
Other variables										
Favourite area (Mann-W U)			0.021			<i>0.058</i>				
How often visit green space		0.043			0.009				0.008	
Volunteer for conservation activities					0.027					

†Kruskal-Wallis and Mann Whitney-U test for analysis of variance with chi-square test for asymmetrical significance

‡ Transformed variables split by thirtile to create categorical variable (low, medium or high score)

Bold figures denote p value ≤ 0.01

Italicised figures denote p value ≥ 0.05 and ≤ 0.1

Apart from age, this result may also be directly influenced by security of home ownership, as lower levels of subjective well-being have been found to be associated with mortgage insecurity and indebtedness (Nettleton & Burrows, 1998). In this study, the data collected did not differentiate between respondents who owned their homes outright and those who held a mortgage. Census data, however, indicates that the proportion of homes in Subiaco, Wanneroo and Subiaco Centro that are fully owned, mortgaged or rented is relatively even and is reflected in similar results for Perth's population (30% owned, 38% mortgaged and 35% rented). This was not the case in Ashby where 75 per cent of homes were mortgaged (ABS, 2007).

Apart from age and income, proximity to parks and social spaces, perceptions of green space useability, feelings of belonging, and how often people visit nearby green space account for the most consistent patterns of variation in health outcome scores (Table 7.5). There was significant difference associated with these variables and scores for general health, social function, vitality and mental health.

Significant variance in physical role, function and general health was also noted in relation to being able to identify a favourite place, how often people visited nearby green space and volunteering for conservation activities. There was also some variance in mental health component scores associated with proximity to parks and social spaces, perceptions of green space useability and identifying a favourite area, though in these cases, the observed *p* values were not considered statistically significant.

Neighbourhood location did not appear to influence health outcomes as strongly as it had influenced results relating to attitudes to nature or perceptions of green space quality discussed in previous chapters (Table 7.6). Each neighbourhood was different in terms of socio-demographic composition and it may be that specific demographic characteristics, particularly age and income, have greater influence on health than neighbourhood setting. As already mentioned, strong associations between health outcomes, age and income were most evident in relation to self-reported physical health, particularly for Wanneroo respondents.

**Table 7.6: Mean ranking[†] by neighbourhood location of self-reported health scores
(including results of post-hoc testing[‡] with significant relationships identified)**

Self-reported health		Subiaco	Wanneroo	Ashby	Subiaco Centro
	<i>p</i> =	Mean ranking [†] and significant post-hoc relationships [‡]			
		3	4	1	2
Physical health (PCS)	0.025	>Wanneroo	<Subiaco <Ashby <Subiaco Centro	>Wanneroo	>Wanneroo
		2	4	1	3
Physical functioning	0.001	>Wanneroo	<Subiaco <Ashby <Subiaco Centro	>Wanneroo	>Wanneroo
		3	4	1	2
Role physical	0.001		<Ashby <Subiaco Centro	>Wanneroo	>Wanneroo
		1	4	3	2
Bodily pain	0.015	>Wanneroo	<Subiaco		
General health	0.191	3	4	1	2
Mental health (MCS)	0.589	3	2	4	1
Social functioning	0.432	2	4	3	1
Role emotional	0.071	1	4	3	2
Vitality	0.186	2	4	3	1
Mental health	0.847	4	2	3	1
Mean rank[†] of demographic and attitudes to natural environment variables (from Table 5.11, p. 115)					
Age (oldest to youngest)	0.000	3	1	4	2
Weekly household income (highest to lowest)	0.000	2	4	3	1
Educational qualifications (highest to lowest)	0.000	1	4	3	2
Time lived in neighbourhood (longest to shortest)	0.000	2	1	4	3
EcoTV1 Positive emotion from spending time in nature	0.005	2	1	4	3
EcoTV2 Sad to see nature destroyed	0.000	2	1	3	4
CareTV1 Care about environmental issues	0.000	1	2	4	3
Volunteer for conservation activities	0.012	2	1	4	3
Mean rank of green space-related and other variables (from Table 6.12, p. 153)					
ProxTV1 Trees/connective green space	0.000	2	1	4	3
ProxTV2 Play and social spaces	0.000	2	3	4	1
GSQ TV1 Retention of green spaces	0.000	1	2	3	4
GSQ TV2 Useability	0.000	2	3	4	1
GSQ TV3 Enough public green space	0.000	1	2	4	3
NA TV1 Feelings of belonging	0.000	1	3	4	2
NA TV2 Identifying with others	0.000	1	4	3	2
Favourite area nearby	0.000	2	1	4	3
How often visit green space	0.006	1	2	4	3

[†] Kruskal-Wallis and Mann Whitney-U test for analysis of variance with chi-square test for asymmetrical significance

[‡] Tukey post hoc testing of ANOVA with mean difference significant at $p \leq 0.05$ level

The same association inversely applied to mental health. In Subiaco Centro, respondents formed an older – though not the oldest – age group and reported the highest median weekly household income. This group ranked highest in relation to overall mental health (MCS) and second for overall physical health (PCS). Subiaco Centro respondents also ranked highest for proximity to play and social spaces, and perceptions of green space useability.

With an expectation that older age is associated with better mental health, Wanneroo respondents should record higher mental health scores because of their increased age, though results are likely to be confounded by lower income, or chronic physical illness (Crouchley & Daly, 2007). Even so, Wanneroo respondents ranked second for mental health component and domain scores (though lowest in relation to social function, role emotional and vitality factors). Wanneroo respondents ranked highest in proximity to trees and connective areas of green space, positive attitudes to natural environments, care about environmental issues, volunteering for conservation activities, and identifying a favourite area of public green space (Table 7.6).

Subiaco respondents ranked third in both PCS and MCS mean scores, though second in relation to physical function, social function and vitality. Respondents from this neighbourhood were the most diverse in relation to age, income, time lived in the neighbourhood and living arrangement. They were the most highly educated group and reported the highest scores for retention of green spaces and bushland, caring about environmental issues, neighbourhood attachment and were the most frequent visitors to nearby green spaces (Table 7.6). Level of education may be related to the low ranking observed here in relation to mental health. There is some emerging evidence that correlations exist between higher educational qualifications and higher rates of anxiety disorders and chronic fatigue syndrome (Hammond, 2002).

When the influence of age and income is considered for Ashby respondents, it might be expected that this youngest age group would score higher in physical health and lower in mental health domains. This was the case with Ashby respondents recording the highest ranking in all physical health outcomes (except bodily pain), third in relation to social functioning, role emotional and vitality domain scores, and lowest for mental health component and domain scores. Even though the median income level in this

neighbourhood was above the Australian median, the higher than average level of mortgage indebtedness (ABS, 2007) may also contribute to lower overall mental health scores (Nettleton & Burrows, 1998). With regard to all other variables, Ashby respondents ranked lowest in almost all scores relating to proximity to different types of green space, perceptions of green space quality, neighbourhood attachment and positive attitude to environmental issues (Table 7.6).

While there are no conclusive causal patterns relating to health outcomes and socio-demographic variables in each neighbourhood, the observed patterns suggested that different variables may be influential in predicting potential health outcomes. As strongly indicated in current literature, age and income are the most consistent determinants of health outcomes. While the study findings support this, the main focus of this study was to explore the relative influence of other variables on health outcomes. In order to determine how influential transformed variables (such as perceptions of green space quality) and other variables (such as how often people visit green space) were in determining health outcomes, it was necessary to control for the influence of specific socio-demographic variables (such as age and income). This was achieved through logistic regression modelling. The following section of this chapter explores the results of these analyses.

Logistic regression

Logistic regression was used to determine whether selected variables might predict health outcomes. In this study, forced entry block entry logistic regression models were constructed with a single block of predictor variables. The effect of each variable is independently assessed, with possible confounding effects of socio-demographic variables (such as age or income) taken into account. Significant effect of any independent predictor variable is identified through production of an odds ratio (+/-1.0) which measures the odds of cases “falling into an outcome category given a one-unit change in a specific indicator” (Harlow, 2005, p. 158).

To predict effect on health outcomes using bivariate logistic regression, scores for all physical and mental component scores and scores for health domains needed to be split into dichotomous categories. In this case, scores equal to identified median or below (coded as 0) indicated poorer health and above median scores (coded as 1) indicated

better health. Attempts to dichotomously categorise scores for bodily pain, physical and emotion role and social function outcomes were unsuccessful as the range of scores was very narrow and almost all cases fell into the same category (median and below). These four health outcomes were not included in further analyses. Of the six SF-36v2™ health outcomes suitable for further analysis, three related to physical health: (1) physical health component score (PCS); (2) physical function (presence and extent of physical limitation); and (3) general health (respondents' rating and expectation of health). The remaining three related to mental health: (1) mental health component score (MCS); (2) vitality (subjective well-being); and (3) mental health (anxiety, depression, loss of control and psychological well-being).

Univariate analysis

Univariate analysis (cross-tabulation with chi-square testing) of each socio-demographic, transformed and other variable with dichotomous physical health and mental health outcomes was conducted to assess the strength of possible associations and identify potential predictor variables. Results of cross-tabulation and significant chi-square tests of association are presented in Table 7.7. Full results of univariate analysis are included as Appendix 7.4.

In this first stage of analysis, results were reported as significant where $p \leq 0.250$. Dales and Ury (1978) suggest that increasing significance levels in preliminary stages of regression analysis may ensure that all possible confounding effect is assessed. In support of this position, some researchers argue that only considering results that meet statistical significance criterion at $p \leq 0.05$ may be misleading. Relying only on statistical outcomes to further analyse results of regression modelling may exclude patterns of positive or negative effect and fail to identify important associations of interest (Hoem, 2008).

Table 7.7: Chi-square results[†] generated through univariate analysis (cross-tabulation) of selected SF-36v2TM health outcomes[‡] and categorical variables

	PCS	Physical function	General Health	MCS	Vitality	Mental Health
Gender	<i>0.163</i>		0.000	0.073		0.045
Age	0.000	0.000	0.090	0.000	0.009	0.000
Cultural background	0.040		<i>0.167</i>			
Weekly household income	0.005	0.000		<i>0.158</i>	0.033	<i>0.175</i>
Educational qualifications		<i>0.134</i>		<i>0.201</i>	<i>0.244</i>	
Neighbourhood	<i>0.187</i>	0.039	<i>0.152</i>		<i>0.105</i>	
Time lived in neighbourhood	0.026	0.000		0.033		0.074
Living arrangement	0.094	0.044	0.028	0.000	0.004	0.000
Own or rent home	0.091	0.005	0.024	0.000	0.046	0.000
Type of home			0.011	<i>0.139</i>		
Size of garden					<i>0.243</i>	
Favourite place						<i>0.169</i>
Visit green spaces			0.061		<i>0.154</i>	
Involvement in conservation activities	<i>0.139</i>	<i>0.245</i>	0.001		0.045	
¥						
ProxTV1 Proximity to trees/connective green spaces						
ProxTV3 Proximity to parks/social spaces	<i>0.100</i>		<i>0.133</i>	0.066	0.022	
GSQ TV1						
Retention of green spaces and bushland	<i>0.118</i>	<i>0.175</i>				
GSQ TV2						
Green space useability			0.002	<i>0.120</i>	0.010	0.098
GSQ TV3						
(Not) enough green space		<i>0.164</i>		<i>0.225</i>	0.053	
NA TV1						
Feelings of belonging	<i>0.120</i>	<i>0.151</i>	0.051	0.015	0.048	0.012
NA TV2						
Identify with others						
EcoTV1						
Enjoy spending time in nature						
EcoTV2						
Feel sad when nature destroyed		0.084				
CareTV1						
Care about environmental issues	0.096		0.040			

[†]Only results where p value ≤ 0.250 are included
Bold figures denote p value ≤ 0.05 and *Italicised* figures denote p value ≥ 0.10 and ≤ 0.250
[‡] Dichotomous dependent variables for all health outcomes defined as median score and below (0) and above median score (1)
[¥] Transformed variable score categories = low/medium/high

Multivariate analysis

The next stage of analysis involved construction of forced entry logistic regression models. All significant associations ($p \leq 0.250$) identified in univariate analysis (Table 7.7) between health outcomes and all other variables were included in these models. The upper limit of reporting statistical significance in this stage of the analysis was set at ≤ 0.1 as results at this level are commonly accepted and reported in epidemiological studies (Clayton & Hills, 1993). In addition, other patterns of positive effect are also discussed, though results did not reach required statistical significance ($p \leq 0.1$).

Unlike previous analysis, outlying cases were not included here. Using SPSSv14 for logistic regression analysis, cases with any missing items are automatically excluded, as are outliers (any cases with a score more than two standard deviations from the mean) as these can bias the correlation coefficients (Field, 2000). In some models, this resulted in as many as 40 cases being excluded from analysis. This applied most particularly to models that included weekly household income as a variable as 33 respondents had chosen not to provide a response to this question in the survey.

As was expected, socio-demographic variables (particularly age and income) demonstrated the most consistent effect on health outcomes. Variables included in each model and the results of forced entry logistic regression for each of the six selected health outcomes are described below. Full results for each model are included as Appendices 7.5-7.10.

Physical health component score (PCS)

The forced entry logistic regression model for physical health component score (physical function, role physical, bodily pain and general health) included: gender, age and cultural background; weekly household income; neighbourhood; time lived in neighbourhood; living arrangement; own or rent home; proximity to parks and social spaces; retention of green spaces and bushland; feelings of belonging within the neighbourhood; care about environmental issues; and involvement in conservation activities. Only significant results ($p \leq 0.1$) are included in Table 7.8.

Table 7.8: Forced entry logistic regression analysis showing significant ($p \leq 0.1$) odds ratio (OR) results for physical health component score (PCS)

Physical Health component score (PCS)	<i>n</i>	OR	95.0% C.I. for OR		<i>p</i> =
	397		Lower	Upper	
Age					
18-34	82	1.00			
35-54	174	0.752	0.398	1.422	
55+	141	0.334	0.156	0.715	0.005
Cultural background					
Australian	218	1.00			
British	99	1.248	0.728	2.142	
Other	80	2.031	1.115	3.698	0.020
Weekly household income					
\$1-499	66	1.00			
\$500-999	108	1.737	0.856	3.524	
\$1000-1499	89	2.070	0.954	4.492	0.066
\$1500 +	134	2.434	1.100	5.387	0.028
Involvement in conservation activities					
No, never wanted to	118	1.00			
No, but thought about it	189	1.560	0.923	2.635	0.097
Yes, current or prior involvement	90	1.309	0.707	2.424	
The full model with all predictor variables was statistically significant ($\chi^2 = 57.35, p=0.001$) with explained variance of 13-18% and correct classification of 65.5 % of cases.					

Three socio-demographic variables (age, cultural background and weekly household income) demonstrated significant influence on this health outcome. Respondents who were younger, from a non-Australian background or had a household income of more than \$1000 per week were most likely to record better physical health component scores.

Significant positive effect was also noted for people who indicated they had thought about involvement in conservation activities compared to those who had not (OR= 1.6). Positive effect was less (and not significant) for those people who indicated current or prior involvement in conservation activities. Non-significant positive effect was noted between medium and low scores for proximity to play and social spaces (OR =1.5 and $p=0.148$) and high and low scores for retention of bushland and other green spaces (OR = 1.6 and $p=0.127$).

Physical function

The forced entry logistic regression model for physical function (presence and extent of physical limitation) included: age; weekly household income; educational qualifications; neighbourhood; time lived in neighbourhood; living arrangement; own or rent home; retention of green spaces and bushland; not enough green space; feelings of belonging; feel sad when see nature destroyed; and involvement in conservation activities. Only significant results ($p \leq 0.1$) are included in Table 7.9.

Table 7.9: Forced entry logistic regression analysis showing significant ($p \leq 0.1$) odds ratio (OR) results for physical function

Physical function	<i>n</i> 396	OR	95.0% C.I. for OR		<i>p</i> =
			Lower	Upper	
Age					
18-34	82	1.00			
35-54	173	0.326	0.168	0.632	0.001
55+	141	0.061	0.026	0.143	0.000
Weekly household income					
\$1-499	65	1.00			
\$500-999	108	1.078	0.459	2.529	
\$1000-1499	89	1.524	0.607	3.825	
\$1500 +	134	3.054	1.198	7.782	0.019
Living arrangement					
Single	91	1.00			
Couple no children at home	165	0.619	.311	1.230	
Family with children at home	140	0.555	.277	1.112	0.097
GSQ TV1					
Retention of green spaces and bushland					
Low	130	1.00			
Medium	132	1.674	0.871	3.219	
High	134	1.815	0.897	3.674	0.097
The full model with all predictor variables was statistically significant ($\chi^2=111.1, p=0.000$) with explained variance of 24-33% and correct classification of 73.7 % of cases.					

Three socio-demographic and home-related variables (age, weekly household income and living arrangement) demonstrated significant influence on this health outcome. Younger, single respondents with a household income of more than \$1500 per week were most likely to report better physical function.

With regard to other variables, respondents who perceived that green spaces and bushland were being retained in their neighbourhood reported better physical function (OR=1.8). There was also some non-significant positive effect noted between medium/high and low scores for feelings of belonging within the neighbourhood with

medium scoring respondents most likely to report better physical function (OR=1.6 and $p=0.122$).

General health

The forced entry logistic regression model for general health (respondents' rating and expectation of health) included: gender; age; cultural background; neighbourhood; living arrangement; own or rent home; type of home; how often visited green space; proximity to parks and social spaces; perception of green space useability; feelings of belonging; care about environmental issues; and involvement in conservation activities. Only significant results ($p \leq 0.1$) are included in Table 7.10.

Four socio-demographic and home-related variables (gender, cultural background, neighbourhood and type of home) demonstrated statistically significant influence on this health outcome. With regard to socio-demographic variables, female respondents from non-Australian backgrounds, living in a house in a new neighbourhood were more likely to report better general health.

Results for other variables indicated that respondents who scored high for perception of green space useability (OR=2.1), cared most about environmental issues (OR=1.6), and were either interested or involved in conservation activities (OR=2.4 and 1.8 respectively), were most likely to report better general health. A non-significant positive effect between high and low scores for feelings of belonging within the neighbourhood was also noted (OR=1.5 and $p=0.164$).

Table 7.10: Forced entry logistic regression analysis showing significant ($p \leq 0.1$) odds ratio (OR) results for general health

General Health	n	OR	95.0% C.I. for OR		p=
	427		Lower	Upper	
Gender					
Female	275	1.00			
Male	152	0.605	0.377	0.969	0.037
Cultural background					
Australian	224	1.00			
British	104	1.044	0.608	1.794	
Other	78	2.037	1.154	3.595	0.014
Neighbourhood location					
Wanneroo	108	1.00			
Subiaco	141	1.038	0.573	1.880	
Subiaco Centro	80	2.964	1.227	7.157	0.016
Ashby	98	2.151	1.110	4.169	0.023
Type of home					
Townhouse, duplex or apartment	64	1.00			
House	363	2.754	1.167	6.499	0.021
GSQ TV2					
Green space useability					
Low	141	1.00			
Medium	141	1.519	0.874	2.642	
High	145	2.076	1.165	3.697	0.013
CareTV1					
Care about environmental issues					
Low	140	1.00			
Medium	144	1.045	0.614	1.777	
High	143	1.611	0.933	2.783	0.087
Involvement in conservation activities					
No, never wanted to	125	1.00			
No, but thought about it	200	2.482	1.459	4.223	0.001
Yes, current or prior involvement	102	1.801	0.968	3.352	0.063
The full model with all predictor variables was statistically significant ($\chi^2 = 80.53, p=0.000$) with explained variance of 17-23% and correct classification of 67 % of cases.					

Mental health component score (MCS)

The forced entry logistic regression model for mental health component score (emotional role, social function, vitality and mental health) included: gender; age; weekly household income; educational qualifications; time lived in neighbourhood; living arrangement; own or rent home; type of home; proximity to parks and social spaces; perception of green space useability; not enough green space; and feelings of belonging within the neighbourhood. Only significant results ($p \leq 0.1$) are included in Table 7.11.

Four socio-demographic and home-related variables (age, weekly household income, educational qualifications and own or rent home) demonstrated statistically significant influence on this health outcome. Older respondents who had a household income of more than \$1000 per week, who owned or were buying their home or who had not completed tertiary education were more likely to record better mental health component scores.

Table 7.11: Forced entry logistic regression analysis showing significant ($p \leq 0.1$) odds ratio (OR) results for mental health component score (MCS)

Mental health component score (MCS)	n 398	OR	95.0% C.I. for OR		p=
			Lower	Upper	
Age					
18-34	83	1.00			
35-54	173	1.780	0.940	3.368	
55+	142	6.281	2.903	13.591	0.000
Weekly household income					
\$1-499	65	1.00			
\$500-999	108	1.874	0.907	3.871	0.090
\$1000-1499	91	1.335	0.625	2.851	
\$1500 +	134	2.268	1.087	4.732	0.029
Educational qualifications					
Secondary school	102	1.00			
TAFE or trade	101	1.024	0.544	1.928	
University degree	120	0.57	0.299	1.080	0.085
Postgraduate degree	75	0.66	0.318	1.363	
Own or rent home					
Rent or board	80	1.00			
Own or are buying	318	2.116	1.113	4.022	0.022
ProxTV3					
Proximity to play/social spaces					
Low	128	1.00			
Medium	144	1.623	0.930	2.831	0.088
High	126	1.704	0.941	3.088	0.079
The full model with all predictor variables was statistically significant ($\chi^2=82.89$, $p=0.000$) with explained variance of 19-25% and correct classification of 69.8 % of cases.					

Proximity to parks and social spaces demonstrated significant positive effect with respondents recording high scores for this variable were 1.7 times more likely to record a better mental health component score than those who scored lowest.

Vitality

The forced entry logistic regression model for vitality (subjective well-being) included: age; weekly household income; educational qualifications; neighbourhood; living arrangement; own or rent home; size of garden; how often visit green space; proximity to parks and social spaces; perception of green space useability; not enough green space; feelings of belonging; and involvement in conservation activities. Only significant results ($p \leq 0.1$) are included in Table 7.12.

Two socio-demographic variables (age and weekly household income) demonstrated statistically significant influence on this health outcome. Older people (55+ years of age) with a household income of more than \$1000 per week were more likely to report better vitality.

Table 7.12: Forced entry logistic regression analysis showing significant ($p \leq 0.1$) odds ratio (OR) results for vitality

Vitality	n	OR	95.0% C.I. for OR		p=
	396		Lower	Upper	
Age					
18-34	82	1.00			
35-54	173	1.396	0.745	2.617	
55+	141	2.280	1.092	4.764	0.028
Weekly household income					
\$1-499	65	1.00			
\$500-999	108	1.214	0.606	2.433	
\$1000-1499	89	1.488	0.691	3.206	
\$1500 +	134	2.305	1.032	5.146	0.042
GSQTV2					
Green space useability					
Low	127	1.00			
Medium	134	1.677	0.962	2.924	0.068
High	135	1.618	0.892	2.933	
How often visit green space					
<once a month	58	1.00			
> once a month	38	1.991	0.805	4.921	
>once a fortnight	64	1.635	0.727	3.676	
> once a week	236	1.852	0.940	3.648	0.075
Involvement in conservation activities					
No, never wanted to	117	1.00			
No, but thought about it	189	1.474	0.878	2.473	
Yes, current or prior involvement	90	1.706	0.927	3.139	0.086
The full model with all predictor variables was statistically significant ($\chi^2=52.85$, $p=0.004$) with explained variance of 13-17% and correct classification of 66.2 % of cases.					

Significant positive effect on vitality was also noted for respondents who held good perceptions of green space useability (OR=1.7), visited green space more than once per week (OR=1.8) or were currently involved in conservation activities (OR=1.7).

Mental health

The forced entry logistic regression model for mental health (anxiety, depression, loss of control and psychological well-being) included: gender; age; weekly household income; time lived in the neighbourhood; living arrangement; identifying a favourite place; perceptions of green space useability; and feelings of belonging. Only significant results ($p \leq 0.1$) are included in Table 7.13.

Three socio-demographic and home-related variables (age, living arrangement, and own or rent home) demonstrated statistically significant influence on this health outcome. Respondents aged more than 55 years, who owned or were buying their home and were living as a couple with no children at home were more likely to report better mental health.

Table 7.13: Forced entry logistic regression analysis showing significant ($p \leq 0.1$) odds ratio (OR) results for mental health

Mental health	<i>n</i> 399	OR	95.0% C.I. for OR		<i>p</i>=
			Lower	Upper	
Age					
18-34	83	1.00			
35-54	174	1.423	0.779	2.601	
55+	142	2.294	1.130	4.655	0.022
Living arrangement					
Single	91	1.00			
Couple with no children at home	166	2.290	1.277	4.108	0.005
Family with children at home	142	1.745	0.934	3.261	0.081
Own or rent home					
Rent or board	80	1.00			
Own or are buying	319	1.989	1.103	3.588	0.022

The full model with all predictor variables was statistically significant ($\chi^2 = 54.20, p=0.000$) with explained variance of 13-17% and correct classification of 65.4 % of cases.

Non-significant positive effect was also noted between higher and low scores for perceptions of green space useability. Respondents recording high scores for useability were 1.5 ($p=0.157$) times more likely to report better mental health than respondents who recorded low scores.

Overall results of logistic regression analysis

Results for logistic regression are supported by much of the current literature, particularly results for socio-demographic and home related variables. As was expected, age and income were the most consistent predictors of physical and mental health outcomes (Table 7.14).

Table 7.14: Significant patterns of effect ($p \leq 0.1$) for socio-demographic and home-related variables with odds ratio (OR) associated with better health outcomes

Socio-demographic and home-related variables	PCS	Physical function	General health	MCS	Vitality	Mental health
Gender						
Female			1.00			
Male			0.61*			
Age						
18-34	1.00	1.00		1.00	1.00	1.00
35-54	0.75	0.33**		1.78	1.40	1.42
55+	0.33*	0.06**		6.28**	2.28*	2.29*
Cultural background						
Australian	1.00		1.00			
British	1.25		1.04			
Other	2.03*		2.04*			
Weekly household income						
\$1-499	1.00	1.00		1.00	1.00	
\$500-999	1.74	1.08		1.87†	1.21	
\$1000-1499	2.07*	1.52		1.34	1.49	
\$1500 +	2.43*	3.05*		2.27*	2.31*	
Educational qualifications						
Secondary school				1.00		
TAFE or trade				1.024		
University degree				0.57†		
Postgraduate degree				0.66		
Neighbourhood location						
Wanneroo			1.00			
Subiaco			1.04			
Subiaco Centro			2.96*			
Ashby			2.15*			
Living arrangement						
Single		1.00				1.00
Couple no children at home		0.62				2.29**
Family with children at home		0.55†				1.75†
Type of home						
Townhouse, duplex or apartment			1.00			
House			2.75*			
Own or rent home						
Rent or board				1.00		1.00
Own or are buying				2.12*		1.99*

** OR significant at 0.001 level * OR significant at 0.05 level † OR significant at 0.1 level

Green space-related variables that demonstrated positive effect on health outcomes are included in Table 7.15. Retention of neighbourhood green spaces and positive perceptions of green space useability influenced overall physical health (PCS), physical function and general health. It was also seen that proximity to parks and social green spaces, positive perceptions of green space useability, and how often people visit green space can have a significant positive effect on achieving better overall mental health (MCS) and feelings of vitality.

Table 7.15: Significant patterns of effect ($p \leq 0.1$) for green space-related variables with odds ratio (OR) associated with better health outcomes

Green space-related variables	PCS	Physical function	General health	MCS	Vitality	Mental health
ProxTV3						
Proximity to play/social spaces						
Low	1.00			1.00		
Medium	1.48			1.62†		
High	1.19			1.70†		
GSQ TV1						
Retention of green spaces and bushland/						
Low	1.00	1.00				
Medium	1.01	1.67				
High	1.61	1.82†				
GSQ TV2						
Green space useability						
Low			1.00		1.00	1.00
Medium			1.52		1.68†	1.44
High			2.08*		1.62	1.50
How often visit green space						
<once a month					1.00	
> once a month					1.99	
>once a fortnight					1.64	
> once a week					1.85†	
Care TV1						
Care about environmental issues						
Low			1.00			
Medium			1.05			
High			1.61†			
Involvement in conservation activities						
No, never wanted to	1.00		1.00		1.00	
No, but thought about it	1.56		2.48**		1.47	
Yes, current or prior involvement	1.31†		1.80†		1.71†	

** OR significant at 0.001 level * OR significant at 0.05 level † OR significant at 0.1 level

Grey text indicates non-significant ($p > 0.1$) positive effect from variable set

Positive health effects suggest that people who cared about environmental issues and were interested in conservation would report better overall physical and general health. Actual involvement, rather than interest, in conservation activities may result in greater vitality and feelings of well-being.

While several variables demonstrate positive effect on physical and mental health outcomes, the strength of the models examined here needs to be considered. While all final logistic regression models met criteria for goodness of fit, the upper level of explained variance was less than 25 per cent in all but one of the models (33% for physical function model). As such, all of the findings discussed here must be treated with some caution. Apart from well-established relationships between health and socio-demographic variables such as age and income (Demakakos *et al.*, 2008; Marmot, 2007), it is not suggested that these results suggest causal links between other variables included in these models and health outcomes. At best, they provide evidence that significant associations do occur between several green space-related variables and physical and mental health outcomes.

In support of these findings, interviewees identified relationships between access to green space and their feelings of general health, well-being, happiness and social inclusion. The next section of this chapter explores interview data relating to green space and health.

Talking about green space and health

When people were first asked about how neighbourhood green space might contribute to health, several were uncertain where to begin but, as each interview progressed, and interviewees thought more about their feelings, experiences and observations, rich opinions began to emerge. Myriad relationships between green space and health were identified and several key themes emerged. The next sections of this chapter follow the path of discussion regarding green space and health that occurred in many of the interviews. Several interviewees started with observations and opinions about their relationship with spaces directly around their home, including their gardens and other private green space, then moved further afield to talk about public green spaces as

places to be active, to relax, and to connect with other people, and ended by talking about green space and the health of neighbourhood surroundings.

Private spaces: gardens and greenery

Contemporary residential development is characterised by urban infill and in new outer suburban estates, smaller block size and a larger home footprint (ABS, 2004). This style of development means that space for a home garden is decreasing (Hall, 2007) and potential health benefits are diminished. Gardens are recognised as important in engendering connection to place (Mulcock, 2008) and reconnection to urban nature (Barlett, 2005). In this study, several interviewees spoke at length about their gardens. Throughout most of the interviews, even with those interviewees who were not keen gardeners, private gardens emerged as an important component of neighbourhood green space.

It was obvious that for some interviewees, their home garden was an important place and maintaining a garden contributed to their sense of well-being. Charlie, the oldest interviewee at 81 years of age, kept a large garden of vegetables and fruit trees and shared much of his produce with his family and neighbours. He felt that being in the garden each day helped maintain his health and the health of other friends his age.

Well that's what they reckon keeps me going. ... And I've known more than one that have lived to 80, 90 and they always potter around with their bit of garden, even on a quarter acre block, they've got enough space to put their own veggies and plant a lemon tree, an orange tree, you know.

William was another interviewee who spent a great deal of time tending his vegetable garden. He liked it and found it rewarding. People in his neighbourhood were friendly and often stopped to ask what he was growing. Mark also kept several vegetable patches within his garden and liked being able to eat fresh produce.

We wanted to have a few little patches of vegetables for different seasons ... but we wouldn't be self sufficient, we don't have the space and don't have the winter sun. We've had a few peas and broad-beans and the usual thing, they just give you the feeling you're creating something for yourself ... and you can grow something that's very clean – there's a health aspect there.

For other interviewees, having a garden was a place to enjoy being outdoors. Jess had always kept a garden. At 70 years of age, she was starting to consider what might happen if she was unable to get out of the house and into the garden.

I haven't thought about it but surely walking in the fresh air and breathing properly etcetera must be better for you than staying cooped up inside ... I'd never really thought about it as how it might affect [me] ... I think if I had no garden and had no access to a garden conveniently, it would very definitely upset me ... affect my mental wellbeing. [I'd feel] a bit claustrophobic I think ... It's hard to imagine because I have access easily to places to walk but I think if one was confined for some reason ... ummm ... I would, oh I think I would really miss it if I couldn't be wheeled out into a garden for instance ... I imagine I would feel trapped.

Relaxing in the garden also helped others deal with the stress of a busy working life. Luke had swapped the fast paced lifestyle of Sydney for a small cottage in Subiaco with a garden. He spoke of how much he now enjoyed having a place to spend time outside.

I live in a three bedroom house in a very, very quiet street – very, very nice, leafy street with a good back garden. ... We spend a lot of time in our back garden so that's really important for me. ... After being confined to units for so many years of my life... it's really nice to have a back garden to walk out into, lay in the hammock, and just spend time outside.

Hans spent a lot of time driving for work and like Luke, saw his garden as a retreat.

99.9% it is important for my life because ... I switch off here and ... I come home and this is my paradise. I make the paradise the way I want it, stage by stage... I reckon this is very important for me that I probably would have a heart attack already, if I have stress ... I come home, I want quiet, I want nature, I want green, green relaxes your eyes, I don't have green when I see the bitumen on the road all the time ... This is just my relaxation ... come home, be happy, have a glass of wine ... water the plants and that is alright ...

For Kathryn, her garden provided a different type of stress relief. Over the past few years, she had suffered bouts of depression after a close friend died. When asked about how her garden influenced her health, it took her some time to answer.

(Long pause) To be honest, my mental health for the last couple of years has not been the best. ... Depression hit really hard ... A lot of the times I go out there and I think well I'd rather be out ...[doing] things where you can actually go out and see a change. ... You can sit out there. ... [Do] less work (smiles). I don't know because I really haven't thought about it. ... The colours make it look good too. Yeah. It's a sense of achievement that you've actually helped it grow, that you haven't killed it! (laughs).

Fiona's garden provided unexpected benefits: she gained confidence and made new friends in her street.

I suppose it's the old idea of putting something in and it actually growing and changing and making a difference. ... I started to read lots of gardening books ... and I became obsessed ... and then realised that it actually wasn't too hard. ... I suppose I grew in confidence that was probably the main thing. ... So that's how that all started and then I sort of grew.

Then I found ... it was a topic I could talk to other people about and a lot of people know quite a bit about gardening. The other thing too that I never knew would happen is that I spend a lot of time in the front garden. ... People would stop and they would talk and they would give some advice ... So people really engaged and I really liked that experience too, all people would stop and say 'oh isn't this nice'.

As a part of being more engaged with people in her street, Fiona commented further that there was a protective relationship between neighbours and “we all look out for each other”. And that was what Fiona valued most.

Jack's garden was the place where he connected with his family. His small garden was surrounded by trees and was designed for privacy and easy entertaining. He offered this insight about what it might be like to live without his garden and the greenery immediately around his home.

I couldn't think of a world without trees, you know, my own small world. I mean, if I was living in an area that was devoid of greenery I think it would be dreadful. I couldn't tolerate the thought of living in a world which didn't... I would be quite depressed. Just trying to think about what it would be like to be living where there wasn't any greenery, I think I would shrivel up. Yes, I hadn't really thought about it but it is a horrible thought. ...

Private gardens were places to grow healthy food, enjoy relaxation and rejuvenation, and make connections with friends and family. Not everybody wanted to grow a garden but for those interviewees who did, spending time in their garden gave them pleasure. Jack also saw open space and greenery as providing a sense of freedom, with gardens being one space that allowed people to experience a sense of well-being.

I think ... that this is good for us, to have freedom. Freedom that space brings you, that sense of freedom that people need. And as things become more stressful ... it is so important for people to ... return to that sense of well-being of which open spaces and greenery and their garden is part.

Public green spaces for physical activity and relaxation

Public green space provided a broad range of opportunities to enhance individual well-being and the benefits of being physically active or relaxing in an attractive environment were most often mentioned. It is widely held that viewing or being in green space can generate a number of positive physiological and psychological benefits for human health (Frumkin, 2001, 2003; Kaplan & Kaplan, 1995; Ulrich, 1984) and many researchers consider one of the primary health contributions of urban green space is providing places for physical activity (Bedimo-Rung *et al.*, 2005; Chau, 2007;

Duncan, Spence, & Mummery, 2005; Giles-Corti *et al.*, 2005; Kirtland *et al.*, 2003; Powell, 2005; Pretty *et al.*, 2003; Pretty *et al.*, 2005; Takano *et al.*, 2002).

It can be argued that physical activity can occur in a great variety of places – at home, in the gym, on the street – and not only in a local park or nature reserve. However, when asked about the contribution of public green space to their health, many interviewees talked about using local parks, bushland areas or nearby lakes as places to walk, run or cycle. Several interviewees described green spaces as their preferred place for physical activity. Some of their comments included:

I've seen the joggers who run along city streets, I'd have no enjoyment in doing it in a complete concrete environment. I seek places which we walk on the grass or besides trees or something interesting to look at. (Mark)

If it was a nice summer's night and I get home ... I'd like to go for a run and ... I don't want to run down streets, I want to run around a park or something like that so... Yeah I want to have some space close to me. (Andrew)

If you're in a street, you're just closed in and you haven't got much to look at. The footpaths are hard and you've got cars going past and you're also breathing in the fumes ... whereas just going to the park, there's so much round about, so much to look at, and if you're lucky enough you've got the birds singing and you see other people and they all seem to be happy. You don't really meet people who are unhappy when they're walking out in the park. (Sue)

It's really important for people to exercise and ... walking around the streets really doesn't do it. [People] need to go some place where they can see natural things, green grass, trees, birds, blue sky, that it's all quite good for their mental health. (Chloe)

Kevin walked every day around a circuitous route through shady streets and local parks in Subiaco Centro. It was part of his fitness routine and he enjoyed having that time to relax and think through personal issues.

It's a part of fitness and partly I enjoy it. It's a means of I suppose cleansing my mind, I sort of think while I'm walking along, I think through issues.

When asked about what might happen to his physical activity levels if he didn't have access to green areas in Subiaco Centro where he could exercise, Gordon replied:

Well I'd still cycle, I probably wouldn't enjoy walking as much because I think you need to have some stimulus otherwise it gets a bit boring. But health-wise I go to the gym a couple of times a week [but] I prefer to be outdoors ...

Brad also commented about his preference for exercising outdoors:

I find it very hard to be motivated to go to a gym and run on a treadmill. I actually find it quite strange that people will go to a gym and do that sort of stuff. I probably [would not run] as much if I didn't have [green space] around me.

Amber stated that not having places where she enjoyed walking in her Ashby neighbourhood was affecting her physical activity levels. She found it boring to walk past houses and she rarely walked around the neighbourhood.

It's not very exciting, it's not relaxing, it's boring. I don't know ... I find it a bit boring walking past houses and... I actually think it translates to being less active because I don't go for a walk here because it's boring. But when I lived in [another suburb] I used to go everyday because I had somewhere nice to walk and nice to take the children and look at the trees and the birds and things, whereas here I take them up the park but that's across the street and then we'd walk around the park and come back, you know, it's not ... um ... I don't go for like an hour walk whereas I used to do that all the time ... I find it a nice way to kind of get your thoughts together and whatever but here I don't because like I said, you walk amongst the houses.

Leanne lived just north of Amber and also spoke about missing the parks around where she used to live in an older suburb. In her old neighbourhood, there was a park at the end of the street where she went regularly.

Yeah, we miss [the parks] as well, because at the moment when we go for walks, we're walking through suburbia, you know just walking through streets aren't we when we go for a walk, whereas you could follow a park all the way to my mum and dad's house ... they had meandering paths that you could just walk through [my old neighbourhood]. It was really good, and there were gully sort of things so that you know, you could walk the dog along the bottom and he wouldn't see too much to dart off ... Yes, so we miss the parks as well.

When she was asked what was different about walking around suburban streets and walking around parks, Leanne replied:

It's just nicer. I mean we don't mind walking down the streets and stuff, I don't know, just the hardness when you're walking, I'd rather walk on grass than on the road for one. You feel you can just talk normally I guess when you're in a park sort of thing, but if you're walking down the street you sort of have to just quiet, quiet talk you know, whatever.

Several interviewees had mentioned that walking in the park provided an opportunity to relax. Walking the streets did not provide this opportunity for Leanne.

You're more having a nosey on what other people are doing to their houses when you're walking the street, you're not really getting away from it, I guess. You don't feel like you're ... doing something different really I suppose.

Access to local parks was an integral part of their daily life for some interviewees. Mark exercised regularly and found Kings Park offered a number of benefits.

Well, just being in Kings Park ... there's different types of relaxation there. I find it relaxing just going along through the paths, cycle paths or walking paths when it's not too crowded so during the week that's really good. It's fun on the weekend too. But you're away ... you could have Thomas Street just thick with traffic, peak hour building up, and get in there a hundred metres and ... you know you might hear the noise a bit, but it's somewhere to enjoy the peace and ... you're reminded of how separate you are from all the sort of city goings on, the noise and the busyness..

Andrew also viewed physical activity in parks as a form of relaxation.

So relaxation for me is I use parks as more for exercise, run, go and kick footy, you know, take someone else's dog for a walk, do that sort of stuff than just wander around in a park. I might on a Sunday afternoon go 'let's take a bottle of wine and go and sit up at Kings Park and enjoy the view' and then might go for a walk or slow wander through the bush land on the way home, that sort of thing.

When interviewees were asked if they thought access to green space might affect their psychological or mental health, most people spoke about green areas providing a sense of space, of freedom, of not feeling trapped in and having somewhere to escape the stress of work or city life. Jack offered this observation about why green space was important to people.

We need it because it is natural to us. ... It's probably the most important fact of all, the reason why we need it. We can adapt and we have done a lot of adapting but the fact is that there is something deep in our genes where life is more natural in a natural environment. And close to the earth.

Eleanor felt there was a strong relationship between being able to see open green space and good mental health.

It's definitely emotional and mental, even if you don't realise it, just having this view here is very, very calming and there is always something going on there. But apart from that it is so pleasing on the eye because of the textures and contrasts and colours and you know, there is a movement and there is so much going on but it doesn't impinge on our personal lives, so having that ... um ... feeling very comfortable in the house plus having this wonderful open space that we can gaze on and get so much from, it's really very emotionally healthy, it's a very healthy aspect really. That's why I think we're so blessed (laughs).

Others interviewees, like Chloe, were also certain that green space affected their emotional health.

Yeah, I think it's really important for your emotional health or your psychological health to be surrounded by green things, green things and blue sky and things like

that. It's part of the reason why I walk every day because I find it ... it lifts my mood a bit, especially if you're feeling down.

I notice, when I'm down there and I'm walking along and I see the dogs playing and looking at the wildlife, I feel very happy. It gives me a little lift. ... I just really, really like going out every day and walking. I really miss it if I can't do it... Yeah, I like to get out. I feel happier when I'm down there, watching the dogs run around and enjoy themselves.

Sarah felt the same. She thought visiting green space was something that everybody should do.

I think it just makes you feel happier ... I do think it's important for all people. I don't think it's just me. I don't know whether all people would recognise that or not. ... My personal belief is that whether or not you thought about it consciously, it would make a difference for everybody, a positive difference. ... I really think that somewhere in people's hearts, it is important whether they consciously think it or not and I think it's just part of general wellbeing. People are better off. Good for the soul.

Expressing feelings of happiness was a common response when asked about green space and mental health. Tash spoke about why she liked living in an area surrounded by bushland.

It just makes you feel better like you just sort of feel happy knowing you're surrounded by more bush than houses and roads. Just a feeling, I don't know ... you just feel nicer, you feel like in the country a bit more, surrounded by nature a bit more...

Matt was happier after a day's work when he was able to see bushland and open space while driving home.

Yeah, [my current workplace] is in the bush. ... It's relaxing. ... I was driving from here to [across the city] every day and after three months I was going nuts. ... I was coming home, I was miserable. ... And where I'm working now it's an industrial environment but it is surrounded by farms. So yeah it's just relaxing, you don't have the hustle and the bustle ...

Brad often worked in outdoor environments and enjoyed being outdoors rather than spending time in the office.

Yeah, I'm just so much happier. If I had a rare week that I'm in the office you know, Monday through to Friday, at the end of that week it seems like you know, it's been ten weeks and I had worked 40 hours a day whereas when I'm in the field the week just flies by and it's so easy and I enjoy it so much more.

Some of the interviewees had lived overseas and spoke of their experiences living in a city where there was little green space. Brad lived in an Irish city for twelve months and was asked if he thought living there had made any difference to his health. He was

also asked whether he had thought about this issue before or whether his response was influenced by the fact that he had just been asked about it.

I definitely made the link then. The housing in [Ireland] was very hard to come by so we pretty much had to take what we could get. ... Within a couple of months I just found I was, not getting depressed, but certainly just wasn't really happy with the situation and I could tell it was because I wasn't ... because I'd grown up at the beach and you know, just lived outdoors pretty much my entire life ... and being removed just from an outdoor environment and being made to be indoors all the time because of the climate and the surrounds was quite a shellshock so...

[In Dublin] I just found that I was becoming just quite down, not depressed but certainly not as happy as what I am here ...and the happiest that I was over there was when we were actually out ... in the countryside ... It was very hard to put my finger on but I just didn't feel as energised and sort of full of life, I suppose, not having that natural sort of element.

Anya recently moved to Perth from the United Kingdom. She spoke about living in London while she was completing a postgraduate degree.

Quite sort of displaced and I know other people who've said, speaking about living in London, that there's a feeling that you feel quite disconnected and I know that there will be more to it than just green spaces... Like you've lost your roots, sort of thing, I mean living in a city like that, it's different because you may not have a sense of community and you know, lots of people who are transient and you don't have relationships. So there's more to it probably than just the green space but I don't know ... just surrounded by traffic and concrete, you just feel worse, well I felt worse in those sorts of environments.

Fiona had also lived in London for some time and made regular visits to large parklands surrounding the city. When Fiona was asked what it might feel like if she did not have access to green spaces, she spoke about visiting a Polish city.

I think it would be very claustrophobic ... I went on holiday to Poland ...and there was no parkland at all. And it was very oppressive. It was hot and I remember wanting to get out of there but not knowing where to go ... Often parkland area is restful, a regeneration, and oh it was just awful ... there were no birds, no trees outside, it was just awfully oppressive ...

Mary, Eleanor, Fiona and Sarah all mentioned having family properties outside of the city. For Sarah, this was particularly important as besides providing a safe place where her children could play, the family farm and holiday home were places she felt she could relax. When asked where she went to relax when she was at home, her local options were limited and she spoke of having to leave the neighbourhood.

Probably the park bench, yeah, and even that would be a bit like ... (pause), a bit of a non-event. ... If we didn't have [holiday home] and the farm and I really needed to really go somewhere and relax, it wouldn't be the park, unless it was a

five-minute relax. If I wanted to go for the day somewhere and relax, I'd have to drive somewhere. I don't know where that would be but ...I wouldn't want to stay in the house all day. I'd want to get out. Yeah.

Green spaces provided opportunities for relaxation and psychological restoration. Perhaps most importantly, green spaces provided relief from stress. Matt and Toni found spending time outdoors to be “calming” and “stressless”. They enjoyed having space in their backyard to watch children “run around outside, they have a great time”. Tash spoke about feeling less stress when in bushland and was asked to explore those feelings.

If you can listen outside and hear birds and wind as opposed to cars and traffic and all that sort of stuff, it does make you feel less stressed. Just to know that you've got somewhere that you can go if you need to get out in nature, that there's a lot of available space to go and do that is also less stressful because it's sort of reassuring that you've got somewhere to go... some nice bushland to walk around in if you wanted to. It's hard to explain, it's just ... it just makes you feel... yeah when I say 'nice' I would probably say ... more relaxed and sort of just healthier thinking that you're breathing air that has not got so many cars and people in it, and more trees in it, you just feel like you're healthier being surrounded by that.

Andrew felt being in bushland gave him a greater sense of well-being than being in other recreational environments.

I think that there, I think it's relaxing, yeah it does generate a few different emotions – relaxing is one of the major ones of it, a sense of well being, just the freshness of it and you actually think that you're doing something good for yourself instead of going into another pub or bar (laughs).

Amber's comments have already said much about what it is like to live in a neighbourhood with fewer green space options. When asked how she felt about where she lived and whether not having a place to walk in her neighbourhood had affected her health, she replied:

Um ... I don't think my mental state is drastically different ... I think I'm fairly mentally stable ... I'd say I probably am not as happy living here as I was [when we lived in our last neighbourhood] although I'm happier that we own the home here ... so I'm more satisfied with my house and immediate surroundings but not as happy in the community ... I would like [to have somewhere to walk] and I have certainly been thinking with the second child coming along that I probably need to make more time to do something for myself and relax ...

Green spaces as places for connecting people

The idea that green space may contribute to social interaction and feelings of community connection is well supported in the literature (Coley *et al.*, 1997; Kim &

Kaplan, 2004; Kuo, Sullivan *et al.*, 1998). When Tash was asked to describe the kind of neighbourhood that she thought would be healthy, her response focused on including green spaces where people could interact and spend time together.

Umm ... just to have lots of bush areas allocated to keep as bush and then to have parks for the kids to play their sport in, and to sort of see lots of people out and about on weekends having picnics in parks and things, that's what I would imagine and that is what it is like around here. Like Neil Hawkins Park and along the lake here, there's always people out and about doing things and it's always green ...

In Sarah's neighbourhood the local park was regularly used as a community meeting place in summer.

People with their dogs and with kids, in the evening sometimes people go out there in summer and take drinks out there and have a chitchat with the neighbours in the park and then all wander on home for dinner. It's nice. ... It wouldn't be the same if we didn't have it, definitely, it would feel different.

Adam also saw the local parks in Ashby as important community places – especially for people with children and dogs.

I think it would be a good meeting place especially if the people were with children because the children tend to congregate in those parks and that would draw the rest of their parents and I suppose the community a little bit closer, so you could meet people and get a bit of a social network going ... and then meet other people within their communities. I suppose if they weren't there, the kids would just be playing in the streets or what not. And I think it's good for the animals as well I suppose, people who have got pets go there.

Green spaces for dogs and children were mentioned several times. Chloe said:

It's a place for all ages to get out, walk, exercise, socialise, play sport. [And] for me it's a place to walk the dogs!

Michael rode to and from his Subiaco workplace each day and often noticed children playing in nearby parks.

There's always a parent or grandfather or whatever, playing with kids on the swings in different areas. That's what I see every morning and every night when I come home.

Michael also spoke of using parks less often now that his children were grown.

When the kids were younger, I used to do that. Umm... and for birthdays when our kids were younger, but now I'd only use the park, or my kids would use it if they wanted to throw a ball around and uhhh... every now and then, I might want to go and sit down and have a picnic, once a year with my girlfriend, I might use the park ...

William and Charlie spent a lot of time in their private gardens and spoke of rarely visiting public green spaces except for family gatherings. This was not the case for other interviewees as most regularly visited nearby public green spaces. Brad stated that he felt good when he was around other people at the park and offered this observation of a typical summer morning in the main park in Subiaco Centro.

There's lots of people, I think that's probably just because it's got a fairly high density of housing around it so a lot of people use that as their green space because they don't have spaces like this around their house ... In summer, I'd say there would be almost a hundred people at any time of the morning walking dogs and that sort of stuff. ... You see the same people running in the morning and the same people walking their dog and you always say good morning ... and that's a nice start to the day.

It gets really busy and it's really friendly ... which I suppose is another reason why people are sort of drawn to those things and they make people feel good so you feel good around people feeling good.

Luke regularly exercised in the early morning and enjoyed meeting other people that he knew.

At Rosalie Park at 6.30 in the morning, I'm amazed at the number of people that I see that I know, exercising or walking around the park, or playing with the dog ... who that I now stop and talk to ... So I think it's promoting more opportunity for people to interact ... it helps you form a pretty good sense of care and compassion, knowledge of people and comfortableness in knowing that there's people around you all the time that you know or ... that you've met before.

In Wanneroo, Tash often walked alongside the lake with her mother. She liked the fact that she often saw the same people and felt a casual, friendly relationship with them.

We see the same people and it's really nice to think, 'I wonder if whatever her name is going to be, is going to be out with her dog this morning' and then we see her and we have a little chat. I'm sure if we saw her at the shops we'd stop and say hello and I suppose relationships could sort of build from there. I think it definitely brings a community together [when] you get out regularly and see the same people. ... I think it's nice. I think it's nice to walk along and people say hello to you. Like I've walked in other areas and people just walk along with their heads down, but in this area everyone says hello and yeah, are friendly. I don't know if that's to do with the green space here, I don't know why it is ...

The importance of local parks as a place to interact with others was mentioned by almost all of the interviewees. More statements included:

Well that's just where you will just ... bump into a neighbour and get to know them ... if they're sitting there watching their kids, you can sit there and watch your kids with them and get to know them... so I think [parks are] important to get to know neighbours and people in your area. (Leanne)

When you go to a green space you will see the same people you know and eventually you make eye contact and you have a chat and you interact with them and find out that they are actually living in the same apartment block and things like that. (Andrew)

I have had a good six or seven years going down there regularly in the morning and there is a sense of community ... everybody knows everybody else. We know each other by name, we know our dog's names and this sort of thing and, 'oh haven't seen so and so for a while'. (Mary)

Jess also saw parks as meeting places and particularly liked how these relationships were casual: you could speak with others if you wanted to or you could choose to spend time on your own.

I suppose it's very often a meeting place ... The mothers sit chatting even if they've never met before, the children are all climbing all over everything and playing and then everybody goes their separate ways. So it's a kind of meeting place, it's a community sort of thing ... There's no ties ... it's not like a social setting, you speak to someone if you want to, you walk away when you want to... it's very open, you walk past and don't speak to people if you don't want to. ... So there is a sense of kind of community in park places.

Adam spoke about the bushland area across from his house in Ashby and its role in generating interaction and involvement between neighbours.

I think it does get people out of their houses and it gets people talking to each other and I think people want it there, it's something that is nice to have ... and I would say if they ever tried to take it away, there would be a lot of fighting from the residents to try and keep it because it's a lovely thing to have, and it's a shame and we don't have enough of it. I think it's nice to have these pockets of natural bushland. It keeps the animals around, we get the birds, the wildlife, we get a lot of spiders but that's ok (laughs). I don't know, I just think it's nice to have it to look at and be able to involve yourself in.

Public green spaces were seen as a community resource and played a role in engendering feelings of social connection. Apart from providing places for physical activity, restoration and relaxation, they were often a focal point for community interaction and observation. While all interviewees were able to make connections between green space and their health, I was also interested in exploring whether people felt their neighbourhood as a healthy place to live. The next section of this chapter explores interviewees' responses to questions about green space and healthy neighbourhood surroundings, maintaining green spaces, and whether they believed that living in greener surroundings made a difference to their health.

Healthy neighbourhood surroundings

When the interviewees were asked whether they thought there was a relationship between green space and the quality of their neighbourhood surroundings, most found this question difficult. They were conscious of their own health status but very few had thought about whether the place where they lived was healthy.

In one of the pilot interviews, I asked Sarah what it might be like to live in her neighbourhood if there was no green space around her home. She responded:

Probably feel a bit depressed, claustrophobic. I reckon even if ... I think it would be psychosomatic. Even if the air was exactly the same, you'd feel like it's more polluted. There is something about having green space and trees that make you feel like the air and the environment itself is cleaner and healthier to be living in.

Sarah was then asked if she thought her neighbourhood was healthy, and if there was anything she could do to make her neighbourhood healthier. She responded:

I don't think it's unhealthy. I don't think it's ideal ... ummm ... I'm so bad at this kind of thing. Yeah but problem solving, what is somebody going to do about it, that's like I don't know, someone else can think about these things, someone that knows about these things. (Long pause). Ummm Oohhh ...

As Sarah struggled with this question, I prompted her to reflect on statements she had made earlier about liking to see trees and asked if maybe having more trees meant the neighbourhood might be healthier.

Yeah there's trees. I don't know how big they are going to grow. I think things like that, make it healthy. Though I suppose, what do I mean by healthy? Ummm. I don't know ... I think as much natural stuff as possible ...

In subsequent interviews I began this discussion by asking if people thought their neighbourhood was a healthy place to live. This seemed to be an easier concept to grasp though most people still found it was difficult to answer. Amber readily admitted she had not ever really thought about that aspect of living in her neighbourhood.

I think it's ok, I've never really thought about it to be honest, whether it's a healthy place to be. I think it's ok, there is the natural bush land right near us and there are parks and things and all the main streets have a lot of trees and things, so I don't feel like it's terribly barren compared to some places.

The presence of trees appeared to be the most consistent measure of whether or not a neighbourhood was considered to be a healthy place to live. Trees and natural settings were strongly associated with fresh air by several interviewees in both inner and outer suburban neighbourhoods.

While there are trees and things making oxygen for us, it must make a difference ... they purify the air don't they, I mean they turn carbon dioxide into oxygen so they must have some effect ... They must be there to purify the air and if you had great spaces with no parks, it would make a big difference. (Jess)

Well I think it for me, it means just fresher air, I don't know, I look at trees and that's what I think, they're cleaning our air... ... Well you know there are pockets of trees everywhere so I guess that's what I think. (Leanne)

Tash spoke of her health and how she felt about living in an inner city area compared to her current home in Wanneroo.

One time I lived in [an area where] there were so much traffic fumes ... and that's actually why I moved out ... Now, I probably did feel a little bit better but it wasn't hugely different but still, having said that, I do think the cleaner the air, the more trees, and the less traffic I guess more than anything ... I definitely think it would be healthier, better health-wise to live in a more natural setting.

Mary remembered that when she first moved to Wanneroo, she could smell the bush when she got up in the morning. She was also very concerned that increased traffic was contributing to poorer local air quality.

When we first moved here it was much fresher. You can still notice when you get to a certain hill going south you can see the smog over the city but it's less noticeable and that's why I think we're getting to have more pollution here. I'm sure the cars are responsible for more pollution than anything else ...

Gordon also felt trees combatted pollution – an important consideration in an area with high traffic. When he asked what he would like to see in a healthy neighbourhood environment, he replied “more trees ... and less traffic”.

A different tree-related issue for interviewees living in new neighbourhoods was heat. With few large trees, there was very little shade and residents relied on air-conditioning. With no trees or shade in the yard space around Amber's home, she did not allow her daughter to play outside. William's house in Ashby was one of only a few that had large trees. These trees were planted after his family had cleared the land for market gardens and he expressed regret for what had been done.

We just cleared ... huge stumps and some big trees. ... We were a bit young and stupid then so we treated every tree ... should have left some [big trees] ... I regret doing some of the total clearing ... When we cleared every tree, it was like 'oh it's hot out here'. Where with the trees we could sit underneath the shade? We were dying of heat, so we ended up planting a few trees at the front.

When asked whether Wanneroo was a healthy neighbourhood, the loss of green spaces due to surrounding residential development was mentioned by several interviewees. Chloe and Tash felt that retaining bushland and stopping green spaces being bulldozed for more housing would help maintain the health of their neighbourhood.

Questions about how to maintain the health of local green space produced varied responses. Chloe spoke of local waterways and bushland staying healthy simply by being left alone.

But I guess the lake sort of looks after itself really because nobody really interferes with it. The little duck pond I'm not so sure about because there's a drain running in there and people throw things in it and clogs up the waterworks ...so that doesn't take care of itself ... and I think the bush if let alone is alright.

Before Adam gave this response, he admitted that he had thought little about whether the area was healthy.

I really don't know ... it's nice, lovely to see the kangaroos and the kookaburras and everything in there. ... It's definitely a healthy piece of bush. It's got no dramas and it's growing and you can see the fires have been through and got it going again and it's definitely a healthy bit of bush, there's no sort of dead patches, it's fairly dense and healthy and there's heaps of animals in there: loads of kangaroos and lizards and stuff and snakes. But yeah it's definitely a thriving ecosystem I suppose, definitely all seems to be working in there.

In new neighbourhoods, the approach to maintaining manicured green spaces was entirely different. These areas required regular care. When Sue was asked how she thought the parks and other green spaces in her Subiaco Centro neighbourhood stayed healthy, she responded:

What, the park? Well that's maintained by the council. ... I guess it's always looked after and I know that they, the Council, come in and in effect, they are gardeners because they will fertilise the hedges, they throw the fertiliser around, they fertilise the plants, they trim them, they weed them, they remove the graffiti, they care for it.

Eleanor also commented on how well the local council maintained green spaces in Subiaco Centro.

I'm very impressed with the way Subiaco Council or whoever looks after the whole area here, they're always out, just about every morning they're running around in their little trucks, you know doing things and checking things out and weeding, it's amazing. It's very well kept.

Sarah was concerned that the level of care that was currently maintained by the developer in her new neighbourhood would not be continued once the estate was completed.

I've thought about what's going to happen when [the developer] stops looking after that park any more 'cause I'm sure they don't intend to care for that park and manicure it for the next hundred years. And so who's going to do that when they stop?

Tash acknowledged that often, the health of neighbourhood green spaces was simply taken for granted.

I must admit I probably don't think about that, that much but probably do take it for granted a bit. But it is important that we do look after it because if it all dies off or whatever, it's not going to be there.

Discussion

Several issues relating to understandings of health emerged during this study and how people perceived and assessed their own health became a particular point of interest. As discussed earlier in this chapter, there was some indication that survey respondents considered their physical health more than their mental health when assessing their general health status. In many ways, this was mirrored by interviewees, as when asked about green space and their health, most first responses made connections between green space and physical activity. It was only when prompted that most interviewees began to consider how time spent in green space might affect how they felt psychologically and emotionally, not just physically.

In the SF-36v2™ survey, general health was measured by asking respondents to provide an assessment of their health expectations and to compare their health status to that of others. Vitality (well-being) is measured by asking respondents whether they feel full of life and had energy, or feel worn out and tired and mental health status is measured by responses to questions about levels of anxiety, depression, loss of control and psychological well-being. These types of questions are more likely to generate emotive, subjective responses than questions relating to physical function, where respondents were asked specific questions about what they were able to achieve physically.

In light of the subjectivity of psychological assessment, some questions were raised about whether the findings of this study might carry greater weight if green space variables had been found to exert most influence on more objective measures of physical function, rather than on more subjective measures of psychological health. However, the definition of health adopted by the World Health Organisation (1948) is holistic in approach and includes aspects of physical, mental and social well-being in determinants of health. Within the context of this study, all of these aspects were given credence. What became very clear in interpretation of results was that while there was some evidence of association between neighbourhood green space and physical health and function, access to useable green space had far greater positive effect on perceptions of general health, vitality and mental health.

Exploring differences between health outcomes in each neighbourhood was an important aspect of this study. In relation to attitudes to nature and perceptions of green space quality, neighbourhood location accounted for significant differences in results. This variable did not appear to influence health outcomes to the same extent though it was found that neighbourhood location was a significant predictor of better general health. Despite logistic regression models adjusting for age and income, it is difficult to disregard the potential influence of these determinants on self-reported health. Perceptions of neighbourhood quality have been found to have a significant effect on self-rated health with residents in lower income neighbourhoods more likely to report their health as fair or poor (Collins *et al.*, 2009). Respondents in the new neighbourhoods of Ashby (the neighbourhood with the youngest age group) and Subiaco Centro (the wealthiest neighbourhood) were two or three times more likely to report better general health than Wanneroo respondents who, on average, were older, reported lower income than respondents in other neighbourhoods, and fewer had initially assessed their health to be very good or excellent (Table 7.2).

Interviewees were not directly asked about their health status, though most offered this information during interview. In general, there was little to differentiate health status between neighbourhoods, with older interviewees in all neighbourhoods describing more chronic physical conditions, such as heart disease or mobility issues. In relation to mental health, female interviewees from three neighbourhoods (Ashby, Wanneroo and Subiaco) spoke of ongoing emotional issues but these were more related to personal

circumstances rather than specific neighbourhood setting. However, there was some indication that landscape changes within neighbourhoods, lack of access to useable green spaces and lack of neighbourhood social interaction, did affect health status for some individuals.

When all data were taken into account, no matter where people lived, retention of green spaces and bushland, proximity to parks and social green spaces, perceptions of green space useability, how often people visited nearby green space, and involvement in conservation activities were all found to predict better self-reported health outcomes, particularly in relation to general health and vitality (well-being). In turn, people who enjoyed spending time spent in nature and lived near diverse green spaces, trees and bushland were most likely to report positive perceptions of useability, attachment, and care about environmental issues. It also seems that perceptions of not having enough public green space in a neighbourhood are detrimental to developing feelings of attachment and care about environmental issues. Integration of the qualitative data assisted interpretation and understanding of these results. Relationships between these factors are explored in more detail below.

Within the quantitative data analysis, retention of green spaces and bushland positively influenced physical function. From this finding, it could perhaps be assumed that respondents who thought areas of green space or bushland were being retained in their neighbourhood were more physically active. This assumption was supported by the interview data where analysis revealed links between being more physically active and proximity to larger areas of bushland and other natural environments. It is also supported by findings in other studies that access to large, attractive parks and green spaces was associated with higher levels of walking and physical activity (Bedimo-Rung *et al.*, 2005; Giles-Corti *et al.*, 2005). Interviewees who lived in Subiaco and Subiaco Centro spoke of regularly visiting Kings Park or Lake Monger, walking through local parks, and using shaded streetscapes as connective routes to different places in the neighbourhood. In Wanneroo, Lake Joondalup was a popular destination with most interviewees regularly using the walking and cycling paths along its edge.

This was not the case in Ashby where interviewees complained of limited space and accessibility of neighbourhood parks and bushland and the lack of opportunity for

physical activity within local green spaces. The bushland area adjacent to this neighbourhood was fenced, had few entry points and was considered by most interviewees to be unattractive and uninviting. Other parks in the neighbourhood were described as small or boring. It was also noted that in terms of neighbourhood connectivity, there were no walk or cycle paths, few footpaths, hardly any street or garden trees, or any other facilities that encouraged residents to walk around their neighbourhood.

The proportion of Ashby respondents who regularly visited neighbourhood green space and the level of enthusiasm expressed by interviewees in regard to visiting local green spaces, was substantially lower than any other neighbourhood. While Ashby respondents did score highest for almost all physical health outcomes in this study (Table 7.6), this result may be more strongly influenced by their younger age (Crouchley, 2007) than where they live. These results would predict that as residents in this neighbourhood age, long-term health problems associated with lower levels of physical activity, exacerbated by perceived lack of access to nearby areas of green space and bushland may become more evident.

Apart from physical health benefits, positive effects relating to mental health and vitality were also associated with proximity to play and social spaces and how often people visited nearby green spaces. Again, this observation was supported by the findings of previous studies where casual social interaction that occurred either on the way to, or within parks, positively influenced self-reported mental health (Sugiyama *et al.*, 2008). In addition, most interviewees described how they felt happier when they visited nearby green spaces, with those spaces providing opportunity for escape, relaxation and personal time, casual social interaction, and socialising with family and friends. These factors can be associated with well-being (Korpela *et al.*, 2008) and perceptions of green space useability were significant in predicting general health and vitality.

Subiaco Centro respondents scored highest in relation to proximity to play and social spaces, green space useability and mental health outcomes (Table 7.6). Interviewees described the neighbourhood atmosphere as vibrant with access to a great number of community facilities and services within walking distance. Again, it was Ashby

interviewees who gave less enthusiastic descriptions of their neighbourhood surroundings, were most concerned by the lack of “useable” green spaces and more often spoke of feeling socially isolated within their neighbourhood. Ashby respondents recorded the lowest overall component scores for mental health (Table 7.6) and while younger age, living as a family with children (Ross *et al.*, 1990) or mortgage commitments (Nettleton & Burrows, 1998) may play a role in determining mental health outcomes, lower scores in Ashby may also be associated with lower scores in relation to proximity and perceived quality of neighbourhood green spaces. As discussed in earlier chapters, the presence of green space is being increasingly identified as an important pathway to generating feelings of well-being (O'Campo *et al.*, 2009) and that positive or negative perceptions of neighbourhood quality can significantly influence self-reported health (Bowling *et al.*, 2006; Collins *et al.*, 2009).

Overall perceptions of neighbourhood quality, coupled with lower incomes, may explain why Wanneroo respondents recorded the lowest scores in some mental health domains. Despite scoring relatively well with regard to perceptions of green space quality and overall mental health, mean ranked scores for social functioning, emotional role and vitality for Wanneroo respondents were lower than any other neighbourhood (Table 7.6). While Wanneroo interviewees generally spoke very positively about local green spaces and their connections to natural environments, several negative issues relating to neighbourhood safety were raised. In addition, a great deal of change had occurred in the surrounding landscape through clearing of bushland and redevelopment of market gardens. Wanneroo respondents scored highest in ecocentric attitudes to nature (enjoying spending time in nature and feeling sad to see nature destroyed) and registered the greatest level of current involvement in conservation activities. It may be that lower scores for social and emotional functioning and vitality reported in this neighbourhood are consistent with feelings of solastalgia, defined as “distress caused by environmental change” (Albrecht, 2005; Albrecht *et al.*, 2007, p. S95).

Respondents who cared most about environmental issues and expressed interest (though not necessarily involvement) in conservation activities, reported better general health, overall physical health and vitality. Previous research on benefits associated with involvement in conservation activities supports this observation with volunteers reporting better general health (Moore *et al.*, 2006) as well as psychological benefits

associated with doing something meaningful, spending time in nature and working with others (Miles *et al.*, 1998, 2000). There is little in the qualitative data that assists to explain this finding as none of the interviewees were currently involved in conservation activities and perceptions of links between individual health and caring about environmental issues were not well articulated. Perhaps there is a link between caring for self, caring about environmental issues and getting involved in caring for natural environments that deserves further exploration.

Another issue that emerged from the qualitative data related to perceptions of the health of neighbourhood surroundings. While the survey data asked about perceptions of green space quality, there were no questions that asked specifically about overall perceptions of neighbourhood surroundings. Interview data, however, indicated that the presence of trees was strongly related to perceptions of a healthy neighbourhood. In general, trees were associated with better air quality and less pollution, as well as providing shade and improving the aesthetic appeal of the neighbourhood. Much of the literature on healthy neighbourhood environments focuses on built aspects such as pedestrian access and community connectivity (Frumkin, 2006; Frumkin *et al.*, 2004; Sturm & Cohen, 2004). A growing body of literature suggests that trees and green spaces improve urban environments through temperature modification, absorption of pollutants and stormwater management (Fam *et al.*, 2008) and contribute to healthier, more vital neighbourhoods (Barton & Grant, 2006; Barton *et al.*, 2003; Girling & Kellett, 2005). It is also suggested that retention of green spaces needs to be a primary consideration in urban design and receive attention in the early, rather than later, stages of neighbourhood planning (Cannavo, 2007; EnviroPlanning, 2009; Low *et al.*, 2005).

Overall, it seems that proximity to useable, well-cared-for green spaces does positively influence perceptions of health, particularly general health and vitality. This finding supports the notion that people who enjoy spending time in nature, and regularly visit favoured nearby green places will gain health benefits from improved psychological restoration and relief from stress, and increased physical activity (Korpela *et al.*, 2008). From a physical health perspective, access to good quality green space encouraged activity, and as reported by interviewees who exercised regularly, whether walking, cycling or working in their garden, green spaces were their most preferred places to be active. In relation to mental health outcomes, time spent in green space promoted

relaxation and restoration and people reported feeling happier. Perhaps as importantly, visiting green spaces resulted in casual social interaction that promoted feelings of social connection and belonging within neighbourhoods. Access to nearby green spaces that provided a variety of experiences and opportunities was considered by most interviewees to be an essential aspect of maintaining better health.

Entwined in this exploration of relationships between green space and health was analysis of attitudes to nature and natural environments, green space preference and perceived attractiveness of particular types of green spaces. As discussed in previous chapters, individual attitudes and preference strongly influenced perceptions of green space useability and the importance of these connections between green space and health is explored in more detail in the following chapter.

Chapter 8: Health and the nature of neighbourhood green spaces

This research project explored relationships between attitudes, perceptions and attachment to nature, green spaces and neighbourhood as determinants of self-reported health. In this final chapter, I attempt to integrate quantitative and qualitative findings and explore what can be said about relationships between green space and health. I conclude with an overview of key findings, and their application to health promotion, neighbourhood planning and conservation initiatives.

Self-reported health, attitudes and perceptions of neighbourhood green space

The first research question posed within this study sought to identify relationships between self-reported health and factors relating to attitudes, perceptions and attachments. This question was:

Do measurable or identifiable relationships occur between attitudes to nature and natural environments, perceptions of proximity, diversity and quality of neighbourhood green space, or attachment to neighbourhood and self-reported health?

In general, two patterns of relationships between attitudes to nature, perceptions of green spaces and neighbourhood attachment emerged from the data. People who expressed strong emotional connection to, and care about, nature and natural environments were more likely to be aware of greater diversity in relation to nearby green spaces, were more likely to regularly visit those areas, and to identify a favourite area within their neighbourhood. They were also more likely to care about local environmental issues. Several people spoke at some length about their enjoyment of nature, the diversity of places within their neighbourhoods, the contribution green space made to neighbourhood aesthetics, feelings of cultural and historical continuity, and personal connections to both local people and places. Many who described emotional connections to nature also spoke about choosing their home because of neighbourhood surroundings, particularly the presence of trees and private garden space.

People who expressed less emotional connection to, or care about, nature were less aware of the diversity of green spaces within their neighbourhood, more likely to be selective about the type of green spaces they visited, with stronger preference for areas they regarded as aesthetically pleasing, managed, manicured and inviting to people,

rather than nature. Interviewees who expressed least interest in nature or conservation were more likely to also communicate feelings of fear and anxiety about visiting natural environments, or about danger associated with having natural areas near their home. For this group of interviewees, access to green space was not an important consideration in neighbourhood choice. Other characteristics of their neighbourhood, such as proximity to services or facilities, family connections, or the opportunity to purchase a new home were more important considerations.

These observations support literature that suggests that people who were interested in nature and regularly visited nearby favoured places were more likely to gain benefits than those who had little experience of spending time in natural environments (Korpela *et al.*, 2008). Other research also suggests that people living in neighbourhoods with natural features and open spaces are more likely to be connected to their community (Kim & Kaplan, 2004). This literature, and the patterns identified above, suggests that people with the strongest connection to nature are likely to be healthier as they are less stressed, more physically active, have a greater awareness of local environmental quality and are more connected to their local community. However, this was not necessarily so and what became evident in the findings of this study was attitude to nature *per se* was not directly related to self-reported health. It was perceptions people held of the useability, diversity and value of their neighbourhood green spaces that most influenced self-reported health (Figure 8.1).

In many ways, diversity was a key aspect in perceptions of neighbourhood green space useability and value. At one level, access to diverse neighbourhood green spaces provided a range of cultural ecosystem services that could meet the needs and expectations of a greater number of people within a community. At a second level, private and public neighbourhood green spaces provided material ecosystem services such as space to grow a garden or shady trees that assisted with temperature mitigation. Green space preference also played a substantial role in determining what constituted useable, valued green space.

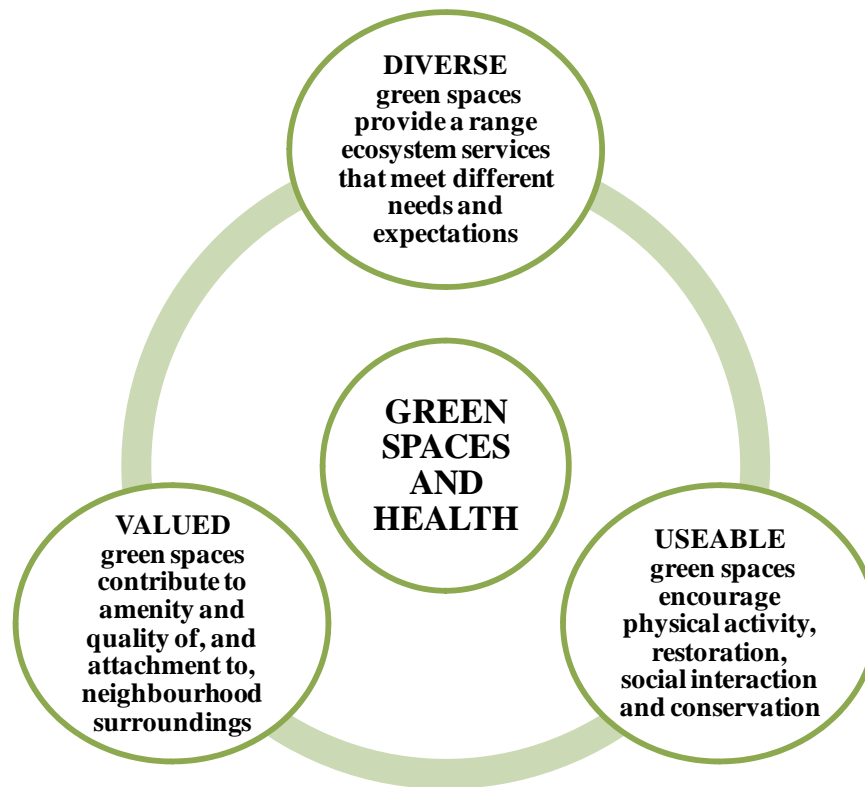


Figure 8.1: Diverse, useable, valued green spaces contribute to better health outcomes

As discussed in Chapter 6, green space preferences described by interviewees stretched along a continuum of perceptions of orderliness and human intervention that matched individual choice in levels of coherence, legibility, complexity and mystery (as described by Kaplan & Kaplan, 1995). In this study, people who expressed strong connections to nature and natural environments identified a broader spectrum of useable green space with more diverse environments, than those who did not. With regard to bushland and other natural environments, some people considered relatively undisturbed areas with little evidence of orderliness or human intervention highly useable, while for others, these places were unsafe areas to be avoided. People who avoided more natural areas preferred places that demonstrated high levels of orderliness and human intervention and they sought green spaces with formal pathways and facilities, such as picnic tables and seating that sent a clear message that people were welcome.

Positive perceptions of green space useability emerged as the strongest single factor in predicting relationships between green space and better health. Based on the quantitative analysis, useable areas were considered to be in good condition, provided

opportunity for physical activity, relaxation and social interaction. However, these parameters do not fully define useable green space. Some people also considered it important that green spaces were seen as *useful* as much as *useable* and they spoke of the fundamental value of these areas in providing habitat and material ecosystem services. By including this definition, categorisation of useable green spaces may also then incorporate areas retained for conservation purposes, and those providing material, as well as cultural, ecosystem services³.

Diversity and useability strongly influenced perceptions of valued neighbourhood green spaces. Similar findings emerged from prior research examining public attitudes to naturalistic versus designed landscapes, with appearance and utility being important factors in determining whether green spaces were a valued part of the neighbourhood surroundings (Ozguner & Kendle, 2006). In this study it was apparent that people visited different types of neighbourhood green spaces for different purposes and valued places that met their expectations of preferred appearance, amenity and utility. How personal preference and perceptions of green spaces might influence health outcomes is explored further in response to subsequent research questions.

The influence of social and environmental determinants

The second research question posed within this study explored whether differences in relationships could be attributed to social or environmental determinants. This question was:

Is there significant difference in measurable or identifiable relationships [between attitudes to nature and natural environments, perceptions of proximity, diversity and quality of neighbourhood green space, or attachment to neighbourhood and self-reported health] based on socio-demographic factors or neighbourhood type and location?

There is a substantial literature that explores relationships between each of these variables and the context and relevance of that literature to the results of this study are discussed in previous chapters. To provide an adequate response to this research question, it is appropriate to revisit the most significant findings here.

³ Refer Figure 1.2 (p. 6) for depiction of relationships between material (supporting, provisioning and regulating) and cultural (aesthetic, spiritual, educational and recreational) ecosystem services and health.

In this study, gender, age and educational qualifications had some influence on quantitative results relating to attitudes to nature and natural environments. Females scored higher in relation to enjoying spending time in nature, feeling sad to see nature destroyed and caring about environmental issues. People with the highest weekly household income (\$1500+) recorded lower scores for enjoying spending time in nature and feeling sad to see nature destroyed, though people with more educational qualifications (in this case, a post graduate degree) scored higher with regard to care for environmental issues. People who had lived in their neighbourhood for longer periods of time (>10 years) recorded the highest scores for feeling sad to see nature destroyed. These findings are supported by several authors who report that women tend to express stronger emotional connections to nature (Milton, 2002); that age, education and income appear to have some influence on attitudes to environmental issues (Dunlap *et al.*, 2000); and that the experience of seeing extensive change occur in living environments may evoke feelings of sadness (Albrecht *et al.*, 2007).

People who lived in the established neighbourhoods of Subiaco and Wanneroo recorded higher overall scores for enjoying time in nature, feeling sad when it was destroyed, caring about environmental issues and being involved in conservation activities. These observations were strongly supported by the interview data. Interviewees in established neighbourhoods were best able to articulate how they felt about nature and natural environments, particularly areas adjacent to their neighbourhoods. They voiced strong emotional connections to natural environments and most concern about environmental issues, and were more likely to have been involved in some form of conservation activity than people who lived in new neighbourhoods. Again, there is some support for these findings in the literature with one study reporting that residents in new neighbourhoods had significantly less knowledge or concern about environmental issues than those who lived in more established residential areas (Youngentob & Hostetler, 2005).

Weekly household income and educational qualifications were the only socio-demographic variables to substantially influence perceptions of green space proximity, diversity and quality. Neighbourhood location accounted for the greatest amount of variance in perceptions of green space with respondents in established neighbourhoods recording higher scores for proximity to private gardens with trees, sports and

recreational facilities, retention of bushland and other green spaces, having enough space, identifying a favourite area of public green space and regularly visiting nearby green spaces. Several studies have noted that newer residential developments are designed with less private garden space than older neighbourhoods (Hall, 2007; Seddon, 1997) and that less bushland is being retained, particularly in new peri-urban developments (EnviroPlanning, 2009; Grose, 2009; Low et al., 2005).

Respondents in more affluent inner suburban neighbourhoods recorded the highest scores for proximity to parks and social spaces and green space useability, and for neighbourhood attachment. As discussed in earlier chapters, access to community facilities and services and the attention paid to green space design and maintenance in inner suburban neighbourhoods, particularly Subiaco Centro, may have influenced this result. A number of studies have identified substantial differences in the quality and design of facilities in public open space depending on socio-economic status within neighbourhoods (Coen & Ross, 2006; Crawford *et al.*, 2008).

Variation in findings relating to perceptions of neighbourhood green space was most evident in Ashby. Survey respondents living in this neighbourhood scored lower than other respondents for almost all factors relating to perceptions of green space proximity, diversity and quality, and neighbourhood attachment. Again, these observations were strongly supported by the interview data. In the main, interviewees in Ashby were less enthusiastic about living in their neighbourhood and often drove out of the neighbourhood to access areas of green space. Several also stated that their choice of neighbourhood was based primarily on financial considerations. If they could afford it, they would prefer to live in a neighbourhood with more community facilities and services, a stronger feeling of community connection, and more useable green spaces. This was not the case for interviewees in any other neighbourhood. All other interviewees spoke enthusiastically about at least one aspect of living in their neighbourhood, with inner suburban interviewees being most positive, particularly in terms of access to facilities and services and community interaction. Some Wanneroo interviewees mentioned concerns relating to the behaviour of their neighbours, yet none expressed a desire to live elsewhere.

With regard to self-reported health, analysis of the quantitative data demonstrated that age and income were the two most consistent predictors of health status and this finding replicates much prior research (Wilkinson & Marmot, 2003). As also found in previous research, social environment and neighbourhood characteristics were important determinants of participants' reported feelings of neighbourhood social interaction, networks and connection (Bush & Baum, 2001). In this study, feelings of belonging demonstrated positive (though not statistically significant) effect on self-reported health.

There appears to be little variance, however, in self-reported health outcomes that can be directly related to neighbourhood location. Some variance, however, can be indirectly attributed to characteristics associated with age and income of residents and access to community services within each neighbourhood. Differences in physical health outcomes were noted between older Wanneroo respondents and those in all other neighbourhoods. Higher scores for mental health outcomes in Subiaco Centro may be associated with higher income and better access to community services and facilities. The opposite position was apparent in Ashby where lower mental health component scores, a lower level of neighbourhood satisfaction and less proximity to community services and facilities, including green space, was observed. As reported in research on social capital and mental health (Almedon, 2005), lack of access to community services and facilities may correspond with lower feelings of belonging reported in Ashby and contribute to poorer mental health outcomes. In contrast, study participants in Subiaco and Subiaco Centro had the best access to community facilities and expressed the most positive perceptions of green space quality and the strongest feelings of belonging.

Whether specific attitudes to natural environments or perceptions of green space might influence self-reported health is less well described in the literature. In this study, proximity to play and social spaces, retention of green spaces and bushland, green space useability, visiting green spaces more than once per week, caring about environmental issues and interest in conservation activities were all identified as significant predictors of better self-reported health. It appears that no matter where people live, the combined influence of positive attitudes towards nature and natural environments, positive perceptions of proximity, diversity and quality of neighbourhood green space and positive attachment to neighbourhood will result in better self-reported health. The specific characteristics and attributes of green space that most influence individual

perceptions of health are discussed in more detail in response to the third research question.

Green space and perceptions of health and healthy places

The third research question posed within this study examined the role neighbourhood green space played in determining perceptions of health. This question was:

What importance do people attach to neighbourhood green space and what part does green space play in influencing residents' perceptions of their health and the health of their neighbourhood surroundings?

One illustration of the relationship between living in preferred neighbourhoods with diverse green spaces and self-reported health is shown as Figure 8.2. Previous research has found that pedestrian friendly neighbourhoods with diverse green spaces are well-regarded (Kim & Kaplan, 2004) and that use of nearby green spaces, particularly natural areas, can play a role in generating feelings of attachment and care about local environmental issues (Eisenhauer, Krannich, & Blahna, 2000; Ryan, 2005). This study determined that significant relationships do exist between these factors and self-reported health, with particular neighbourhood attributes and ecosystem services provided by nearby green space being instrumental in forming perceptions of people's health and the health of their surroundings.

Most literature dealing with health and place focuses on the built environment, particularly community connectivity and access to community services (Altschuler *et al.*, 2004; Bowling *et al.*, 2006). Limited literature deals specifically with relationships between green space and perceptions of healthy places. Where green spaces and healthy neighbourhoods are the focus of discussion, health is most often related to material ecosystem services such as clean air and water or climate control (Barton *et al.*, 2003) rather than cultural ecosystem services that provide aesthetic, recreational or social benefits for communities.



Figure 8.2: A relationship equation between neighbourhood green spaces and health

In exploring relationships between green space and health in this study, interviewees identified characteristics of neighbourhood green spaces that could result in positive or problematic outcomes, for their health and the perceived quality of their neighbourhood surroundings. These characteristics and potential outcomes associated with healthy or poor quality neighbourhood settings are presented in Table 8.1. In general, characteristics identified by interviewees related to perceptions of useability, diversity and value of neighbourhood green space, and the connectivity, management and safety of nearby green spaces.

Positive outcomes associated with useability and diversity of good quality green spaces included being valued as an integral part of the neighbourhood, providing access to places of interest that engaged people in activities in natural environments that matched their preferences and expectations. Problematic outcomes were a possible consequence of lack of choice, forcing people to seek opportunities elsewhere, resulting in less localised interaction and feelings of social isolation. People may not care about local green spaces if they find them uninspiring, do not use them or do not consider they contribute to neighbourhood appeal or amenity.

The presence of established trees and connected greenways emerged as an important factor in perceptions of healthy neighbourhood surroundings. Apart from providing shade and a more comfortable environment to be physically active or seek relaxation, the presence of older, large trees was considered to substantially improve air quality and reduce pollution. Greenways, including private gardens, street corridors and connected green spaces also provided habitat for wildlife.

Table 8.1: Characteristics of neighbourhood green spaces and positive and problematic outcomes associated with perceptions of healthy or poor quality neighbourhood settings

Positive outcomes associated with healthy neighbourhood settings	Characteristics of neighbourhood green spaces	Problematic outcomes associated with poor quality neighbourhood settings
Interesting, engaging places encouraging multi-purpose use, frequent casual interaction with places to meet and play	Useable public green spaces	Nowhere close by and people drive out of neighbourhood to find alternate places resulting in less local interaction and social isolation
Aesthetic appeal to match different preferences and ability to choose where to go depending on purpose	Diverse green spaces	Few choices, boring and uninspiring places
Considered <i>a part of</i> the neighbourhood with community caring about local environmental issues	Valued green spaces	Considered <i>apart from</i> the neighbourhood with few people caring about local environmental issues
Shaded walkable streets, green corridors for people and wildlife, fresh air and less pollution	Gardens, trees and connected greenways	Barren landscape discouraging people and displacing wildlife
Reflects local landscape, engenders sense of place and provides community reference points	Connection to place	Landscaped ⁴ environment with few defining features and neighbourhood is homogenous and difficult to navigate
Appears looked after, not overgrown, messy, weedy or untended	Management	Appears that no one cares and areas left to go wild
Confident to visit, not afraid of interaction with others nor overly concerned about potential risks or hazards	Safety	Fear of other people (particularly stranger danger) or possible injury from natural hazards, and heightened concerns about potential risks (particularly snakes)

⁴ *Landscaping* is defined as the current Western Australian practice of bulldozing all vegetation (often referred to as site waste) prior to residential development and levelling house blocks by constructing retaining walls and backfilling with sand and rubble.

Table 8.2: Assessment of quality of life, health determinants, attitudes, values and perceptions relating to nature and green space quality in each neighbourhood

Neighbourhood Health Assessment			Established		New	
			Inner	Outer		Inner
			Subiaco	Wanneroo	Ashby	Subiaco Centro
Nature and neighbourhood green spaces quality	Perceptions	Useability	>	<		
		Proximity and (bio)diversity	>		<	
		Sense of place		>		<
	Values	Value local green spaces		>		<
		Care about environmental issues		>		<
	Attitudes	Feel sad to see destroyed	>		<	
		Enjoy time in nature	>			<
	Spend time	Often visit green space		>		<
Proximal and distal determinants of health	Natural environment	Air, water, land	>		<	
		Natural habitats	>		<	
		Gardens, trees and connected greenways		>		
	Built environment	Streets, routes (connectivity)		<		>
		Diversity of buildings, public places		>		<
	Activities	Living, playing, learning	>	<		
		Working, shopping, moving	>	<		
	Economy	Socio-economic status	>		<	
		Local employment opportunities	>	<		
	Community	Culture and heritage		>		
		Networks		<		>
		Social capital		<		>
	Lifestyle	Neighbourhood walkability and utility of nearby green spaces		<		>
	People	Age (High = oldest)	>			<
Quality of Life		Satisfaction with neighbourhood		<		>
		Mental health (MCS)	>	<		
		Physical health (PCS)	<			>
	>	<		Assessments based on reported results, mean rankings, stated perceptions and researcher observations. Health determinants from Figure 1.1 (Barton & Grant, 2006).		
High	Med-high	Med-low	Low			

Without trees, neighbourhood landscapes were considered barren and uninviting. People tended to be more inwardly-focused, only considering their involvement in managing or caring for the space immediately around their home, not the wider neighbourhood environment. The presence of trees strongly influenced personal connections to place, through engendering emotional attachments to particular areas within the neighbourhood and recognition of significant local landscapes features. Many of the landscape features (and almost every tree) in Ashby were bulldozed prior to development and some people did not readily connect with green spaces in this new outer suburban neighbourhood. Despite this, several Ashby interviewees specifically chose to live in that neighbourhood as when they bought their property, there were more trees surrounding the estate than around other nearby developments.

Management of green spaces and perceptions of safety were also important considerations in perceptions of quality and health of neighbourhood surroundings. Opinions regarding the level of management of bushland and other natural environments varied, with some interviewees stating these areas were most healthy when simply left alone, while others stated there needed to be some intervention to ensure hazards were reduced. The role of urban landscape management is generating much debate with some authors asserting that urban natural environments may not remain healthy if simply left alone (Meyer, 2008) and caring for natural areas through active management can deliver good ecological outcomes, not just visually pleasing results (Nassauer, 2008). This position is further supported by calls to re-evaluate concepts of environmental aesthetics within landscape architecture and design: to ensure that urban landscapes are sustainable, functioning ecosystems as well as places for social and cultural experience (Meyer, 2008).

At the other end of the preference spectrum, people who favoured more formal, landscaped green spaces expected them to be well-maintained, regularly mowed, weeded and cleaned. No matter what preference individuals expressed, an essential aspect of perceptions of healthy neighbourhood surroundings was that green spaces appeared to be well-cared for, not left to grow wild, or people expressed anxiety, were concerned about risks (particularly snakes) and were reluctant to visit them. This finding supports the concept of biophobia with negative responses to natural

environments often associated with fear of predatory or poisonous animals hiding in overgrown places (Kellert & Wilson, 1993; Ulrich, 1993).

When green space characteristics and recognised health determinants and assessed within each neighbourhood, observed relationships between quality of life and neighbourhood environment were confirmed (Table 8.2). Relationships between better self-reported health and neighbourhood walkability, connected greenways and street routes, and how often people visit nearby green space were apparent. An active lifestyle is an important determinant of health, and undertaking exercise in green spaces has both physical and mental health benefits (Pretty *et al.*, 2003; Pretty *et al.*, 2005) and can result in increased longevity (Takano *et al.*, 2002). There is also emerging evidence that access to useable green areas and the occurrence of casual social contact that comes with increased mobility within a neighbourhood strengthens feelings of community and place attachment (Maas *et al.*, 2009).

Relationships between mental health and people's satisfaction with neighbourhood environment observed in this study support the notion that access to diverse, quality green space can make a substantial contribution to perceived quality of life. The inner suburban neighbourhoods of Subiaco and Subiaco Centro consistently scored higher in assessment of determinants associated with lifestyle, community, economic and social activity and built environment attributes. Satisfaction with neighbourhood was highest in Subiaco and Subiaco Centro, as were mental health scores. In Subiaco, most interviewees expressed strong connection to place, valued local green spaces and cared about local environmental issues.

In Subiaco Centro, assessment of economic and functional characteristics of the neighbourhood, including green space useability, generated the highest rankings. In this neighbourhood, affluence and appreciation of the social and built environment may have been most influential in generating high mental health scores and strong neighbourhood satisfaction. Assessment of characteristics of the natural environment, valuing local green spaces and attitudes towards nature ranked substantially lower than in Subiaco. It is reasonable to assume that the social and economic aspects of living in this neighbourhood were more valued than access to nature and natural environments.

This is contrasted to outer suburban Wanneroo where nature and the natural environment ranked much higher in the assessment of neighbourhood characteristics. People enjoyed spending time in nature, green spaces were valued and people cared about environmental issues. Local culture, history and attachment to nearby green spaces, both public places and peoples' private gardens, engendered a keen sense of place. Several interviewees expressed great concern about the changes occurring within their neighbourhood and in surrounding areas. The highest scores for feeling sad to see nature destroyed were recorded here and it may be that lower social and economic status combined with feelings of lack of control over external forces of change may be contributing factors to the lower mental health scores reported in this neighbourhood. Lack of control over changes in the surrounding area may also have had some effect on Ashby residents who had lived in this neighbourhood before development began. William spoke at length of feeling very depressed as he watched the trees being bulldozed around his Ashby home, but as time went on, he had become accustomed to his new neighbourhood environment. As discussed in earlier chapters, research is exploring the effect of landscape change and feelings of distress. This research has established that negative effect is exacerbated by feeling powerless and having little control over how change occurs (Albrecht *et al.*, 2007).

Ashby respondents scored lowest in almost all neighbourhood assessment categories, including mental health and satisfaction with the neighbourhood. It is difficult to know how much of this result can be attributed to lack of quality green space, or whether this is simply the result of people moving into a new neighbourhood that has very little access to any community facilities or social support. Perhaps with time, community infrastructure may be built and people will develop stronger social connections and greater appreciation of neighbourhood surroundings.

Access to community facilities and infrastructure plays an important role in perceptions of residential satisfaction (Bonaiuto *et al.*, 1999) with lack of access more common in peri-urban neighbourhoods (Ford, 2001). In this study it was observed that, except for people who expressed strong connections to nature and specifically wanted to live close to natural environments, access to green space appeared to be a secondary factor in neighbourhood choice, something that becomes important only after needs associated with social and economic security are met. People who live in Subiaco have access to a

great diversity of built and natural environments and recorded the highest level of satisfaction with their neighbourhood. People who live in Subiaco Centro do not have direct access to an array of natural environments, but for those who do care about such access there are several extensive green spaces located within a relatively short distance. It may well be that for people who chose to live in this neighbourhood, access to a comprehensive range of social and community facilities more than compensates for the lack of immediate proximity to an array of green spaces and natural environments.

Conversely, limited access to social and community facilities in Wanneroo is compensated by access to a diversity of public and private green spaces. Most importantly, people living in Wanneroo enjoyed spending time in nature and all of the people interviewed specifically chose to live in that neighbourhood because of its natural features, not because they sought immediate access to social, economic or community infrastructure.

However, neither community facilities nor diverse public and private green spaces are accessible in Ashby. The negative aspects of car dependence, lack of community infrastructure and social isolation that can come with living in outer suburban sprawling neighbourhoods are well-documented (Frank *et al.*, 2003; Frumkin *et al.*, 2004) but the style of development adopted in Ashby does not meet classic descriptions of suburban sprawl (Hall, 2007). Blocks are small, houses are large, high fences provide a solid barrier between homes, there is little private outdoor space, and areas retained for public green space around the neighbourhood meet only the maximum level required under statutory requirements (EnviroPlanning, 2009). In addition, the process of landscaping that is evident in new residential developments in Perth's northern outer suburbs means that important topographic features are lost, vegetation is destroyed, wildlife is displaced and new residents buy blocks of poor-quality sand that sit on top of a once viable landscape.

Apart from living in a brand new home, there is little in Ashby to compensate for the lack of social and community facilities, and people who wish to spend time in nature and natural environments drive out of the neighbourhood to find useable green spaces. This can only exacerbate the already identified negative aspects of living in sprawling outer suburbs. Without adequate social, community and green space infrastructure

nearby, it is very likely that people living in Ashby-type suburbs will continue to report poorer mental health and less satisfaction with their neighbourhood.

Health and green spaces in suburban neighbourhoods

This study explored relationships between self-reported health and green spaces in four specific neighbourhood environments: two established and two new neighbourhoods located in both inner and outer suburbs of Perth, Western Australia. The outcomes of this study confirmed previous research in finding that access to green spaces was an important factor in encouraging people to exercise (Bedimo-Rung *et al.*, 2005; Giles-Corti *et al.*, 2005) and that the benefits of “green exercise” were both physical and psychological (Pretty *et al.*, 2003; Pretty *et al.*, 2005). In addition, social interaction in green spaces was important to generating feelings of community connection and safety (Coley *et al.*, 1997; Kuo, Sullivan *et al.*, 1998) and may play a part in promoting better self-reported health (Maas *et al.*, 2009).

It has also been found that as part of neighbourhood surroundings, green spaces contributed to aesthetic appeal, levels of resident satisfaction and neighbourhood attachment (Bonaiuto *et al.*, 2003). Caring about environmental issues and involvement in local conservation activities can engender stronger connections to place and better self-reported general health (Ryan, 2005; Townsend & Moore, 2005). Whether there is a positive connection between caring for self and caring for place cannot be conclusively answered here, though statistical analysis in this study demonstrated that interest (though not necessarily direct involvement) in conservation activities predicted better overall self-reported physical health, general health and vitality. The question of whether better health outcomes are the result of interest or involvement in voluntary community service, and not necessarily involvement in conservation activities, needs to be examined in more detail. Psychological benefits from being involved in meaningful action, working with others and developing new skills are associated with many voluntary activities (Veal & Lynch, 2001). Additional benefits that can result from conservation activity include opportunities to spend time in psychologically restorative environments, to be physically active and to learn more about nature (Miles *et al.*, 1998, 2000) and it may be these aspects of conservation activity that set it apart from volunteering for other community activities. If the relationship between better health

and caring for place holds true in future research, it bodes well for promoting involvement in conservation activities as a positive means of achieving better health, for both people and for the places where they live.

This study adds to greater understanding of which specific aspects of urban green space most influence better health outcomes. Underpinning these findings is support for the biophilia hypothesis (Kellert & Wilson, 1993) which recognises innate emotional connection to nature and other living things, and for the savannah hypothesis (Joye & Van Locke, 2007; Ulrich, 1993) which makes a direct link between preference for open landscapes, perceptions of safety and positive aesthetic and restorative responses. Even if people did not profess to care a great deal about nature or explicitly seek experiences in natural environments, all expressed positive response to one or more local green spaces, either because of emotional attachment, aesthetic preference or feelings of security. As noted earlier, people were more likely to express biophobic responses to the prospect of entering less open landscapes that appeared unsafe, uncared for or unmanaged (Ulrich, 1993).

Overall satisfaction with their neighbourhood surroundings, proximity to diverse places, positive perceptions of green space useability and attitudes of care towards nearby green spaces were the most influential predictors of self-reported health and well-being. In many ways these factors related to an individual's ability to choose their place of residence and their sense of control over what was happening in and around their neighbourhood. As choice of living environment is often determined by socio-economic status (Barton *et al.*, 2003), issues of equity related to green space provision must be considered.

It has been suggested that current patterns of urban development disadvantage more marginalised populations, particularly people with lower incomes and minorities, as new communities that incorporate good design do not accommodate these populations (Dannenberg *et al.*, 2003). With emerging evidence that a lack of quality green spaces may exacerbate health inequalities associated with lower income and poorer neighbourhood surroundings (Coen & Ross, 2006; Mitchell & Popham, 2008), there are many questions that need to be explored regarding the interrelationships between socio-economic status, access to green space and health inequalities. It is a limitation of this

study that this aspect was not able to be examined in more detail. While the socio-economic status of respondents living in Wanneroo was relatively low, this neighbourhood was adjacent to large tracts of green space and some people chose to live there because of its proximity to natural environments. It was not possible to conclusively determine whether living nearby to valued green spaces may ameliorate some potential effects of lower income on self-reported health.

As already mentioned, much research exploring relationships between green spaces and health focuses on identifying how neighbourhood environments, particularly the built environment, might impact on levels of physical activity (Frank *et al.*, 2003). When natural environments and other green spaces are considered, they are often simply categorised as parks or public open space with little distinction made between areas with significantly different ecological or recreational values (Giles-Corti *et al.*, 2005; Tzoulas & James, 2004). This study contributes to better understandings of which aspects of green space influence positive perceptions of quality and useability, though in the limited settings of only four neighbourhoods. Future research could examine relationships between health and green space quantity, quality, preference and useability in a wider range of neighbourhood settings. In addition, while this study did include some discussion of relationships between green space and physical activity, more focus was placed on examining relationships between green spaces and self-reported mental health. From the findings of this study, and that of previous research, it appears that access to diverse, useable neighbourhood green space exerts stronger positive effect on self-reported mental health, rather than physical health (Sugiyama *et al.*, 2008).

New evidence about the positive contributions neighbourhood green spaces can make to health emerged from this study, and will continue to emerge from other current international research exploring aspects of green space and health (Eyles & Williams, 2008; Hartig, 2008; Maas *et al.*, 2009). Collaboration between professionals in health promotion, local area planning and urban conservation will be an important step forward in order to reduce green space-related health inequalities and generate good long-term health outcomes for suburban populations.

This is especially relevant in new suburban residential estates in Western Australia where, at present, successful planning is often measured by the number of residential

lots, not by the quality of the neighbourhood environment created or retained (EnviroPlanning, 2009). There is also increasing concern about continued application the 10 per cent public space allocation outlined in the Stephenson Hepburn Plan for Perth in 1955. Contemporary design of housing estates results in higher residential density than was assumed at that time and prescriptive approaches to green space allocation may no longer be appropriate (Grose, 2009). Again, this is particularly relevant in Perth's peri-urban regions where issues of biodiversity and ecological value are secondary to ongoing suburban expansion. It is strongly suggested that nature conservation and public open space allocation needs to be considered separately, with planning occurring at a regional level, rather than only considering these issues as part of local "parcel-by-parcel" land development (Grose, 2009, p. 62).

Following a path towards healthier regional planning that ensures adequate provision and retention of diverse, useable green spaces in all new neighbourhoods may result in better long-term population health outcomes. Increased opportunities for physical activity, relaxation, restoration and social interaction may foster satisfaction with neighbourhood surroundings (Handy *et al.*, 2008). Through positive experiences in their neighbourhood green spaces, people may develop stronger connections to particular places, feel more confident in using different areas and become more interested in caring for them (Korpela *et al.*, 2008; Ryan, 2005). It was evident in this study that people were most concerned about protecting and retaining neighbourhood green space to which they were personally attached, whether through active engagement for recreation, relaxation or restoration, or because they liked how it looked, or simply because they knew it was there and being conserved as wildlife habitat and for the benefit of future generations.

From a different perspective, highlighting the importance of regional ecosystem services may increase understanding of the health benefits of neighbourhood green spaces and promote community demand for retention and conservation of natural environments. Apart from health benefits, this approach could enhance personal attachment and emotional connection to neighbourhood green spaces through greater knowledge about local environmental issues or involvement in conservation activities. As discussed in earlier chapters, there is considerable recognition of the importance of urban ecosystems and growing support for sustainable urban development that enhances

the vitality of both people and places through reconnecting people with urban nature and engendering a stronger sense of place (Beatley, 2004; Benton-Short & Short, 2008; Girling & Kellett, 2005; Gleeson, 2008; Hellmund & Smith, 2006; Relph, 2008). Perhaps more importantly, it is also proposed that professionals involved in urban conservation and urban planning need to work together to restore the balance between preservation of natural areas and ongoing suburban development (Cannavo, 2007), particularly in peri-urban regions that often contain ecologically and culturally significant natural environments (EnviroPlanning, 2009). Future researchers and professionals dealing with issues relating to health and neighbourhood environments must work within interdisciplinary models which integrate knowledge, understandings and experience to avoid degrading urban ecosystem services and putting the health of people at risk.

Local application of research findings

There is no doubt that the quality of local living environment can have a significant effect on human health (Millennium Ecosystem Assessment, 2005a). Even so, multi-faceted research that explicitly explores relationships between urban ecosystem services and human health is relatively limited (McMichael, 2006) and development of urban planning policies that specifically address health inequalities, health promotion and preventive health is a relatively new practice (Barton & Tsourou, 2000). Aside from health-related issues, increased urbanisation has generated conflict between those who support urban consolidation and those who support conservation and retention of urban nature and other green spaces (Cannavo, 2007). To manage these multi-faceted issues, new approaches to research and decision-making that intersect health and planning and conservation policy and practice are needed.

At the time of writing, two new initiatives relating to health, local area planning and natural resource management were under discussion in Western Australia. A summary document published by the state Department of Health, proposed that all new developments, including residential developments, be subject to health impact assessment in much the same way as an Environmental Impact Assessment (EIA) was routinely conducted on major projects (Department of Health, 2007). The Health Impact Assessment (HIA) process recognises three key determinants of health: the

physical environment; the social environment; and sustainable development. In local area planning, health impact assessments would consider built and natural environments and examine potentially positive and negative health effects of planned land use (Department of Health, 2007).

Ideally, HIA occurs in the early stages of the planning process (Scott-Samuel, 1998). In the summary document, it was further proposed that HIA in Western Australia become a systematic, evidence-based process that occurred at the planning stage of all new developments, in order to provide decision makers with information about potential health impacts, and suggested improvements to initial plans (Department of Health, 2007). If the HIA process is adopted in Western Australia, the findings of this study may have particular local relevance.

A second initiative was introduced by the Western Australian Planning Commission. A discussion paper highlighting current links and lapses in authority and responsibility between federal, state and local government planning and natural resource management agencies throughout Australia was released for public comment (EnviroPlanning, 2009). In this document, Western Australian local government agencies were identified as having limited capacity to control development on all land within their jurisdiction. This paper proposed changes to current practice and policy that would enable better integration of local land use planning and natural resource management, with particular attention paid to retention and protection of urban bushland and wetland environments. However, less attention was paid to other types of green space and explicit connections between health, access to public open space, local land use planning and natural resource management are missing from this document, and from many of the ensuing discussions. Local land use change often occurs with residential development, particularly in new peri-urban neighbourhoods, and it is vital that potential health effects associated with loss of local vegetation or lack of access to nearby green spaces are taken into account. As demonstrated by the findings of this study, the retention and management of nearby natural environments can have substantial impact on self-reported health and people's perceptions of neighbourhood amenity and the health of their surroundings.

With mounting evidence of positive relationships between human health and contact with nature, it will no longer be acceptable to disregard public health and ecological imperatives in neighbourhood planning and other local land use schemes. Connections between health determinants and natural resource management issues must be considered at the initial stage of local land use planning, rather than as now, dealing with the consequences of loss of irreplaceable ecosystems, and the subsequent loss of opportunities to enrich physical and mental health. Change will only occur with greater recognition of the health benefits that come with retaining diverse, quality green spaces within suburban neighbourhoods.

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Appendices

Appendix 3.1: Survey pack - Covering letter (printed on ECU letterhead)

May Carter
PhD Candidate
Consortium for Health and Ecology
School of Natural Sciences
Edith Cowan University, Joondalup
email: m.carter@ecu.edu.au
phone: 6304 5677
mobile: 0409 889 270

Dear Resident

Inside this envelope you will find information regarding a research project entitled:

Nature in urban communities: An exploration of relationships between urban green space, environmental connection and health.

This PhD study, being conducted by May Carter from the Consortium for Health and Ecology at the School of Natural Sciences, has the approval of the Higher Research Ethics Committee at Edith Cowan University.

Residents in four Perth suburbs are being surveyed to investigate possible links between health and neighbourhood surroundings. It is anticipated that the results of this study will be of interest to people working in urban planning, natural resource management and health promotion.

It is requested one person in your household (over the age of 18 years) completes the enclosed questionnaire and returns it in the reply paid enveloped provided.

If you would like further information or have any enquiries about the questionnaire, please contact May Carter on 6304 5677 or 0409 889 270 or by email at m.carter@ecu.edu.au.

If you have any questions or concerns about the project itself, please contact Dr Mark Lund, Head of School, School of Natural Sciences, Edith Cowan University on 6304 5644.

Thank you for your interest in this research project.

May Carter
BA, MSocSc

Appendix 3.2: Survey pack – Interview participation form

Nature in urban communities
May Carter, PhD Candidate
Consortium for Health and Ecology
School of Natural Sciences
Edith Cowan University, Joondalup

Interview Participation

If you are willing to participate in a detailed interview on the subject of health and green space in your neighbourhood, please provide the information requested below.

When completed, please place this form in the small envelope provided and return with your completed questionnaire in the reply paid envelope.

It is expected that each interview will take approximately one hour and can be held at a place of your choice. Interviews will be conducted between June and December this year.

You will be offered a \$25 gift certificate to reimburse you for your time.

If you have any questions about the interview process, please contact May Carter on [redacted] or [redacted] or by email at m.carter@ecu.edu.au.

Name _____

Address _____

Phone (home) _____

Phone (work) _____

Phone (mobile) _____

Email _____

When is the best day and time to contact you? _____

What year were you born? _____

How long have you lived in this suburb? _____ years / months
(cross out whichever does not apply)

Appendix: Chapter 3

PLEASE NOTE:

You are asked not to complete the Consent Form at this time. It is provided for your information only and will be completed and signed at time of interview.

Nature in urban communities
May Carter, PhD Candidate
Consortium for Health and Ecology
School of Natural Sciences
Edith Cowan University, Joondalup

Consent Form

I _____ (please print your name) agree to participate in an interview associated with this research project and understand that I can withdraw consent at any time.

I understand that my participation in this research project is voluntary. Any questions about this project have been answered to my satisfaction.

I understand that interviews will be tape-recorded and that all steps will be taken to maintain confidentiality and ensure my anonymity.

I agree that the research data gathered in this study may be published providing I am not personally identified in any way.

Signed: _____ **Date:** _____

Witnessed by May Carter

Signed: _____ **Date:** _____



***Nature in urban communities:
An exploration of relationships
between urban green space,
environmental connection and health***

Questionnaire for residents

May Carter, PhD Candidate
Consortium for Health and Ecology
School of Natural Sciences
Edith Cowan University
100 Joondalup Drive, Joondalup WA 6027
Phone: [REDACTED]
Email: m.carter@ecu.edu.au

Appendix: Chapter 3

<i>For administrative purposes only</i>		
Suburb code		
ID#		
Received		
DEMO data entry completed		
GSS/NAS data entry completed		
EAS data entry completed		
SF36 data entry completed		
GSS + comments entered		

Nature in urban communities

Your completion of this questionnaire will greatly assist me to explore possible relationships between urban green space, environmental connection and general health in the community.

To enable comparison between communities, the questionnaire is being distributed in four Perth suburbs – all with differences in style and age of residential development, proximity to the city and access to areas of green space.

The questionnaire is divided into four sections:

- You and your home
- Your neighbourhood
- The natural environment
- Your health and wellbeing

Completion of this questionnaire should take about 20-30 minutes. Please make yourself a cuppa, get comfortable and answer all questions as per the instructions.

Once you have completed the questionnaire, please place it in the large reply paid envelope and return by mail. A stamp is not required.

Maintaining confidentiality and ensuring your anonymity is important. In completing the questionnaire, you are asked not to provide any personal information that could be used to identify you.

If you are willing to take part in an interview on the subject of health and green space in your neighbourhood, please complete the interview participation form included in the package. You are asked to provide contact details, and information regarding your age and the length of time you have lived in this suburb.

When completed, seal this form in the small envelope provided and return it inside the large reply paid envelope with your questionnaire. When we receive your reply paid envelope, all small envelopes with contact details will be removed and stored separately so that your responses to the questionnaire remain anonymous.

If you would like more information or have any questions, please contact me on [REDACTED] or by email at m.carter@ecu.edu.au.

Thank you for being part of this research project.

MAY CARTER

You and your home

To answer the following questions, please mark an ☒ in the one box that best matches your response, or write a response in the space provided.

1. What is your gender?

☐ Female
☐ Male
☐ _____

2. What is your age?

☐ 18-24
☐ 25-34
☐ 35-44
☐ 45-54
☐ 55-64
☐ 65 and over

3. How do you describe your cultural background?
(i.e. Australian, Italian, British, Vietnamese)

4. What is the weekly income (*after tax*) in your household?

☐ \$1-\$199
☐ \$200-\$499
☐ \$500-\$999
☐ \$1000-\$1499
☐ \$1500 or more
☐ _____

5. What is the highest level of educational qualifications you have completed?

☐ Secondary school
☐ TAFE or trade qualification
☐ University degree
☐ Postgraduate degree
☐ _____

6. Which of the following best describes your current living arrangements?
- ☐ Single, living alone
 - ☐ Single, sharing home with friends or family
 - ☐ Couple (married or de facto) with no children, or no children living in the home
 - ☐ Family (single or two parent) with children living in the home
 - ☐ _____
7. Do you ...?
- ☐ Own (or are buying) your home
 - ☐ Rent your home
 - ☐ Board with friends or family
 - ☐ _____
8. Do you live in a ...?
- ☐ House
 - ☐ Townhouse
 - ☐ Duplex or villa
 - ☐ Flat or unit
 - ☐ _____
9. Does your home have a...?
- ☐ Large yard/garden
 - ☐ Small yard/garden
 - ☐ No yard/garden or outdoor area
 - ☐ Courtyard only
 - ☐ Balcony only
 - ☐ _____
10. How long have you lived in this neighbourhood?
- ☐ Less than 1 year
 - ☐ 1-5 years
 - ☐ 6-10 years
 - ☐ 11-20 years
 - ☐ More than 20 years

Your neighbourhood

1. In your neighbourhood, which of the following types of green spaces are within easy walking distance (up to 500m) of your home?

(In this question, please mark an ☒ in as many boxes as applicable)

- ☐ Bushland
including bushland, wetlands and bush areas around rivers or lakes
- ☐ Parks and gardens
including mown grass parkland with trees, formal public and/or botanical gardens
- ☐ Play and social green spaces
including play grounds and meeting/ hanging out areas
- ☐ Outdoors sports and recreation facilities
including sports ovals, playing fields, golf courses and other sports areas, cycle and walk paths
- ☐ Green corridors
including footpaths and verges, road and rail corridors, rights of way
- ☐ Market gardens, farms or vacant land
- ☐ Private yards and/or gardens with large trees
- ☐ _____

2. Do you have a favourite area of public green space in your neighbourhood?

☐ Yes

☐ No

If yes, please describe what type of place it is.

(i.e. patch of bush, quiet park with old trees, footy oval)

3. How often do you usually visit nearby green spaces?

- ☐ More than once per week
- ☐ More than once per fortnight
- ☐ More than once per month
- ☐ Several times per year
- ☐ Only a few times per year
- ☐ Hardly ever or never

4. Have you ever been involved in any voluntary conservation projects (not necessarily in your neighbourhood) such as tree planting or weeding in parks or nature reserves?
- ☐ Yes, currently involved
- ☐ Yes, but not at the moment
- ☐ No, but have thought about it
- ☐ No, never wanted to
- ☐ Not voluntarily involved (work or training placement)

When you complete the following sections, circle the number that best represents your level of agreement with each of the statements. For example, if you strongly agree with a statement, please circle 7. If you disagree, but only a little, please circle 3. If, for any reason, you are unsure whether you agree or disagree, please circle 4.

In this section, please consider all of the areas of green space in your neighbourhood unless the statement specifically refers to a particular type of green space, such as bushland or parks.

		Strongly disagree	Somewhat disagree		Unsure	Somewhat agree	Agree	Strongly agree
		1	2	3	4	5	6	7
1.	Areas of green space in this neighbourhood are in good condition	1	2	3	4	5	6	7
2.	There are areas of green space in this neighbourhood where I can go to relax	1	2	3	4	5	6	7
3.	There is enough bushland in this neighbourhood	1	2	3	4	5	6	7
4.	Many areas of green space in this neighbourhood are disappearing	1	2	3	4	5	6	7
5.	Going to an area of bushland means travelling outside of this neighbourhood	1	2	3	4	5	6	7
6.	Areas of public green space in this neighbourhood are well-equipped for visiting (i.e. good access points, pathways etc)	1	2	3	4	5	6	7
7.	Areas of green space in this neighbourhood are too small	1	2	3	4	5	6	7

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		Strongly disagree	Somewhat disagree	Disagree	Unsure	Somewhat agree	Agree	Strongly agree
8.	There are not enough areas of green space in this neighbourhood where children can play freely	1	2	3	4	5	6	7
9.	There is at least one park in this neighbourhood where people can meet	1	2	3	4	5	6	7
10.	Many areas of green space in this neighbourhood are private or closed to the public	1	2	3	4	5	6	7

In this section, please consider how you feel about living in your neighbourhood.

		Strongly disagree	Somewhat disagree	Disagree	Unsure	Somewhat agree	Agree	Strongly agree
1.	Living in this neighbourhood is important to me	1	2	3	4	5	6	7
2.	I feel like I belong in this neighbourhood	1	2	3	4	5	6	7
3.	I have a different life-style to most other people in this neighbourhood	1	2	3	4	5	6	7
4.	I have little in common with other people in this neighbourhood	1	2	3	4	5	6	7
5.	I would willingly live in another neighbourhood	1	2	3	4	5	6	7
6.	I do not identify with the people in this neighbourhood	1	2	3	4	5	6	7
7.	This is the perfect neighbourhood for me to live in	1	2	3	4	5	6	7
8.	It would be very hard for me to leave this neighbourhood	1	2	3	4	5	6	7

The natural environment

In this section, please consider how you feel about nature and environmental issues.

		Strongly disagree	Somewhat disagree	Disagree	Unsure	Somewhat agree	Agree	Strongly agree
1.	I enjoy spending time in natural settings just for the sake of being out in nature	1	2	3	4	5	6	7
2.	Nature is important because of what it can contribute to the pleasure and welfare of humans	1	2	3	4	5	6	7
3.	Environmental threats such as deforestation and ozone depletion have been exaggerated	1	2	3	4	5	6	7
4.	I need time in nature to be happy	1	2	3	4	5	6	7
5.	One of the worst things about development is that many natural areas are being destroyed	1	2	3	4	5	6	7
6.	Sometimes it makes me sad to see forests cleared for agriculture	1	2	3	4	5	6	7
7.	It seems to me that most conservationists are pessimistic and somewhat paranoid	1	2	3	4	5	6	7
8.	I prefer wildlife reserves to zoos	1	2	3	4	5	6	7
9.	I do not think the problem of depletion of natural resources is as bad as many people make it out to be	1	2	3	4	5	6	7
10.	I find it hard to get too concerned about environmental issues	1	2	3	4	5	6	7
11.	It bothers me that humans are running out of their supply of oil	1	2	3	4	5	6	7
12.	The thing that concerns me most about deforestation is that there will not be enough timber for future generations	1	2	3	4	5	6	7
13.	I do not feel that humans are dependent on nature to survive	1	2	3	4	5	6	7
14.	Sometimes when I am unhappy I find comfort in nature	1	2	3	4	5	6	7

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		Strongly disagree	Disagree	Somewhat disagree	Unsure	Somewhat agree	Agree	Strongly agree
15.	Most environmental problems will solve themselves given enough time	1	2	3	4	5	6	7
16.	I don't care about environmental problems	1	2	3	4	5	6	7
17.	I'm opposed to programs to preserve wilderness, reduce pollution and conserve resources	1	2	3	4	5	6	7
18.	It makes me sad to see natural environments destroyed	1	2	3	4	5	6	7
19.	The most important reason for conservation is human survival	1	2	3	4	5	6	7
20.	One of the best things about recycling is that it saves money	1	2	3	4	5	6	7
21.	One of the worst things about loss of rainforest is that it will restrict development of new medicines	1	2	3	4	5	6	7
22.	Too much emphasis has been placed on conservation	1	2	3	4	5	6	7
23.	Nature is valuable for its own sake	1	2	3	4	5	6	7
24.	We need to preserve resources to maintain a high quality of life	1	2	3	4	5	6	7
25.	Being out in nature is a great stress reducer for me	1	2	3	4	5	6	7
26.	One of the most important reasons to conserve is to ensure a continued high standard of living	1	2	3	4	5	6	7
27.	One of the most important reasons to conserve is to preserve wild areas	1	2	3	4	5	6	7
28.	Continued land development is a good idea as long as a high quality of life can be preserved	1	2	3	4	5	6	7
29.	Sometimes animals seem almost human to me	1	2	3	4	5	6	7
30.	Humans are as much a part of the ecosystem as other animals	1	2	3	4	5	6	7

Your health and wellbeing

This section of the questionnaire asks for your views about your health.

For each of the following questions, please mark an ☒ in the one box that best describes your answer.

1. In general, would you say your health is:

Excellent	Very good	Good	Fair	Poor
<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

2. Compared to one year ago, how would you rate your health in general now?

Much better now than one year ago	Somewhat better now than one year ago	About the same as one year ago	Somewhat worse now than one year ago	Much worse now than one year ago
<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

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3. The following questions are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?

	Yes, limited a lot	Yes, limited a little	No, not limited at all
a. <u>Vigorous activities</u> , such as running, lifting heavy objects, participating in strenuous sports	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3
b. <u>Moderate activities</u> , such as moving a table, pushing a vacuum cleaner, bowling, or playing golf	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3
c. Lifting or carrying groceries	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3
d. Climbing <u>several</u> flights of stairs	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3
e. Climbing <u>one</u> flight of stairs	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3
f. Bending, kneeling, or stooping	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3
g. Walking <u>more than a kilometre</u>	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3
h. Walking <u>several hundred metres</u>	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3
i. Walking <u>one hundred metres</u>	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3
j. Bathing or dressing yourself	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3

4. During the past 4 weeks, how much of the time have you had any of the following problems with your work or other regular daily activities as a result of your physical health?

All of the time	Most of the time	Some of the time	A little of the time	None of the time
-----------------	------------------	------------------	----------------------	------------------

- a. Cut down on the amount of time you spent on work or other activities..... ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
- b. Accomplished less than you would like..... ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
- c. Were limited in the kind of work or other activities..... ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
- d. Had difficulty performing the work or other activities (for example, it took extra effort) ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

5. During the past 4 weeks, how much of the time have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)?

All of the time	Most of the time	Some of the time	A little of the time	None of the time
-----------------	------------------	------------------	----------------------	------------------

- a. Cut down on the amount of time you spent on work or other activities..... ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
- b. Accomplished less than you would like..... ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
- c. Did work or other activities less carefully than usual ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

6. During the past 4 weeks, to what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbours, or groups?

Not at all	Slightly	Moderately	Quite a bit	Extremely
<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

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7. How much bodily pain have you had during the past 4 weeks?

None	Very mild	Mild	Moderate	Severe	Very severe
<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6

8. During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?

Not at all	A little bit	Moderately	Quite a bit	Extremely
<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

9. These questions are about how you feel and how things have been with you during the past 4 weeks. For each question, please give the one answer that comes closest to the way you have been feeling. How much of the time during the past 4 weeks...

All of the time	Most of the time	Some of the time	A little of the time	None of the time
-----------------	------------------	------------------	----------------------	------------------

- a. Did you feel full of life? ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
- b. Have you been very nervous? .. ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
- c. Have you felt so down in the dumps that nothing could cheer you up? ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
- d. Have you felt calm and peaceful? ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
- e. Did you have a lot of energy? ... ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
- f. Have you felt downhearted and depressed? ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
- g. Did you feel worn out? ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
- h. Have you been happy? ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
- i. Did you feel tired? ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

10. During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting with friends, relatives, etc.)?

All of the time	Most of the time	Some of the time	A little of the time	None of the time
<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

11. How TRUE or FALSE is each of the following statements for you?

Definitely true	Mostly true	Don't know	Mostly false	Definitely false
--------------------	----------------	---------------	-----------------	---------------------

- a. I seem to get sick a little easier than other people ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
- b. I am as healthy as anybody I know ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
- c. I expect my health to get worse ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
- d. My health is excellent ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

Thank you for completing these questions.

Your comments

Is there is anything you would like to add about local green space and your neighbourhood environment? Do you think having more or less green space could affect your health?

[illegible]

Appendix 3.4: Interview schedule

Opening questions:

Pseudonym?

Age in 2006?

How do you describe your cultural background?

What is the highest level of educational qualification you have completed?

Are you employed or self-employed?

If yes, what do you do for a living?

It's been some time since you returned the questionnaire. Thinking back, do you recall what sort of things came to mind as you were completing it? Was there anything it started you thinking about?

Before we get into the interview questions, can you tell me what you think this study is about? Do you have any ideas or thoughts about why I'd be asking questions about neighbourhood green space and your health?

To start off the interview process, let's begin with where you live.

Home environment

With regard to your home, can you please describe what type of house or building you live in?

Is it an old house, a new 2-storey townhouse, an apartment on the 15th floor?

What kind of garden or outdoor space does it have?

Who do you live there with?

You stated on the interview form that you have been living in this neighbourhood for *(insert)* years.

Can you tell me how you came to live in your current home – what factors influenced your decision to live there?

Did you make a conscious choice to live here or is it just how things happened?

Neighbourhood

(physical environment, perception and connection)

If someone asked you to describe your neighbourhood, how would you reply?

What are the best aspects of living in your neighbourhood?

Would you prefer to live somewhere else?

If yes, where would that be?

If no, what is it about living in this neighbourhood that is important to you?

Importance of green space - Local green space type and diversity

(immediate to home such as garden or plants on balcony etc + in the neighbourhood and/or surrounding area)

How important is it to you to have green space as part of your immediate home environment?

Why does/doesn't it matter?

How important is it to you to have accessible green space close to your home?

Why does/doesn't it matter?

Do you think having (or not having) accessible green space close to your home makes a difference to how you feel about living in your neighbourhood?

Why does/doesn't it matter?

Does it matter to you what types of green spaces are around you?

Would you like to see more trees in people's gardens – or bushland - or parks - or playgrounds – or sports-type spaces in your local area?

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Do you think having areas of public green space in your neighbourhood makes a difference to how you interact with other local people?

Have you got to know people through chatting with them while working in the garden, or when you are out walking or visiting the local park?

Getting away from it all – restoration and recreation

If you want to go someplace to relax, is there somewhere local that you can go to spend time out?

If yes, where is it and can you describe what type of place it is?

If no, where do you go to relax and what type of place is it?

What about when you go on holidays – are there any particular types of places you prefer to visit?

Nature experiences

What influences you to seek out nature experiences or spend time in natural environments?

Is there any reason why you chose to avoid nature experiences or spending time in natural environments?

We've talked about "green space". Are the green spaces around you "natural environments"? Are they "nature"?

How important do you think it is to have access to green spaces like bushland or other natural (non-human) environments in the city?

If important, why so? If not important, why so?

Health

Have you ever thought about how having green space around you might influence your health?

Is there any way that having green space around you could make a difference to your physical or mental health – or both?

What about that relationship between access to green space and the health of your community as a whole? Have you ever thought about whether that's important?

Do you think (not) having access to green space could influence or make a difference to your community's health? Even if it's not important to you, is it important for children or families with children?

Have you ever thought about how green space contributes to the ecological health of your neighbourhood?

If yes: What do you think are the most important ecological contributions green space makes to this neighbourhood? *If no: If you think about it now, what might this neighbourhood be like to live in if there was no green space?*

How much local green space does there need to be to have a positive impact on your health?

Involvement in conservation/ environmental care

Have you ever been involved in any type of conservation or environmental care project?

If yes, what was it and what did it mean to you to be involved? If no, what might it take to get you involved?

Reflection – and perception of community care

If you think back over what we've just talked about, do you feel that the way you think about the relationship (or lack of) between green space and health is similar to others in your community?

Is having access to green space something that you think is more/less important to you than to other people you know?

Appendix 3.5: Tree node categories for qualitative data coding

Primary tree node	Secondary nodes
Neighbourhood	Choice Perceptions of ... Place attachment Convenience A tidy community Character Interaction with neighbours Traffic
Urban environment	\$\$\$\$ Adapting to change Development High density living Home design Living in a big city Strip it bare
Suburb history	Ashby Subiaco Subiaco Centro Wanneroo
Green environment	At home Bush and trees Diversity Don't notice green Feel lucky ... take it for granted Useful space What's green space
Green space and place	Design and aesthetics Having space Place to be active Place to get away Public and private Safety Social space
Nature	Childhood experience Connection to nature Contact with nature Holiday preference Love it or hate it People vs. nature What's nature/natural
Conservation	Being green Involvement and motivation Reflection
Health	Community (others) Ecosystem (environment) General Physical (self) Psychological (self)

Appendix: Chapter 4

Appendix 4.1: Cross-tabulation of responses by neighbourhood for socio-demographic questions

Gender

Crosstab

			Neighbourhood				Total
			Subiaco	Wanneroo	Ashby	Subiaco Centro	
Gender	Female	Count	93	71	73	47	284
		% within Neighbourhood	64.6%	62.3%	73.0%	57.3%	64.5%
	Male	Count	51	43	27	35	156
		% within Neighbourhood	35.4%	37.7%	27.0%	42.7%	35.5%
Total		Count	144	114	100	82	440
		% within Neighbourhood	100.0%	100.0%	100.0%	100.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	5.251 ^a	3	.154
Likelihood Ratio	5.338	3	.149
Linear-by-Linear Association	.096	1	.756
N of Valid Cases	440		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 29.07.

Age

Crosstab

			Neighbourhood				Total
			Subiaco	Wanneroo	Ashby	Subiaco Centro	
Age	18-24	Count	5	3	6	1	15
		% within Neighbourhood	3.5%	2.6%	6.0%	1.2%	3.4%
	25-34	Count	14	14	30	10	68
		% within Neighbourhood	9.8%	12.3%	30.0%	12.2%	15.5%
	35-44	Count	33	18	25	15	91
		% within Neighbourhood	23.1%	15.8%	25.0%	18.3%	20.7%
	45-54	Count	38	21	16	18	93
		% within Neighbourhood	26.6%	18.4%	16.0%	22.0%	21.2%
	55-64	Count	27	26	15	21	89
		% within Neighbourhood	18.9%	22.8%	15.0%	25.6%	20.3%
	65 +	Count	26	32	8	17	83
		% within Neighbourhood	18.2%	28.1%	8.0%	20.7%	18.9%
Total	Count	143	114	100	82	439	
	% within Neighbourhood	100.0%	100.0%	100.0%	100.0%	100.0%	

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	42.304 ^a	15	.000
Likelihood Ratio	41.133	15	.000
Linear-by-Linear Association	1.170	1	.279
N of Valid Cases	439		

a. 4 cells (16.7%) have expected count less than 5. The minimum expected count is 2.80.

Cultural background

Crosstab

			Neighbourhood				Total
			Subiaco	Wanneroo	Ashby	Subiaco Centro	
Cultural background	Australian	Count	87	56	46	51	240
		% within Neighbourhood	61.7%	51.4%	48.9%	63.0%	56.5%
	British	Count	29	39	31	12	111
		% within Neighbourhood	20.6%	35.8%	33.0%	14.8%	26.1%
	European	Count	9	7	3	6	25
		% within Neighbourhood	6.4%	6.4%	3.2%	7.4%	5.9%
	Asian	Count	3	0	3	4	10
		% within Neighbourhood	2.1%	.0%	3.2%	4.9%	2.4%
	Sth African or Zimbabwean	Count	3	2	5	3	13
		% within Neighbourhood	2.1%	1.8%	5.3%	3.7%	3.1%
	Nth American	Count	5	1	0	3	9
		% within Neighbourhood	3.5%	.9%	.0%	3.7%	2.1%
	New Zealander	Count	4	4	5	2	15
		% within Neighbourhood	2.8%	3.7%	5.3%	2.5%	3.5%
	Middle Eastern	Count	1	0	1	0	2
		% within Neighbourhood	.7%	.0%	1.1%	.0%	.5%
Total	Count	141	109	94	81	425	
	% within Neighbourhood	100.0%	100.0%	100.0%	100.0%	100.0%	

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	31.461 ^a	21	.066
Likelihood Ratio	36.239	21	.021
Linear-by-Linear Association	.418	1	.518
N of Valid Cases	425		

a. 21 cells (65.6%) have expected count less than 5. The minimum expected count is .38.

Weekly household income

Crosstab

			Neighbourhood				Total
			Subiaco	Wanneroo	Ashby	Subiaco Centro	
Weekly house income	\$1-499	Count	14	39	11	5	69
		% within Neighbourhood	10.4%	37.9%	12.0%	6.4%	17.0%
	\$500-999	Count	28	40	31	9	108
		% within Neighbourhood	20.9%	38.8%	33.7%	11.5%	26.5%
	\$1000-1499	Count	28	19	29	17	93
		% within Neighbourhood	20.9%	18.4%	31.5%	21.8%	22.9%
	\$1500 +	Count	64	5	21	47	137
		% within Neighbourhood	47.8%	4.9%	22.8%	60.3%	33.7%
Total	Count	134	103	92	78	407	
	% within Neighbourhood	100.0%	100.0%	100.0%	100.0%	100.0%	

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Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	109.316 ^a	9	.000
Likelihood Ratio	116.368	9	.000
Linear-by-Linear Association	3.532	1	.060
N of Valid Cases	407		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 13.22.

Educational qualifications

Crosstab

			Neighbourhood				Total
			Subiaco	Wanneroo	Ashby	Subiaco Centro	
Qualifications	Secondary school	Count	23	47	38	14	122
		% within Neighbourhood	16.0%	41.6%	38.0%	17.1%	27.8%
	TAFE or trade	Count	21	42	33	16	112
		% within Neighbourhood	14.6%	37.2%	33.0%	19.5%	25.5%
	University degree	Count	59	19	20	30	128
		% within Neighbourhood	41.0%	16.8%	20.0%	36.6%	29.2%
	Postgraduate degree	Count	41	5	9	22	77
		% within Neighbourhood	28.5%	4.4%	9.0%	26.8%	17.5%
	Total	Count	144	113	100	82	439
		% within Neighbourhood	100.0%	100.0%	100.0%	100.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	84.549 ^a	9	.000
Likelihood Ratio	89.494	9	.000
Linear-by-Linear Association	2.832	1	.092
N of Valid Cases	439		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 14.38.

Living arrangement

Crosstab

			Neighbourhood				Total
			Subiaco	Wanneroo	Ashby	Subiaco Centro	
Living arrangement	Single, living alone	Count	27	20	4	26	77
		% within Neighbourhood	18.8%	17.5%	4.0%	31.7%	17.5%
	Single, sharing home	Count	12	5	5	1	23
		% within Neighbourhood	8.3%	4.4%	5.0%	1.2%	5.2%
	Couple, no children	Count	57	47	42	39	185
		% within Neighbourhood	39.6%	41.2%	42.0%	47.6%	42.0%
	Family with children	Count	47	38	48	15	148
		% within Neighbourhood	32.6%	33.3%	48.0%	18.3%	33.6%
	Other	Count	1	4	1	1	7
		% within Neighbourhood	.7%	3.5%	1.0%	1.2%	1.6%
	Total	Count	144	114	100	82	440
		% within Neighbourhood	100.0%	100.0%	100.0%	100.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	41.734 ^a	12	.000
Likelihood Ratio	45.362	12	.000
Linear-by-Linear Association	.311	1	.577
N of Valid Cases	440		

a. 5 cells (25.0%) have expected count less than 5. The minimum expected count is 1.30.

Own or rent home

Crosstab

			Neighbourhood				Total
			Subiaco	Wanneroo	Ashby	Subiaco Centro	
Own/rent home	Rent or board	Count	35	18	7	22	82
		% within Neighbourhood	24.3%	15.8%	7.0%	27.2%	18.7%
	Own or buying home	Count	109	96	93	59	357
		% within Neighbourhood	75.7%	84.2%	93.0%	72.8%	81.3%
Total	Count	144	114	100	81	439	
	% within Neighbourhood	100.0%	100.0%	100.0%	100.0%	100.0%	

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	16.443 ^a	3	.001
Likelihood Ratio	18.149	3	.000
Linear-by-Linear Association	.447	1	.504
N of Valid Cases	439		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 15.13.

Type of home

Crosstab

			Neighbourhood				Total
			Subiaco	Wanneroo	Ashby	Subiaco Centro	
Type of home	House	Count	138	105	100	32	375
		% within Neighbourhood	95.8%	92.1%	100.0%	39.0%	85.2%
	Townhouse/duplex/villa	Count	4	8	0	15	27
		% within Neighbourhood	2.8%	7.0%	.0%	18.3%	6.1%
	Flat/unit or apartment	Count	2	1	0	35	38
		% within Neighbourhood	1.4%	.9%	.0%	42.7%	8.6%
	Total	Count	144	114	100	82	440
		% within Neighbourhood	100.0%	100.0%	100.0%	100.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	189.709 ^a	6	.000
Likelihood Ratio	159.185	6	.000
Linear-by-Linear Association	92.236	1	.000
N of Valid Cases	440		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.03.

Appendix: Chapter 4

Size of garden

Crosstab

			Neighbourhood				Total
			Subiaco	Wanneroo	Ashby	Subiaco Centro	
Size of garden	Large yard/garden	Count	29	82	35	2	148
		% within Neighbourhood	20.1%	71.9%	35.0%	2.5%	33.7%
	Small/medium yard/garden	Count	111	31	65	20	227
		% within Neighbourhood	77.1%	27.2%	65.0%	24.7%	51.7%
	Courtyard and/or balcony	Count	4	1	0	54	59
		% within Neighbourhood	2.8%	.9%	.0%	66.7%	13.4%
	Common garden or shared courtyard	Count	0	0	0	5	5
		% within Neighbourhood	.0%	.0%	.0%	6.2%	1.1%
Total	Count	144	114	100	81	439	
	% within Neighbourhood	100.0%	100.0%	100.0%	100.0%	100.0%	

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	358.648 ^a	9	.000
Likelihood Ratio	307.320	9	.000
Linear-by-Linear Association	102.020	1	.000
N of Valid Cases	439		

a. 4 cells (25.0%) have expected count less than 5. The minimum expected count is .92.

Time lived in neighbourhood

Crosstab

			Neighbourhood				Total
			Subiaco	Wanneroo	Ashby	Subiaco Centro	
Time lived in neighbourhood	<1 year	Count	19	9	55	15	98
		% within Neighbourhood	13.2%	8.0%	55.0%	18.3%	22.3%
	1-5 years	Count	39	22	44	53	158
		% within Neighbourhood	27.1%	19.5%	44.0%	64.6%	36.0%
	6-10 years	Count	23	19	0	12	54
		% within Neighbourhood	16.0%	16.8%	.0%	14.6%	12.3%
	11-20 years	Count	30	21	1	1	53
		% within Neighbourhood	20.8%	18.6%	1.0%	1.2%	12.1%
	> 20 years	Count	33	42	0	1	76
		% within Neighbourhood	22.9%	37.2%	.0%	1.2%	17.3%
Total	Count	144	113	100	82	439	
	% within Neighbourhood	100.0%	100.0%	100.0%	100.0%	100.0%	

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	201.777 ^a	12	.000
Likelihood Ratio	231.937	12	.000
Linear-by-Linear Association	80.469	1	.000
N of Valid Cases	439		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 9.90.

Appendix 4.2: Analysis of variance and post hoc testing by neighbourhood for age, weekly household income, educational qualifications and time lived in neighbourhood

Ranks

	Neighbourhood	N	Mean Rank
Age	Subiaco	133	208.79
	Wanneroo	102	231.17
	Ashby	92	145.01
	Subiaco Centro	78	224.69
	Total	405	
Weekly house income	Subiaco	133	236.24
	Wanneroo	102	118.98
	Ashby	92	192.73
	Subiaco Centro	78	268.31
	Total	405	
Qualifications	Subiaco	133	251.25
	Wanneroo	102	146.49
	Ashby	92	162.91
	Subiaco Centro	78	241.92
	Total	405	
Time lived in neighbourhood	Subiaco	133	238.85
	Wanneroo	102	279.06
	Ashby	92	99.88
	Subiaco Centro	78	164.04
	Total	405	

Test Statistics^{a,b}

	Age	Weekly house income	Qualifications	Time lived in neighbourhood
Chi-Square	32.705	95.288	70.519	145.278
df	3	3	3	3
Asymp. Sig.	.000	.000	.000	.000

a. Kruskal Wallis Test

b. Grouping Variable: Neighbourhood

Appendix: Chapter 4

Multiple Comparisons

Tukey HSD

Dependent Variable	(I) Neighbourhood	(J) Neighbourhood	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Age	Subiaco	Wanneroo	-.278	.182	.424	-.75	.19
		Ashby	.795 [*]	.188	.000	.31	1.28
		Subiaco Centro	-.206	.198	.723	-.72	.30
	Wanneroo	Subiaco	.278	.182	.424	-.19	.75
		Ashby	1.073 [*]	.199	.000	.56	1.59
		Subiaco Centro	.072	.208	.986	-.47	.61
	Ashby	Subiaco	-.795 [*]	.188	.000	-1.28	-.31
		Wanneroo	-1.073 [*]	.199	.000	-1.59	-.56
		Subiaco Centro	-1.002 [*]	.213	.000	-1.55	-.45
	Subiaco Centro	Subiaco	.206	.198	.723	-.30	.72
		Wanneroo	-.072	.208	.986	-.61	.47
		Ashby	1.002 [*]	.213	.000	.45	1.55
Weekly house income	Subiaco	Wanneroo	1.141 [*]	.127	.000	.81	1.47
		Ashby	.400 [*]	.131	.013	.06	.74
		Subiaco Centro	-.306	.138	.118	-.66	.05
	Wanneroo	Subiaco	-1.141 [*]	.127	.000	-1.47	-.81
		Ashby	-.740 [*]	.139	.000	-1.10	-.38
		Subiaco Centro	-1.447 [*]	.145	.000	-1.82	-1.07
	Ashby	Subiaco	-.400 [*]	.131	.013	-.74	-.06
		Wanneroo	.740 [*]	.139	.000	.38	1.10
		Subiaco Centro	-.707 [*]	.149	.000	-1.09	-.32
	Subiaco Centro	Subiaco	.306	.138	.118	-.05	.66
		Wanneroo	1.447 [*]	.145	.000	1.07	1.82
		Ashby	.707 [*]	.149	.000	.32	1.09
Qualifications	Subiaco	Wanneroo	.978 [*]	.128	.000	.65	1.31
		Ashby	.825 [*]	.132	.000	.49	1.17
		Subiaco Centro	.085	.139	.928	-.27	.44
	Wanneroo	Subiaco	-.978 [*]	.128	.000	-1.31	-.65
		Ashby	-.152	.140	.695	-.51	.21
		Subiaco Centro	-.893 [*]	.146	.000	-1.27	-.52
	Ashby	Subiaco	-.825 [*]	.132	.000	-1.17	-.49
		Wanneroo	.152	.140	.695	-.21	.51
		Subiaco Centro	-.741 [*]	.150	.000	-1.13	-.35
	Subiaco Centro	Subiaco	-.085	.139	.928	-.44	.27
		Wanneroo	.893 [*]	.146	.000	.52	1.27
		Ashby	.741 [*]	.150	.000	.35	1.13
Time lived in neighbourhood	Subiaco	Wanneroo	-.543 [*]	.146	.001	-.92	-.17
		Ashby	1.589 [*]	.151	.000	1.20	1.98
		Subiaco Centro	1.007 [*]	.159	.000	.60	1.42
	Wanneroo	Subiaco	.543 [*]	.146	.001	.17	.92
		Ashby	2.132 [*]	.160	.000	1.72	2.54
		Subiaco Centro	1.550 [*]	.167	.000	1.12	1.98
	Ashby	Subiaco	-1.589 [*]	.151	.000	-1.98	-1.20
		Wanneroo	-2.132 [*]	.160	.000	-2.54	-1.72
		Subiaco Centro	-.582 [*]	.171	.004	-1.02	-.14
	Subiaco Centro	Subiaco	-1.007 [*]	.159	.000	-1.42	-.60
		Wanneroo	-1.550 [*]	.167	.000	-1.98	-1.12
		Ashby	.582 [*]	.171	.004	.14	1.02

*. The mean difference is significant at the 0.05 level.

Appendix 5.1: Frequency of response – ecocentrism items**E1 ECO - enjoy time in nature**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unsure	14	3.2	3.2	3.2
	Disagree	9	2.0	2.0	5.2
	Somewhat agree/disagree	93	21.1	21.1	26.4
	Agree	165	37.5	37.5	63.9
	Strongly agree	159	36.1	36.1	100.0
	Total	440	100.0	100.0	

E4 ECO - time to be happy

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unsure	28	6.4	6.4	6.4
	Strongly disagree	4	.9	.9	7.3
	Disagree	27	6.1	6.1	13.4
	Somewhat agree/disagree	144	32.7	32.7	46.1
	Agree	145	33.0	33.0	79.1
	Strongly agree	92	20.9	20.9	100.0
	Total	440	100.0	100.0	

E5 ECO - development destroys

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unsure	23	5.2	5.2	5.2
	Strongly disagree	5	1.1	1.1	6.4
	Disagree	13	3.0	3.0	9.3
	Somewhat agree/disagree	108	24.5	24.5	33.9
	Agree	125	28.4	28.4	62.3
	Strongly agree	166	37.7	37.7	100.0
	Total	440	100.0	100.0	

E6 ECO - sad forests cleared

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unsure	30	6.8	6.8	6.8
	Strongly disagree	7	1.6	1.6	8.4
	Disagree	16	3.6	3.6	12.0
	Somewhat agree/disagree	95	21.6	21.6	33.6
	Agree	135	30.7	30.7	64.3
	Strongly agree	157	35.7	35.7	100.0
	Total	440	100.0	100.0	

E8 ECO - prefer reserves to zoos

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unsure	58	13.2	13.2	13.2
	Strongly disagree	6	1.4	1.4	14.5
	Disagree	15	3.4	3.4	18.0
	Somewhat agree/disagree	99	22.5	22.5	40.5
	Agree	140	31.8	31.8	72.3
	Strongly agree	122	27.7	27.7	100.0
	Total	440	100.0	100.0	

Appendix: Chapter 5

E14 ECO - comfort in nature

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unsure	38	8.6	8.6	8.6
	Strongly disagree	5	1.1	1.1	9.8
	Disagree	20	4.5	4.5	14.3
	Somewhat agree/disagree	115	26.1	26.1	40.5
	Agree	171	38.9	38.9	79.3
	Strongly agree	91	20.7	20.7	100.0
	Total	440	100.0	100.0	

E18 ECO - sad nature destroyed

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unsure	6	1.4	1.4	1.4
	Strongly disagree	12	2.7	2.7	4.1
	Disagree	10	2.3	2.3	6.4
	Somewhat agree/disagree	60	13.6	13.6	20.0
	Agree	180	40.9	40.9	60.9
	Strongly agree	172	39.1	39.1	100.0
	Total	440	100.0	100.0	

E23 ECO - nature valuable

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unsure	15	3.4	3.4	3.4
	Strongly disagree	2	.5	.5	3.9
	Disagree	4	.9	.9	4.8
	Somewhat agree/disagree	46	10.5	10.5	15.2
	Agree	180	40.9	40.9	56.1
	Strongly agree	193	43.9	43.9	100.0
	Total	440	100.0	100.0	

E25 ECO - stress reducer

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unsure	15	3.4	3.4	3.4
	Strongly disagree	2	.5	.5	3.9
	Disagree	8	1.8	1.8	5.7
	Somewhat agree/disagree	93	21.1	21.1	26.8
	Agree	172	39.1	39.1	65.9
	Strongly agree	150	34.1	34.1	100.0
	Total	440	100.0	100.0	

E27 ECO - preserve wild areas

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unsure	24	5.5	5.5	5.5
	Strongly disagree	2	.5	.5	5.9
	Disagree	10	2.3	2.3	8.2
	Somewhat agree/disagree	126	28.6	28.6	36.8
	Agree	161	36.6	36.6	73.4
	Strongly agree	117	26.6	26.6	100.0
	Total	440	100.0	100.0	

E29 ECO - animals seem human

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unsure	41	9.3	9.3	9.3
	Strongly disagree	24	5.5	5.5	14.8
	Disagree	47	10.7	10.7	25.5
	Somewhat agree/disagree	145	33.0	33.0	58.4
	Agree	108	24.5	24.5	83.0
	Strongly agree	75	17.0	17.0	100.0
	Total	440	100.0	100.0	

E30 ECO - humans part of ecosystem

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unsure	19	4.3	4.3	4.3
	Strongly disagree	5	1.1	1.1	5.5
	Disagree	3	.7	.7	6.1
	Somewhat agree/disagree	79	18.0	18.0	24.1
	Agree	194	44.1	44.1	68.2
	Strongly agree	140	31.8	31.8	100.0
	Total	440	100.0	100.0	

Appendix: Chapter 5

Appendix 5.2: Frequency of response – anthropocentrism items

E2 ANTHRO - human welfare

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unsure	11	2.5	2.5	2.5
	Disagree	3	.7	.7	3.2
	Somewhat agree/disagree	47	10.7	10.7	13.9
	Agree	174	39.5	39.5	53.4
	Strongly agree	205	46.6	46.6	100.0
	Total	440	100.0	100.0	

E11 ANTHRO - out of oil

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unsure	67	15.2	15.2	15.2
	Strongly disagree	25	5.7	5.7	20.9
	Disagree	48	10.9	10.9	31.8
	Somewhat agree/disagree	154	35.0	35.0	66.8
	Agree	97	22.0	22.0	88.9
	Strongly agree	49	11.1	11.1	100.0
	Total	440	100.0	100.0	

E12 ANTHRO - not enough timber

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unsure	47	10.7	10.7	10.7
	Strongly disagree	30	6.8	6.8	17.5
	Disagree	77	17.5	17.5	35.0
	Somewhat agree/disagree	137	31.1	31.1	66.1
	Agree	93	21.1	21.1	87.3
	Strongly agree	56	12.7	12.7	100.0
	Total	440	100.0	100.0	

E19 ANTHRO - human survival

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unsure	48	10.9	10.9	10.9
	Strongly disagree	20	4.5	4.5	15.5
	Disagree	66	15.0	15.0	30.5
	Somewhat agree/disagree	146	33.2	33.2	63.6
	Agree	97	22.0	22.0	85.7
	Strongly agree	63	14.3	14.3	100.0
	Total	440	100.0	100.0	

E20 ANTHRO - recycling saves money

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unsure	61	13.9	13.9	13.9
	Strongly disagree	30	6.8	6.8	20.7
	Disagree	115	26.1	26.1	46.8
	Somewhat agree/disagree	163	37.0	37.0	83.9
	Agree	54	12.3	12.3	96.1
	Strongly agree	17	3.9	3.9	100.0
	Total	440	100.0	100.0	

E21 ANTHRO - loss of medicine

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unsure	157	35.7	35.7	35.7
	Strongly disagree	33	7.5	7.5	43.2
	Disagree	93	21.1	21.1	64.3
	Somewhat agree/disagree	91	20.7	20.7	85.0
	Agree	50	11.4	11.4	96.4
	Strongly agree	16	3.6	3.6	100.0
	Total	440	100.0	100.0	

E24 ANTHRO - quality of life

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unsure	43	9.8	9.8	9.8
	Strongly disagree	5	1.1	1.1	10.9
	Disagree	9	2.0	2.0	13.0
	Somewhat agree/disagree	114	25.9	25.9	38.9
	Agree	175	39.8	39.8	78.6
	Strongly agree	94	21.4	21.4	100.0
	Total	440	100.0	100.0	

E26 ANTHRO - standard of living

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unsure	70	15.9	15.9	15.9
	Strongly disagree	18	4.1	4.1	20.0
	Disagree	47	10.7	10.7	30.7
	Somewhat agree/disagree	185	42.0	42.0	72.7
	Agree	87	19.8	19.8	92.5
	Strongly agree	33	7.5	7.5	100.0
	Total	440	100.0	100.0	

E28 ANTHRO - development good with QoL

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unsure	72	16.4	16.4	16.4
	Strongly disagree	37	8.4	8.4	24.8
	Disagree	93	21.1	21.1	45.9
	Somewhat agree/disagree	166	37.7	37.7	83.6
	Agree	55	12.5	12.5	96.1
	Strongly agree	17	3.9	3.9	100.0
	Total	440	100.0	100.0	

Appendix: Chapter 5

Appendix 5.3: Frequency of response – apathy items

E3 APATHY - threats exaggerated

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unsure	80	18.2	18.2	18.2
	Strongly disagree	132	30.0	30.0	48.2
	Disagree	124	28.2	28.2	76.4
	Somewhat agree/disagree	78	17.7	17.7	94.1
	Agree	16	3.6	3.6	97.7
	Strongly agree	10	2.3	2.3	100.0
	Total	440	100.0	100.0	

E7 APATHY - conservationists paranoid

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unsure	87	19.8	19.8	19.8
	Strongly disagree	62	14.1	14.1	33.9
	Disagree	114	25.9	25.9	59.8
	Somewhat agree/disagree	122	27.7	27.7	87.5
	Agree	35	8.0	8.0	95.5
	Strongly agree	20	4.5	4.5	100.0
	Total	440	100.0	100.0	

E9 APATHY - depletion not as bad

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unsure	73	16.6	16.6	16.6
	Strongly disagree	92	20.9	20.9	37.5
	Disagree	146	33.2	33.2	70.7
	Somewhat agree/disagree	102	23.2	23.2	93.9
	Agree	22	5.0	5.0	98.9
	Strongly agree	5	1.1	1.1	100.0
	Total	440	100.0	100.0	

E10 APATHY - hard to get concerned

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unsure	37	8.4	8.4	8.4
	Strongly disagree	69	15.7	15.7	24.1
	Disagree	131	29.8	29.8	53.9
	Somewhat agree/disagree	176	40.0	40.0	93.9
	Agree	19	4.3	4.3	98.2
	Strongly agree	8	1.8	1.8	100.0
	Total	440	100.0	100.0	

E13 APATHY - humans not dependent

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unsure	34	7.7	7.7	7.7
	Strongly disagree	176	40.0	40.0	47.7
	Disagree	117	26.6	26.6	74.3
	Somewhat agree/disagree	76	17.3	17.3	91.6
	Agree	25	5.7	5.7	97.3
	Strongly agree	12	2.7	2.7	100.0
	Total	440	100.0	100.0	

E15 APATHY - time will solve problems

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unsure	35	8.0	8.0	8.0
	Strongly disagree	139	31.6	31.6	39.5
	Disagree	177	40.2	40.2	79.8
	Somewhat agree/disagree	77	17.5	17.5	97.3
	Agree	8	1.8	1.8	99.1
	Strongly agree	4	.9	.9	100.0
	Total	440	100.0	100.0	

E16 APATHY - don't care

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unsure	6	1.4	1.4	1.4
	Strongly disagree	195	44.3	44.3	45.7
	Disagree	160	36.4	36.4	82.0
	Somewhat agree/disagree	65	14.8	14.8	96.8
	Agree	2	.5	.5	97.3
	Strongly agree	12	2.7	2.7	100.0
	Total	440	100.0	100.0	

E17 APATHY - opposed to eco-programs

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unsure	10	2.3	2.3	2.3
	Strongly disagree	227	51.6	51.6	53.9
	Disagree	138	31.4	31.4	85.2
	Somewhat agree/disagree	40	9.1	9.1	94.3
	Agree	13	3.0	3.0	97.3
	Strongly agree	12	2.7	2.7	100.0
	Total	440	100.0	100.0	

E22 APATHY - too much conservation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unsure	34	7.7	7.7	7.7
	Strongly disagree	117	26.6	26.6	34.3
	Disagree	172	39.1	39.1	73.4
	Somewhat agree/disagree	101	23.0	23.0	96.4
	Agree	10	2.3	2.3	98.6
	Strongly agree	6	1.4	1.4	100.0
	Total	440	100.0	100.0	

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Appendix 5.4: Principal component analysis – ecocentrism items

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	3.452	38.358	38.358	3.452	38.358	38.358	2.995
2	1.276	14.179	52.537	1.276	14.179	52.537	2.445
3	1.040	11.556	64.093	1.040	11.556	64.093	1.529
4	.820	9.109	73.202				
5	.659	7.323	80.525				
6	.499	5.541	86.065				
7	.447	4.972	91.037				
8	.427	4.739	95.776				
9	.380	4.224	100.000				

Extraction Method: Principal Component Analysis.

a. When components are correlated, sums of squared loadings cannot be added to obtain a total variance.

Pattern Matrix^a

	Component		
	1	2	3
E1 ECO - enjoy time in nature	.849		
E4 ECO - time to be happy	.850		
E5 ECO - development destroys		.829	
E6 ECO - sad forests cleared		.869	
E14 ECO - comfort in nature	.707		
E18 ECO - sad nature destroyed		.645	
E25 ECO - stress reducer	.765		
E29 ECO - animals seem human			.695
E30 ECO - humans part of ecosystem			.820

Extraction Method: Principal Component Analysis.

Rotation Method: Oblimin with Kaiser Normalization.

a. Rotation converged in 4 iterations.

Component Score Coefficient Matrix

	Component		
	1	2	3
E1 ECO - enjoy time in nature	.339	-.052	-.106
E4 ECO - time to be happy	.336	-.022	-.020
E5 ECO - development destroys	-.010	.434	-.074
E6 ECO - sad forests cleared	-.026	.455	-.031
E14 ECO - comfort in nature	.275	.054	.075
E18 ECO - sad nature destroyed	.020	.335	.119
E25 ECO - stress reducer	.300	.010	.047
E29 ECO - animals seem human	-.019	.063	.572
E30 ECO - humans part of ecosystem	-.004	-.069	.676

Extraction Method: Principal Component Analysis.

Rotation Method: Oblimin with Kaiser Normalization.

Appendix 5.5: Principal component analysis – anthropocentrism items**Total Variance Explained**

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	1.821	26.018	26.018	1.821	26.018	26.018	1.733
2	1.118	15.972	41.989	1.118	15.972	41.989	1.306
3	1.023	14.620	56.609	1.023	14.620	56.609	1.028
4	.909	12.991	69.600				
5	.806	11.508	81.108				
6	.715	10.211	91.319				
7	.608	8.681	100.000				

Extraction Method: Principal Component Analysis.

a. When components are correlated, sums of squared loadings cannot be added to obtain a total variance.

Pattern Matrix^a

	Component		
	1	2	3
E2 ANTHRO - human welfare			.792
E11 ANTHRO - out of oil		.775	
E12 ANTHRO - not enough timber		.793	
E19 ANTHRO - human survival	.534		
E24 ANTHRO - quality of life	.696		
E26 ANTHRO - standard of living	.771		
E28 ANTHRO - development good with QoL	.493		-.601

Extraction Method: Principal Component Analysis.

Rotation Method: Oblimin with Kaiser Normalization.

a. Rotation converged in 5 iterations.

Component Score Coefficient Matrix

	Component		
	1	2	3
E2 ANTHRO - human welfare	.150	.043	.764
E11 ANTHRO - out of oil	-.010	.622	-.001
E12 ANTHRO - not enough timber	-.016	.636	-.007
E19 ANTHRO - human survival	.318	.031	-.060
E24 ANTHRO - quality of life	.409	.001	.173
E26 ANTHRO - standard of living	.457	-.050	-.012
E28 ANTHRO - development good with QoL	.305	.076	-.597

Extraction Method: Principal Component Analysis.

Rotation Method: Oblimin with Kaiser Normalization.

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Appendix 5.6: Principal component analysis – apathy items

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.847	42.743	42.743	3.847	42.743	42.743
2	.964	10.707	53.450			
3	.769	8.549	61.999			
4	.681	7.567	69.566			
5	.642	7.137	76.704			
6	.605	6.723	83.427			
7	.584	6.490	89.917			
8	.479	5.325	95.243			
9	.428	4.757	100.000			

Extraction Method: Principal Component Analysis.

Component Matrix^a

	Component
	1
E3 CARE - #threats exaggerated	.687
E7 CARE - #conservationists paranoid	.653
E9 CARE - #depletion not as bad	.709
E10 CARE - #hard to get concerned	.647
E13 CARE - #humans not dependent	.588
E15 CARE - #time will solve problems	.669
E16 CARE - #don't care	.587
E17 CARE - #opposed to eco-programs	.599
E22 CARE - #too much conservation	.729

Extraction Method: Principal Component Analysis.

a. 1 components extracted.

Component Score Coefficient Matrix

	Component
	1
E3 CARE - #threats exaggerated	.179
E7 CARE - #conservationists paranoid	.170
E9 CARE - #depletion not as bad	.184
E10 CARE - #hard to get concerned	.168
E13 CARE - #humans not dependent	.153
E15 CARE - #time will solve problems	.174
E16 CARE - #don't care	.153
E17 CARE - #opposed to eco-programs	.156
E22 CARE - #too much conservation	.190

Extraction Method: Principal Component Analysis.

Rotation Method: Oblimin with Kaiser Normalization.
Component Scores.

Rotated Component Matrix^a

a. Only one component was extracted.
The solution cannot be rotated.

Appendix 5.7: Correlation analysis for environmental attitude factors

Correlations											
Spearman's rho	Eco TV1 EnjoyNature	Eco TV2 SadDestroyed	Eco TV3 AsOne	AnthroTV1QoL	AnthroTV2TimberOil	AnthroTV3HumanWelfare	Care TV1	Age	Weeklyhouse income	Qualifications	Time lived in neighbourhood
Correlation Coefficient	1.000	.400**	.247**	.221**	.028	.380**	.442**	-.021	-.154**	.048	.042
Sig. (2-tailed)		.000	.000	.000	.562	.000	.000	.663	.002	.315	.384
N	440	440	440	440	440	440	440	439	407	439	439
Correlation Coefficient		1.000	.265**	.188**	.186**	.317**	.486**	.041	-.280**	-.063	.137**
Sig. (2-tailed)			.000	.000	.000	.000	.000	.386	.000	.185	.004
N	440	440	440	440	440	440	440	439	407	439	439
Correlation Coefficient			1.000	.223**	.110*	.041	.255**	.010	-.151**	-.054	-.006
Sig. (2-tailed)				.000	.021	.389	.000	.839	.002	.261	.892
N	440	440	440	440	440	440	440	439	407	439	439
Correlation Coefficient				1.000	.190**	-.123**	.185**	.029	-.027	-.025	-.012
Sig. (2-tailed)					.000	.010	.000	.541	.589	.600	.797
N	440	440	440	440	440	440	440	439	407	439	439
Correlation Coefficient					1.000	-.098*	.079	.023	-.097*	-.058	-.040
Sig. (2-tailed)						.039	.099	.637	.049	.227	.404
N	440	440	440	440	440	440	440	439	407	439	439
Correlation Coefficient						1.000	.339**	.054	-.042	.080	.113
Sig. (2-tailed)							.000	.255	.401	.093	.018
N	440	440	440	440	440	440	440	439	407	439	439
Correlation Coefficient							1.000	-.109*	-.020	.211**	.027
Sig. (2-tailed)								.023	.682	.000	.576
N	440	440	440	440	440	440	440	439	407	439	439
Correlation Coefficient								1.000	-.156**	-.140**	.381**
Sig. (2-tailed)									.002	.003	.000
N	439	439	439	439	439	439	439	439	406	438	438
Correlation Coefficient									1.000	.394**	-.144**
Sig. (2-tailed)										.000	.004
N	407	407	407	407	407	407	407	406	407	406	407
Correlation Coefficient										1.000	-.079
Sig. (2-tailed)											.098
N	439	439	439	439	439	439	439	438	406	439	438
Correlation Coefficient											1.000
Sig. (2-tailed)											.098
N	439	439	439	439	439	439	439	438	406	439	438
Correlation Coefficient											1.000
Sig. (2-tailed)											.098
N	439	439	439	439	439	439	439	438	407	438	439

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

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Appendix 5.8: Analysis of variance and post hoc testing by neighbourhood for environmental attitude factors

Ranks

	Neighbourhood	N	Mean Rank
Eco TV1 EnjoyNature	Subiaco	143	222.67
	Wanneroo	113	249.73
	Ashby	99	196.26
	Subiaco Centro	82	197.70
	Total	437	
Eco TV2 SadDestroyed	Subiaco	143	220.37
	Wanneroo	113	269.57
	Ashby	99	201.08
	Subiaco Centro	82	168.56
	Total	437	
Eco TV3 AsOne	Subiaco	143	207.00
	Wanneroo	113	236.45
	Ashby	99	222.90
	Subiaco Centro	82	211.16
	Total	437	
AnthroTV1QoL	Subiaco	143	221.15
	Wanneroo	113	215.99
	Ashby	99	231.39
	Subiaco Centro	82	204.44
	Total	437	
AnthroTV2TimberOil	Subiaco	143	196.20
	Wanneroo	113	230.61
	Ashby	99	236.16
	Subiaco Centro	82	222.04
	Total	437	
Care TV1	Subiaco	143	252.13
	Wanneroo	113	219.62
	Ashby	99	189.93
	Subiaco Centro	82	195.48
	Total	437	
Green volunteer	Subiaco	143	232.62
	Wanneroo	113	235.01
	Ashby	99	188.99
	Subiaco Centro	82	209.42
	Total	437	

Test Statistics^{a,b}

	Eco TV1 EnjoyNature	Eco TV2 SadDestroyed	Eco TV3 AsOne	AnthroTV1Qo L	Anthro TV2TimberOil	Care TV1	Green volunteer
Chi-Square	12.355	33.208	3.857	2.148	7.489	17.932	10.990
df	3	3	3	3	3	3	3
Asymp. Sig.	.006	.000	.277	.542	.058	.000	.012

a. Kruskal Wallis Test

b. Grouping Variable: Neighbourhood

Multiple Comparisons

Tukey HSD

Dependent Variable	(I) Neighbourhood	(J) Neighbourhood	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Eco TV1 EnjoyNature	Subiaco	Wanneroo	-.22613	.14923	.429	-.6110	.1587
		Ashby	.21742	.15501	.498	-.1824	.6172
		Subiaco Centro	.28671	.16423	.301	-.1368	.7103
	Wanneroo	Subiaco	.22613	.14923	.429	-.1587	.6110
		Ashby	.44355 [*]	.16321	.034	.0226	.8645
		Subiaco Centro	.51284 [*]	.17199	.016	.0693	.9564
	Ashby	Subiaco	-.21742	.15501	.498	-.6172	.1824
		Wanneroo	-.44355 [*]	.16321	.034	-.8645	-.0226
		Subiaco Centro	.06929	.17703	.980	-.3873	.5259
	Subiaco Centro	Subiaco	-.28671	.16423	.301	-.7103	.1368
		Wanneroo	-.51284 [*]	.17199	.016	-.9564	-.0693
		Ashby	-.06929	.17703	.980	-.5259	.3873
Eco TV2 SadDestroyed	Subiaco	Wanneroo	-.44921 [*]	.15466	.020	-.8481	-.0503
		Ashby	.24313	.16066	.430	-.1712	.6575
		Subiaco Centro	.46989 [*]	.17021	.031	.0309	.9089
	Wanneroo	Subiaco	.44921 [*]	.15466	.020	.0503	.8481
		Ashby	.69234 [*]	.16916	.000	.2561	1.1286
		Subiaco Centro	.91909 [*]	.17826	.000	.4594	1.3788
	Ashby	Subiaco	-.24313	.16066	.430	-.6575	.1712
		Wanneroo	-.69234 [*]	.16916	.000	-1.1286	-.2561
		Subiaco Centro	.22676	.18348	.604	-.2464	.7000
	Subiaco Centro	Subiaco	-.46989 [*]	.17021	.031	-.9089	-.0309
		Wanneroo	-.91909 [*]	.17826	.000	-1.3788	-.4594
		Ashby	-.22676	.18348	.604	-.7000	.2464
Eco TV3 AsOne	Subiaco	Wanneroo	-.26825	.15927	.333	-.6790	.1425
		Ashby	-.11366	.16544	.902	-.5403	.3130
		Subiaco Centro	.01066	.17528	1.000	-.4414	.4627
	Wanneroo	Subiaco	.26825	.15927	.333	-.1425	.6790
		Ashby	.15458	.17420	.811	-.2947	.6038
		Subiaco Centro	.27890	.18357	.427	-.1945	.7523
	Ashby	Subiaco	.11366	.16544	.902	-.3130	.5403
		Wanneroo	-.15458	.17420	.811	-.6038	.2947
		Subiaco Centro	.12432	.18895	.913	-.3630	.6116
	Subiaco Centro	Subiaco	-.01066	.17528	1.000	-.4627	.4414
		Wanneroo	-.27890	.18357	.427	-.7523	.1945
		Ashby	-.12432	.18895	.913	-.6116	.3630
AnthroTV1 QoL	Subiaco	Wanneroo	.07800	.17733	.972	-.3793	.5353
		Ashby	-.08201	.18420	.971	-.5571	.3931
		Subiaco Centro	.23477	.19516	.625	-.2686	.7381
	Wanneroo	Subiaco	-.07800	.17733	.972	-.5353	.3793
		Ashby	-.16001	.19395	.843	-.6602	.3402
		Subiaco Centro	.15677	.20438	.869	-.3703	.6839
	Ashby	Subiaco	.08201	.18420	.971	-.3931	.5571
		Wanneroo	.16001	.19395	.843	-.3402	.6602
		Subiaco Centro	.31678	.21037	.435	-.2258	.8593
	Subiaco Centro	Subiaco	-.23477	.19516	.625	-.7381	.2686
		Wanneroo	-.15677	.20438	.869	-.6839	.3703
		Ashby	-.31678	.21037	.435	-.8593	.2258
AnthroTV2 TimberOil	Subiaco	Wanneroo	-.34444	.18574	.249	-.8235	.1346
		Ashby	-.36946	.19294	.223	-.8671	.1281
		Subiaco Centro	-.25478	.20442	.598	-.7820	.2724
	Wanneroo	Subiaco	.34444	.18574	.249	-.1346	.8235
		Ashby	-.02502	.20315	.999	-.5489	.4989
		Subiaco Centro	.08966	.21408	.975	-.4625	.6418
	Ashby	Subiaco	.36946	.19294	.223	-.1281	.8671
		Wanneroo	.02502	.20315	.999	-.4989	.5489
		Subiaco Centro	.11468	.22035	.954	-.4536	.6830
	Subiaco Centro	Subiaco	.25478	.20442	.598	-.2724	.7820
		Wanneroo	-.08966	.21408	.975	-.6418	.4625
		Ashby	-.11468	.22035	.954	-.6830	.4536
Care TV1	Subiaco	Wanneroo	.37885	.17794	.146	-.0801	.8378
		Ashby	.73497 [*]	.18483	.000	.2583	1.2117
		Subiaco Centro	.69840 [*]	.19583	.002	.1934	1.2034
	Wanneroo	Subiaco	-.37885	.17794	.146	-.8378	.0801
		Ashby	.35612	.19461	.261	-.1458	.8580
		Subiaco Centro	.31955	.20508	.404	-.2094	.8485
	Ashby	Subiaco	-.73497 [*]	.18483	.000	-1.2117	-.2583
		Wanneroo	-.35612	.19461	.261	-.8580	.1458
		Subiaco Centro	-.03657	.21109	.998	-.5810	.5078
	Subiaco Centro	Subiaco	-.69840 [*]	.19583	.002	-1.2034	-.1934
		Wanneroo	-.31955	.20508	.404	-.8485	.2094
		Ashby	.03657	.21109	.998	-.5078	.5810
Green volunteer	Subiaco	Wanneroo	-.008	.108	1.000	-.29	.27
		Ashby	.314 [*]	.112	.027	.03	.60
		Subiaco Centro	.186	.119	.396	-.12	.49
	Wanneroo	Subiaco	.008	.108	1.000	-.27	.29
		Ashby	.322 [*]	.118	.033	.02	.63
		Subiaco Centro	.194	.124	.400	-.13	.51
	Ashby	Subiaco	-.314 [*]	.112	.027	-.60	-.03
		Wanneroo	-.322 [*]	.118	.033	-.63	-.02
		Subiaco Centro	-.128	.128	.749	-.46	.20
	Subiaco Centro	Subiaco	-.186	.119	.396	-.49	.12
		Wanneroo	-.194	.124	.400	-.51	.13
		Ashby	.128	.128	.749	-.20	.46

*. The mean difference is significant at the 0.05 level.

Appendix: Chapter 6

Appendix 6.2: Frequency of response – perceptions of green space quality items

PQ1 Good condition

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unsure	3	.7	.7	.7
	Strongly disagree	1	.2	.2	.9
	Disagree	1	.2	.2	1.1
	Somewhat agree/disagree	39	8.9	8.9	10.0
	Agree	196	44.5	44.5	54.5
	Strongly agree	200	45.5	45.5	100.0
	Total	440	100.0	100.0	

PQ2 Areas for relaxing

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unsure	7	1.6	1.6	1.6
	Strongly disagree	2	.5	.5	2.0
	Disagree	2	.5	.5	2.5
	Somewhat agree/disagree	42	9.5	9.5	12.0
	Agree	164	37.3	37.3	49.3
	Strongly agree	223	50.7	50.7	100.0
	Total	440	100.0	100.0	

PQ3 Enough bushland

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unsure	38	8.6	8.6	8.6
	Strongly disagree	16	3.6	3.6	12.3
	Disagree	44	10.0	10.0	22.3
	Somewhat agree/disagree	90	20.5	20.5	42.7
	Agree	121	27.5	27.5	70.2
	Strongly agree	131	29.8	29.8	100.0
	Total	440	100.0	100.0	

PQ6 Well-equipped areas

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unsure	6	1.4	1.4	1.4
	Strongly disagree	3	.7	.7	2.0
	Disagree	5	1.1	1.1	3.2
	Somewhat agree/disagree	48	10.9	10.9	14.1
	Agree	178	40.5	40.5	54.5
	Strongly agree	200	45.5	45.5	100.0
	Total	440	100.0	100.0	

PQ9 Place to meet

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unsure	4	.9	.9	.9
	Strongly disagree	1	.2	.2	1.1
	Disagree	3	.7	.7	1.8
	Somewhat agree/disagree	26	5.9	5.9	7.7
	Agree	177	40.2	40.2	48.0
	Strongly agree	229	52.0	52.0	100.0
	Total	440	100.0	100.0	

PQ4 #Green disappearing

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unsure	62	14.1	14.1	14.1
	Strongly agree	32	7.3	7.3	21.4
	Agree	59	13.4	13.4	34.8
	Somewhat agree/disagree	112	25.5	25.5	60.2
	Disagree	115	26.1	26.1	86.4
	Strongly disagree	60	13.6	13.6	100.0
	Total	440	100.0	100.0	

PQ5 #Must travel to bushland

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unsure	18	4.1	4.1	4.1
	Strongly agree	44	10.0	10.0	14.1
	Agree	52	11.8	11.8	25.9
	Somewhat agree/disagree	61	13.9	13.9	39.8
	Disagree	118	26.8	26.8	66.6
	Strongly disagree	147	33.4	33.4	100.0
	Total	440	100.0	100.0	

PQ7 #Too small

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unsure	20	4.5	4.5	4.5
	Strongly agree	15	3.4	3.4	8.0
	Agree	28	6.4	6.4	14.3
	Somewhat agree/disagree	120	27.3	27.3	41.6
	Disagree	162	36.8	36.8	78.4
	Strongly disagree	95	21.6	21.6	100.0
	Total	440	100.0	100.0	

PQ8 #No park to play

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unsure	31	7.0	7.0	7.0
	Strongly agree	19	4.3	4.3	11.4
	Agree	24	5.5	5.5	16.8
	Somewhat agree/disagree	88	20.0	20.0	36.8
	Disagree	181	41.1	41.1	78.0
	Strongly disagree	97	22.0	22.0	100.0
	Total	440	100.0	100.0	

PQ10 #Closed to public

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unsure	27	6.1	6.1	6.1
	Strongly agree	1	.2	.2	6.4
	Agree	5	1.1	1.1	7.5
	Somewhat agree/disagree	32	7.3	7.3	14.8
	Disagree	184	41.8	41.8	56.6
	Strongly disagree	191	43.4	43.4	100.0
	Total	440	100.0	100.0	

Appendix: Chapter 6

Appendix 6.2: Frequency of response – neighbourhood attachment items

N1 Important to me

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unsure	14	3.2	3.2	3.2
	Strongly disagree	2	.5	.5	3.6
	Disagree	8	1.8	1.8	5.5
	Somewhat agree/disagree	68	15.5	15.5	20.9
	Agree	173	39.3	39.3	60.2
	Strongly agree	175	39.8	39.8	100.0
	Total	440	100.0	100.0	

N2 Belong

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unsure	33	7.5	7.5	7.5
	Strongly disagree	3	.7	.7	8.2
	Disagree	8	1.8	1.8	10.0
	Somewhat agree/disagree	83	18.9	18.9	28.9
	Agree	166	37.7	37.7	66.6
	Strongly agree	147	33.4	33.4	100.0
	Total	440	100.0	100.0	

N7 Perfect neighbourhood

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unsure	34	7.7	7.7	7.7
	Strongly disagree	6	1.4	1.4	9.1
	Disagree	19	4.3	4.3	13.4
	Somewhat agree/disagree	107	24.3	24.3	37.7
	Agree	153	34.8	34.8	72.5
	Strongly agree	121	27.5	27.5	100.0
	Total	440	100.0	100.0	

N8 Hard to leave

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unsure	38	8.6	8.6	8.6
	Strongly disagree	12	2.7	2.7	11.4
	Disagree	45	10.2	10.2	21.6
	Somewhat agree/disagree	124	28.2	28.2	49.8
	Agree	103	23.4	23.4	73.2
	Strongly agree	118	26.8	26.8	100.0
	Total	440	100.0	100.0	

N3 #Different lifestyle

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unsure	88	20.0	20.0	20.0
	Strongly agree	27	6.1	6.1	26.1
	Agree	41	9.3	9.3	35.5
	Somewhat agree/disagree	117	26.6	26.6	62.0
	Disagree	131	29.8	29.8	91.8
	Strongly disagree	36	8.2	8.2	100.0
	Total	440	100.0	100.0	

N4 #Little in common

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unsure	73	16.6	16.6	16.6
	Strongly agree	9	2.0	2.0	18.6
	Agree	18	4.1	4.1	22.7
	Somewhat agree/disagree	126	28.6	28.6	51.4
	Disagree	168	38.2	38.2	89.5
	Strongly disagree	46	10.5	10.5	100.0
	Total	440	100.0	100.0	

N5 #Willingly live elsewhere

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unsure	75	17.0	17.0	17.0
	Strongly agree	18	4.1	4.1	21.1
	Agree	53	12.0	12.0	33.2
	Somewhat agree/disagree	105	23.9	23.9	57.0
	Disagree	103	23.4	23.4	80.5
	Strongly disagree	86	19.5	19.5	100.0
	Total	440	100.0	100.0	

N6 #Do not identify

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unsure	51	11.6	11.6	11.6
	Strongly agree	4	.9	.9	12.5
	Agree	16	3.6	3.6	16.1
	Somewhat agree/disagree	105	23.9	23.9	40.0
	Disagree	184	41.8	41.8	81.8
	Strongly disagree	80	18.2	18.2	100.0
	Total	440	100.0	100.0	

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Appendix 6.3: Principal component analysis – proximity and diversity of green space

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	2.061	29.443	29.443	2.061	29.443	29.443	1.745
2	1.240	17.715	47.158	1.240	17.715	47.158	1.224
3	1.079	15.413	62.570	1.079	15.413	62.570	1.608
4	.810	11.576	74.146				
5	.708	10.112	84.258				
6	.619	8.850	93.108				
7	.482	6.892	100.000				

Extraction Method: Principal Component Analysis.

a. When components are correlated, sums of squared loadings cannot be added to obtain a total variance.

Pattern Matrix^a

	Component		
	1	2	3
Private yards with large trees	.794		
Bushland	.599	.522	
Sport & recreation facilities	.551		
Green corridors	.534		
Market gardens, farm, vacant land		.879	
Parks and gardens			-.816
Play and social space			-.729

Extraction Method: Principal Component Analysis.

Rotation Method: Oblimin with Kaiser Normalization.

a. Rotation converged in 16 iterations.

Component Score Coefficient Matrix

	Component		
	1	2	3
Bushland	.395	.447	.149
Parks and gardens	-.125	-.045	-.568
Play and social space	.028	.089	-.487
Sport & recreation facilities	.311	-.317	-.238
Green corridors	.317	.042	-.147
Market gardens, farm, vacant land	-.061	.709	-.097
Private yards with large trees	.502	-.065	.130

Extraction Method: Principal Component Analysis.

Rotation Method: Oblimin with Kaiser Normalization.

Appendix 6.4: Principal component analysis – perceptions of green space quality**Total Variance Explained**

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	3.482	34.821	34.821	3.482	34.821	34.821	2.328
2	1.523	15.235	50.056	1.523	15.235	50.056	2.546
3	1.006	10.061	60.117	1.006	10.061	60.117	2.425
4	.781	7.815	67.932				
5	.679	6.786	74.718				
6	.602	6.015	80.733				
7	.569	5.687	86.420				
8	.522	5.219	91.639				
9	.437	4.367	96.007				
10	.399	3.993	100.000				

Extraction Method: Principal Component Analysis.

a. When components are correlated, sums of squared loadings cannot be added to obtain a total variance.

Pattern Matrix^a

	Component		
	1	2	3
PQ1 Good condition		.847	
PQ2 Areas for relaxing		.752	
PQ3 Enough bushland	.828		
PQ6 Well-equipped areas		.701	
PQ9 Place to meet		.560	
PQ4 #Green disappearing	.480		
PQ5 #Must travel to bushland	.845		
PQ7 #Too small			-.567
PQ8 #No park to play			-.812
PQ10 #Closed to public			-.762

Extraction Method: Principal Component Analysis.

Rotation Method: Oblimin with Kaiser Normalization.

a. Rotation converged in 9 iterations.

Component Score Coefficient Matrix

	Component		
	1	2	3
PQ1 Good condition	-.001	.406	.146
PQ2 Areas for relaxing	.070	.350	.054
PQ3 Enough bushland	.456	.039	.072
PQ6 Well-equipped areas	-.154	.328	-.118
PQ9 Place to meet	.042	.253	-.090
PQ4 #Green disappearing	.250	-.007	-.108
PQ5 #Must travel to bushland	.471	-.049	.066
PQ7 #Too small	.146	-.022	-.309
PQ8 #No park to play	-.022	-.074	-.473
PQ10 #Closed to public	-.094	.048	-.442

Extraction Method: Principal Component Analysis.

Rotation Method: Oblimin with Kaiser Normalization.

Component Scores.

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Appendix 6.5: Principal component analysis – neighbourhood attachment

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings ^a
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	3.772	47.145	47.145	3.772	47.145	47.145	3.509
2	1.361	17.013	64.157	1.361	17.013	64.157	2.223
3	.701	8.762	72.920				
4	.649	8.106	81.026				
5	.445	5.564	86.590				
6	.417	5.211	91.800				
7	.347	4.338	96.138				
8	.309	3.862	100.000				

Extraction Method: Principal Component Analysis.

a. When components are correlated, sums of squared loadings cannot be added to obtain a total variance.

Pattern Matrix^a

	Component	
	1	2
N8 Hard to leave	.842	
N7 Perfect neighbourhood	.811	
N1 Important to me	.780	
N5 #Willingly live elsewhere	.737	
N2 Belong	.727	
N3 #Different lifestyle		.820
N4 #Little in common		.814
N6 #Do not identify		.619

Extraction Method: Principal Component Analysis.

Rotation Method: Oblimin with Kaiser Normalization.

a. Rotation converged in 4 iterations.

Component Score Coefficient Matrix

	Component	
	1	2
N1 Important to me	.244	-.003
N2 Belong	.222	.071
N7 Perfect neighbourhood	.253	.012
N8 Hard to leave	.269	-.075
N3 #Different lifestyle	-.088	.472
N4 #Little in common	-.003	.457
N5 #Willingly live elsewhere	.239	-.109
N6 #Do not identify	.080	.336

Extraction Method: Principal Component Analysis.

Rotation Method: Oblimin with Kaiser Normalization.

Appendix 6.6: Correlation analysis between proximity and diversity, green space quality, neighbourhood attachment, and attitudes to natural environments factors

Correlations

	Diversity TV1 BushSport GreenTrees	Diversity TV2 BushFarm	Diversity TV3 ParkPlay	PREQ TV1 Bushland	PREQ TV2 Function Condition	PREQ TV3 SizeSpace	NAS TV1 Belonging	NAS TV2 Identity	EAS ECO TV1 EnjoyTime	EAS ECO TV2 Sad	EAS CARE TV1
Spearman's rho											
Diversity TV1 BushSportGreenTrees	1.000	.405**	-.322**	.338**	.215**	-.213**	.177**	-.109*	.209**	-.107*	.167**
		440	440	440	440	440	440	440	440	440	440
Diversity TV2 BushFarm	.405**	1.000	-.187**	.347**	.030	-.190**	-.060	.016	.038	.025	-.017
		440	440	440	440	440	440	440	440	440	440
Diversity TV3 ParkPlay	-.322**	-.187**	1.000	-.074	.291**	.186**	-.126**	-.108*	-.100*	.009	-.151**
	440	440	440	440	440	440	440	440	440	440	440
PREQ TV1 Bushland	.338**	.347**	-.074	1.000	.303**	-.511**	.142**	.205**	.021	-.042	.084
	440	440	440	440	440	440	440	440	440	440	440
PREQ TV2 FunctionCondition	.215**	.030	.291**	.303**	1.000	-.403**	.364**	.160**	.238**	.067	.151**
	440	440	440	440	440	440	440	440	440	440	440
PREQ TV3 SizeSpace	-.213**	-.190**	.186**	-.511**	-.403**	1.000	-.156**	-.173**	-.042	.035	-.128**
	440	440	440	440	440	440	440	440	440	440	440
NAS TV1 Belonging	.177**	-.060	-.126**	.142**	.354**	-.156**	1.000	.354**	.117*	.041	.039
	440	440	440	440	440	440	440	440	440	440	440
NAS TV2 Identity	.109*	.016	-.108*	.205**	.160**	-.173**	.364**	1.000	.024	-.041	.077
	440	440	440	440	440	440	440	440	440	440	440
EAS ECO TV1 EnjoyTir	.209**	.038	-.100*	.021	.238**	-.042	.117*	.024	1.000	.447**	.462**
	440	440	440	440	440	440	440	440	440	440	440
EAS ECO TV2 Sad	.107*	.025	.009	.042	.067	.035	.041	-.041	.447**	1.000	.502**
	440	440	440	440	440	440	440	440	440	440	440
EAS CARE TV1	.167**	-.017	-.151**	.084	.151**	-.128**	.039	.077	.462**	.502**	1.000
	440	440	440	440	440	440	440	440	440	440	440

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

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Appendix 6.7: Analysis of variance and post hoc testing by neighbourhood for proximity/diversity of green space, perceptions of green space quality and neighbourhood attachment factors

Ranks			
	Neighbourhood	N	Mean Rank
Diversity FSC1 Mix	Subiaco	144	269.53
	Wanneroo	114	285.59
	Ashby	100	138.05
	Subiaco Centro	82	144.46
	Total	440	
Diversity FSC2 BushFarm	Subiaco	144	189.86
	Wanneroo	114	244.86
	Ashby	100	334.66
	Subiaco Centro	82	101.23
	Total	440	
Diversity FSC3 ParkPlay	Subiaco	144	219.98
	Wanneroo	114	247.60
	Ashby	100	262.91
	Subiaco Centro	82	132.03
	Total	440	

Test Statistics ^{a,b}			
	Diversity FSC1 Mix	Diversity FSC2 BushFarm	Diversity FSC3 ParkPlay
Chi-Square	123.895	166.976	56.565
df	3	3	3
Asymp. Sig.	.000	.000	.000

a. Kruskal Wallis Test

b. Grouping Variable: Neighbourhood

Ranks			
	Neighbourhood	N	Mean Rank
PREQ FSC1 Bushland	Subiaco	144	270.77
	Wanneroo	114	250.65
	Ashby	100	197.08
	Subiaco Centro	82	118.87
	Total	440	
PREQ FSC2 Useability	Subiaco	144	248.34
	Wanneroo	114	190.74
	Ashby	100	185.95
	Subiaco Centro	82	255.13
	Total	440	
PREQ FCS3 Size/play	Subiaco	144	195.52
	Wanneroo	114	210.57
	Ashby	100	248.13
	Subiaco Centro	82	244.48
	Total	440	
NAS FSC1 Belonging	Subiaco	144	257.74
	Wanneroo	114	205.58
	Ashby	100	160.52
	Subiaco Centro	82	248.98
	Total	440	
NAS FSC2 Identify	Subiaco	144	256.40
	Wanneroo	114	195.18
	Ashby	100	200.99
	Subiaco Centro	82	216.45
	Total	440	

Test Statistics ^{a,b}					
	PREQ FSC1 Bushland	PREQ FSC2 Useability	PREQ FCS3 Size/play	NAS FSC1 Belonging	NAS FSC2 Identify
Chi-Square	84.692	26.615	13.891	40.284	18.434
df	3	3	3	3	3
Asymp. Sig.	.000	.000	.003	.000	.000

a. Kruskal Wallis Test

b. Grouping Variable: Neighbourhood

Multiple Comparisons

Tukey HSD

Dependent Variable	(I) Neighbourhood	(J) Neighbourhood	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Diversity FSC1 Trees&Connectivity	Subiaco	Wanneroo	-.07393	.05268	.498	-.2098	.0619
		Ashby	.48950*	.05470	.000	.3484	.6306
		Subiaco Centro	.43901*	.05813	.000	.2891	.5889
	Wanneroo	Subiaco	.07393	.05268	.498	-.0619	.2098
		Ashby	.56343*	.05757	.000	.4149	.7119
		Subiaco Centro	.51294*	.06085	.000	.3560	.6699
	Ashby	Subiaco	-.48950*	.05470	.000	-.6306	-.3484
		Wanneroo	-.56343*	.05757	.000	-.7119	-.4149
		Subiaco Centro	-.05049	.06260	.851	-.2119	.1110
	Subiaco Centro	Subiaco	-.43901*	.05813	.000	-.5889	-.2891
		Wanneroo	-.51294*	.06085	.000	-.6699	-.3560
		Ashby	.05049	.06260	.851	-.1110	.2119
Diversity FSC3 Park&Social	Subiaco	Wanneroo	-.09326	.04271	.129	-.2034	.0169
		Ashby	-.07106	.04435	.378	-.1854	.0433
		Subiaco Centro	.13920*	.04714	.017	.0176	.2608
	Wanneroo	Subiaco	.09326	.04271	.129	-.0169	.2034
		Ashby	.02220	.04668	.964	-.0982	.1426
		Subiaco Centro	.23246*	.04934	.000	.1052	.3597
	Ashby	Subiaco	.07106	.04435	.378	-.0433	.1854
		Wanneroo	-.02220	.04668	.964	-.1426	.0982
		Subiaco Centro	.21026*	.05076	.000	.0794	.3412
	Subiaco Centro	Subiaco	-.13920*	.04714	.017	-.2608	-.0176
		Wanneroo	-.23246*	.04934	.000	-.3597	-.1052
		Ashby	-.21026*	.05076	.000	-.3412	-.0794
PREQ FSC1 AccessBushland	Subiaco	Wanneroo	.20673	.16732	.605	-.2248	.6382
		Ashby	.76094*	.17373	.000	.3129	1.2090
		Subiaco Centro	1.80594*	.18464	.000	1.3298	2.2821
	Wanneroo	Subiaco	-.20673	.16732	.605	-.6382	.2248
		Ashby	.55421*	.18286	.014	.0826	1.0258
		Subiaco Centro	1.59921*	.19326	.000	1.1008	2.0976
	Ashby	Subiaco	-.76094*	.17373	.000	-1.2090	-.3129
		Wanneroo	-.55421*	.18286	.014	-1.0258	-.0826
		Subiaco Centro	1.04501*	.19884	.000	.5322	1.5578
	Subiaco Centro	Subiaco	-1.80594*	.18464	.000	-2.2821	-1.3298
		Wanneroo	-1.59921*	.19326	.000	-2.0976	-1.1008
		Ashby	-1.04501*	.19884	.000	-1.5578	-.5322
PREQ FSC2 Useability	Subiaco	Wanneroo	.36274*	.10292	.003	.0973	.6282
		Ashby	.41413*	.10686	.001	.1385	.6897
		Subiaco Centro	-.01810	.11357	.999	-.3110	.2748
	Wanneroo	Subiaco	-.36274*	.10292	.003	-.6282	-.0973
		Ashby	.05139	.11248	.968	-.2387	.3415
		Subiaco Centro	-.38085*	.11887	.008	-.6874	-.0743
	Ashby	Subiaco	-.41413*	.10686	.001	-.6897	-.1385
		Wanneroo	-.05139	.11248	.968	-.3415	.2387
		Subiaco Centro	-.43223*	.12230	.003	-.7476	-.1168
	Subiaco Centro	Subiaco	.01810	.11357	.999	-.2748	.3110
		Wanneroo	.38085*	.11887	.008	.0743	.6874
		Ashby	.43223*	.12230	.003	.1168	.7476
PREQ FCS3 EnoughSpace	Subiaco	Wanneroo	-.19313	.15917	.619	-.6036	.2174
		Ashby	-.52851*	.16528	.008	-.9548	-.1023
		Subiaco Centro	-.46421*	.17565	.042	-.9172	-.0112
	Wanneroo	Subiaco	.19313	.15917	.619	-.2174	.6036
		Ashby	-.33538	.17396	.218	-.7840	.1133
		Subiaco Centro	-.27107	.18385	.454	-.7452	.2031
	Ashby	Subiaco	.52851*	.16528	.008	.1023	.9548
		Wanneroo	.33538	.17396	.218	-.1133	.7840
		Subiaco Centro	.06431	.18916	.986	-.4235	.5521
	Subiaco Centro	Subiaco	.46421*	.17565	.042	.0112	.9172
		Wanneroo	.27107	.18385	.454	-.2031	.7452
		Ashby	-.06431	.18916	.986	-.5521	.4235
NAS FSC1 Belonging	Subiaco	Wanneroo	.61713*	.16707	.001	.1863	1.0480
		Ashby	1.06263*	.17348	.000	.6152	1.5100
		Subiaco Centro	.16814	.18437	.798	-.3073	.6436
	Wanneroo	Subiaco	-.61713*	.16707	.001	-1.0480	-.1863
		Ashby	.44550	.18259	.071	-.0254	.9164
		Subiaco Centro	-.44899	.19297	.094	-.9467	.0487
	Ashby	Subiaco	-1.06263*	.17348	.000	-1.5100	-.6152
		Wanneroo	-.44550	.18259	.071	-.9164	.0254
		Subiaco Centro	-.89449*	.19854	.000	-1.4065	-.3825
	Subiaco Centro	Subiaco	-.16814	.18437	.798	-.6436	.3073
		Wanneroo	.44899	.19297	.094	-.0487	.9467
		Ashby	.89449*	.19854	.000	.3825	1.4065
NAS FSC2 Identify	Subiaco	Wanneroo	.69405*	.19108	.002	.2013	1.1868
		Ashby	.74427*	.19840	.001	.2326	1.2559
		Subiaco Centro	.53443	.21086	.056	-.0094	1.0782
	Wanneroo	Subiaco	-.69405*	.19108	.002	-1.1868	-.2013
		Ashby	.05022	.20883	.995	-.4883	.5888
		Subiaco Centro	-.15961	.22070	.888	-.7288	.4096
	Ashby	Subiaco	-.74427*	.19840	.001	-1.2559	-.2326
		Wanneroo	-.05022	.20883	.995	-.5888	.4883
		Subiaco Centro	-.20983	.22707	.792	-.7954	.3758
	Subiaco Centro	Subiaco	-.53443	.21086	.056	-1.0782	.0094
		Wanneroo	.15961	.22070	.888	-.4096	.7288
		Ashby	.20983	.22707	.792	-.3758	.7954

*. The mean difference is significant at the .05 level.

Appendix: Chapter 7

Appendix 7.1: Allocation of SF36v2™ questions to each domain scale

Q.#	Items	Domain Scales	Summary Measures		
3a	Vigorous activities	Physical functioning (PF)	Physical health (PCS)		
3b	Moderate activities				
3c	Lift, carry groceries				
3d	Climb several flights of stairs				
3e	Climb one flight of stairs				
3f	Bend, kneel or stoop				
3g	Walk > 1 kilometre				
3h	Walk several hundred metres				
3i	Walk 100 metres				
3j	Bathe or dress self				
4a	Cut down work or activity time	Role-physical (RP)	Physical health (PCS)		
4b	Accomplished less				
4c	Limited in kind of activity				
4d	Difficulty in work or activity				
7	Pain – magnitude	Bodily pain (BP)		Physical health (PCS)	
8	Pain – interference				
1	General health rating	General health (GH)			Physical health (PCS)
11a	Get sick easier than other people				
11b	Am as healthy as others				
11c	Expect health to get worse				
11d	Health is excellent				
6	Social activities – extent	Social functioning (SF)	Mental health (MCS)		
10	Social activities – time				
5a	Cut down time at work or activity	Role-emotional (RE)			
5b	Accomplished less				
5c	Not as careful				
9a	Full of life	Vitality (VT)		Mental health (MCS)	
9e	Have energy				
9g	Feel worn out				
9i	Feel tired				
9b	Been nervous	Mental health (MH)			Mental health (MCS)
9c	Felt down in the dumps				
9d	Felt calm and peaceful				
9f	Felt downhearted and depressed				
9h	Been happy				
2	Health compared to 1 year ago	Reported health transition score (HT)			

Appendix 7.2: Correlation analysis health factors and selected socio-demographic variables, proximity and diversity, green space quality, neighbourhood attachment, and attitudes to natural environments factors

Spearman's rho	PCS	Physical function	Role physical	Bodily pain	General health	MCS	Vitality	Social function	Role emotional	Mental health
Age	<i>r</i>	-.338**	-.485**	-.202**	-.194**	-.098	.384**	.180**	.126**	.257**
	Sig. (2-tailed)	.000	.000	.000	.000	.039	.000	.000	.008	.000
	N	439	439	439	439	439	439	439	439	439
Weekly house income	<i>r</i>	.183**	.253**	.201**	.180**	.114	.054	.078	.149**	.156**
	Sig. (2-tailed)	.000	.000	.000	.000	.021	.275	.117	.003	.002
	N	407	407	407	407	407	407	407	407	407
Qualifications	<i>r</i>	.114	.135	.049	.127	-.002	-.073	-.016	-.028	-.005
	Sig. (2-tailed)	.017	.005	.307	.008	.967	.126	.739	.560	.915
	N	439	439	439	439	439	439	439	439	439
Time lived in neighbourhood	<i>r</i>	-.181**	-.257**	-.182**	-.103	-.076	.122	.015	.010	.020
	Sig. (2-tailed)	.000	.000	.000	.030	.112	.010	.755	.827	.673
	N	439	439	439	439	439	439	439	439	439
Diversity/ProximityTV1 Trees/ConnectiveGreen Spaces	<i>r</i>	-.046	-.017	-.042	-.010	-.017	.058	.002	.039	.041
	Sig. (2-tailed)	.335	.728	.378	.838	.727	.225	.960	.412	.386
	N	440	440	440	440	440	440	440	440	440
Diversity/ProximityTV3 Play/SocialSpaces	<i>r</i>	-.070	-.093	-.067	-.069	-.129**	-.089	-.122	-.096	-.086
	Sig. (2-tailed)	.142	.052	.163	.151	.007	.063	.011	.044	.071
	N	440	440	440	440	440	440	440	440	440
GSQuality TV1 RetainBushGreen	<i>r</i>	.008	.042	.051	.045	.036	.070	.040	.074	.081
	Sig. (2-tailed)	.862	.380	.290	.343	.453	.142	.406	.121	.089
	N	440	440	440	440	440	440	440	440	440
GSQuality TV2 Useability	<i>r</i>	.018	.043	.087	-.008	.155**	.133**	.139**	.047	.105
	Sig. (2-tailed)	.707	.373	.069	.871	.001	.005	.004	.323	.028
	N	440	440	440	440	440	440	440	440	440
GSQuality TV3 NotEnoughSpace	<i>r</i>	-.058	-.023	-.053	-.057	-.073	-.066	-.111*	-.086	-.046
	Sig. (2-tailed)	.223	.635	.265	.231	.128	.168	.020	.070	.338
	N	440	440	440	440	440	440	440	440	440
NAttach TV1 Belonging	<i>r</i>	-.083	-.057	-.003	-.108	.128*	.201**	.138**	.080	.102*
	Sig. (2-tailed)	.081	.236	.943	.024	.007	.000	.004	.094	.032
	N	440	440	440	440	440	440	440	440	440
NAttach TV2 Identify	<i>r</i>	-.012	.029	.055	.034	.012	.077	.065	.035	.102*
	Sig. (2-tailed)	.800	.546	.249	.476	.796	.105	.176	.466	.033
	N	440	440	440	440	440	440	440	440	440
Eco TV1 EnjoyNature	<i>r</i>	.014	-.021	-.052	-.037	.051	-.072	-.024	-.179**	-.098*
	Sig. (2-tailed)	.763	.654	.279	.437	.285	.132	.621	.000	.041
	N	440	440	440	440	440	440	440	440	440
Eco TV2 SadDestroyed	<i>r</i>	-.074	-.061	-.117*	-.115*	.016	-.022	.001	-.119*	-.086
	Sig. (2-tailed)	.120	.205	.014	.015	.735	.640	.981	.013	.071
	N	440	440	440	440	440	440	440	440	440
Care TV1	<i>r</i>	.044	.068	-.055	.000	.070	-.043	-.019	-.078	-.027
	Sig. (2-tailed)	.360	.157	.250	.999	.143	.368	.685	.101	.572
	N	440	440	440	440	440	440	440	440	440
Visit green space	<i>r</i>	.098*	.119*	.094*	.088	.150**	.091	.126**	.090	.112*
	Sig. (2-tailed)	.040	.012	.048	.065	.002	.057	.008	.059	.019
	N	439	439	439	439	439	439	439	439	439

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Appendix 7.3: Analysis of variance and post testing by neighbourhood for health factors

Ranks

	Neighbourhood	N	Mean Rank
PCS Physical Health composite score	Subiaco	144	227.64
	Wanneroo	114	189.57
	Ashby	100	234.73
	Subiaco Centro	82	233.62
	Total	440	
MCS Mental Health composite score	Subiaco	144	219.43
	Wanneroo	114	222.61
	Ashby	100	208.34
	Subiaco Centro	82	234.29
	Total	440	
Physical function	Subiaco	144	231.79
	Wanneroo	114	180.15
	Ashby	100	243.89
	Subiaco Centro	82	228.25
	Total	440	
Role physical	Subiaco	144	214.19
	Wanneroo	114	190.68
	Ashby	100	250.74
	Subiaco Centro	82	236.15
	Total	440	
Bodily pain	Subiaco	144	238.49
	Wanneroo	114	189.30
	Ashby	100	224.21
	Subiaco Centro	82	227.76
	Total	440	
General health	Subiaco	144	216.80
	Wanneroo	114	202.93
	Ashby	100	238.54
	Subiaco Centro	82	229.42
	Total	440	
Vitality	Subiaco	144	219.46
	Wanneroo	114	209.88
	Ashby	100	212.45
	Subiaco Centro	82	246.91
	Total	440	
Social function	Subiaco	144	227.39
	Wanneroo	114	207.09
	Ashby	100	218.13
	Subiaco Centro	82	229.95
	Total	440	
Role emotional	Subiaco	144	231.36
	Wanneroo	114	197.14
	Ashby	100	226.36
	Subiaco Centro	82	226.76
	Total	440	
Mental health	Subiaco	144	213.45
	Wanneroo	114	224.48
	Ashby	100	220.47
	Subiaco Centro	82	227.38
	Total	440	

Test Statistics^{a,b}

	PCS Physical Health composite score	MCS Mental Health composite score	Physical function	Role physical	Bodily pain	General health	Vitality	Social function	Role emotional	Mental health
Chi-Square	9.324	1.921	17.327	15.815	10.505	4.745	4.813	2.746	7.041	.810
df	3	3	3	3	3	3	3	3	3	3
Asymp. Sig.	.025	.589	.001	.001	.015	.191	.186	.432	.071	.847

a. Kruskal Wallis Test

b. Grouping Variable: Neighbourhood

Multiple Comparisons

Tukey HSD

Dependent Variable	(I) Neighbourhood	(J) Neighbourhood	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Physical function	Subiaco	Wanneroo	3.44111 [*]	.89197	.001	1.1407	5.7415
		Ashby	-1.00768	.92616	.697	-3.3962	1.3809
		Subiaco Centro	.53678	.98433	.948	-2.0018	3.0753
	Wanneroo	Subiaco	-3.44111 [*]	.89197	.001	-5.7415	-1.1407
		Ashby	-4.44878 [*]	.97483	.000	-6.9628	-1.9347
		Subiaco Centro	-2.90432 [*]	1.03025	.026	-5.5613	-.2473
	Ashby	Subiaco	1.00768	.92616	.697	-1.3809	3.3962
		Wanneroo	4.44878 [*]	.97483	.000	1.9347	6.9628
		Subiaco Centro	1.54446	1.05999	.465	-1.1892	4.2781
	Subiaco Centro	Subiaco	-.53678	.98433	.948	-3.0753	2.0018
		Wanneroo	2.90432 [*]	1.03025	.026	.2473	5.5613
		Ashby	-1.54446	1.05999	.465	-4.2781	1.1892
Role physical	Subiaco	Wanneroo	2.27821	.99828	.104	-.2963	4.8527
		Ashby	-1.87435	1.03655	.271	-4.5476	.7989
		Subiaco Centro	-1.04334	1.10164	.779	-3.8844	1.7978
	Wanneroo	Subiaco	-2.27821	.99828	.104	-4.8527	.2963
		Ashby	-4.15255 [*]	1.09101	.001	-6.9662	-1.3389
		Subiaco Centro	-3.32154 [*]	1.15304	.022	-6.2952	-.3479
	Ashby	Subiaco	1.87435	1.03655	.271	-.7989	4.5476
		Wanneroo	4.15255 [*]	1.09101	.001	1.3389	6.9662
		Subiaco Centro	.83101	1.18633	.897	-2.2285	3.8905
	Subiaco Centro	Subiaco	1.04334	1.10164	.779	-1.7978	3.8844
		Wanneroo	3.32154 [*]	1.15304	.022	.3479	6.2952
		Ashby	-.83101	1.18633	.897	-3.8905	2.2285
Bodily pain	Subiaco	Wanneroo	3.49339 [*]	1.10115	.009	.6536	6.3332
		Ashby	.65321	1.14336	.941	-2.2955	3.6019
		Subiaco Centro	.81196	1.21517	.909	-2.3219	3.9458
	Wanneroo	Subiaco	-3.49339 [*]	1.10115	.009	-6.3332	-.6536
		Ashby	-2.84018	1.20344	.086	-5.9438	.2635
		Subiaco Centro	-2.68143	1.27186	.152	-5.9615	.5987
	Ashby	Subiaco	-.65321	1.14336	.941	-3.6019	2.2955
		Wanneroo	2.84018	1.20344	.086	-.2635	5.9438
		Subiaco Centro	.15875	1.30858	.999	-3.2160	3.5335
	Subiaco Centro	Subiaco	-.81196	1.21517	.909	-3.9458	2.3219
		Wanneroo	2.68143	1.27186	.152	-.5987	5.9615
		Ashby	-.15875	1.30858	.999	-3.5335	3.2160
General health	Subiaco	Wanneroo	1.43951	1.17648	.612	-1.5946	4.4736
		Ashby	-1.22835	1.22158	.746	-4.3788	1.9221
		Subiaco Centro	-.64776	1.29830	.959	-3.9960	2.7005
	Wanneroo	Subiaco	-1.43951	1.17648	.612	-4.4736	1.5946
		Ashby	-2.66787	1.28577	.163	-5.9838	.6481
		Subiaco Centro	-2.08728	1.35887	.417	-5.5918	1.4172
	Ashby	Subiaco	1.22835	1.22158	.746	-1.9221	4.3788
		Wanneroo	2.66787	1.28577	.163	-.6481	5.9838
		Subiaco Centro	.58059	1.39810	.976	-3.0251	4.1862
	Subiaco Centro	Subiaco	.64776	1.29830	.959	-2.7005	3.9960
		Wanneroo	2.08728	1.35887	.417	-1.4172	5.5918
		Ashby	-.58059	1.39810	.976	-4.1862	3.0251
PCS Physical Health composite score	Subiaco	Wanneroo	3.12482 [*]	1.05835	.017	.3954	5.8543
		Ashby	-1.24597	1.09893	.669	-4.0801	1.5881
		Subiaco Centro	-.19512	1.16794	.998	-3.2072	2.8170
	Wanneroo	Subiaco	-3.12482 [*]	1.05835	.017	-5.8543	-.3954
		Ashby	-4.37079 [*]	1.15667	.001	-7.3538	-1.3878
		Subiaco Centro	-3.31994 [*]	1.22243	.035	-6.4725	-.1673
	Ashby	Subiaco	1.24597	1.09893	.669	-1.5881	4.0801
		Wanneroo	4.37079 [*]	1.15667	.001	1.3878	7.3538
		Subiaco Centro	1.05085	1.25772	.838	-2.1928	4.2945
	Subiaco Centro	Subiaco	.19512	1.16794	.998	-2.8170	3.2072
		Wanneroo	3.31994 [*]	1.22243	.035	.1673	6.4725
		Ashby	-1.05085	1.25772	.838	-4.2945	2.1928

*. The mean difference is significant at the 0.05 level.

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Multiple Comparisons

TukeyHSD

Dependent Variable	(I) Neighbourhood	(J) Neighbourhood	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Vitality	Subiaco	Wanneroo	.97198	1.19024	.847	-2.0976	4.0416
		Ashby	.22934	1.23586	.998	-2.9579	3.4166
		Subiaco Centro	-2.40498	1.31348	.260	-5.7924	.9824
	Wanneroo	Subiaco	-.97198	1.19024	.847	-4.0416	2.0976
		Ashby	-.74264	1.30080	.941	-4.0974	2.6121
		Subiaco Centro	-3.37696	1.37475	.068	-6.9224	.1685
	Ashby	Subiaco	-.22934	1.23586	.998	-3.4166	2.9579
		Wanneroo	.74264	1.30080	.941	-2.6121	4.0974
		Subiaco Centro	-2.63432	1.41444	.246	-6.2821	1.0135
	Subiaco Centro	Subiaco	2.40498	1.31348	.260	-.9824	5.7924
		Wanneroo	3.37696	1.37475	.068	-.1685	6.9224
		Ashby	2.63432	1.41444	.246	-1.0135	6.2821
Social function	Subiaco	Wanneroo	2.16682	1.05903	.173	-.5644	4.8980
		Ashby	-.05330	1.09963	1.000	-2.8892	2.7826
		Subiaco Centro	-.17306	1.16869	.999	-3.1871	2.8409
	Wanneroo	Subiaco	-2.16682	1.05903	.173	-4.8980	.5644
		Ashby	-2.22012	1.15741	.222	-5.2050	.7648
		Subiaco Centro	-2.33988	1.22321	.224	-5.4945	.8147
	Ashby	Subiaco	.05330	1.09963	1.000	-2.7826	2.8892
		Wanneroo	2.22012	1.15741	.222	-.7648	5.2050
		Subiaco Centro	-.11976	1.25852	1.000	-3.3654	3.1259
	Subiaco Centro	Subiaco	.17306	1.16869	.999	-2.8409	3.1871
		Wanneroo	2.33988	1.22321	.224	-.8147	5.4945
		Ashby	.11976	1.25852	1.000	-3.1259	3.3654
Role emotional	Subiaco	Wanneroo	2.83745*	1.00962	.026	.2337	5.4412
		Ashby	-.02655	1.04833	1.000	-2.7301	2.6770
		Subiaco Centro	.68413	1.11416	.928	-2.1893	3.5575
	Wanneroo	Subiaco	-2.83745*	1.00962	.026	-5.4412	-.2337
		Ashby	-2.86401*	1.10341	.048	-5.7097	-.0183
		Subiaco Centro	-2.15332	1.16614	.253	-5.1608	.8541
	Ashby	Subiaco	.02655	1.04833	1.000	-2.6770	2.7301
		Wanneroo	2.86401*	1.10341	.048	.0183	5.7097
		Subiaco Centro	.71068	1.19981	.934	-2.3836	3.8049
	Subiaco Centro	Subiaco	-.68413	1.11416	.928	-3.5575	2.1893
		Wanneroo	2.15332	1.16614	.253	-.8541	5.1608
		Ashby	-.71068	1.19981	.934	-3.8049	2.3836
Mental health	Subiaco	Wanneroo	.31239	1.09116	.992	-2.5017	3.1265
		Ashby	.33146	1.13299	.991	-2.5905	3.2534
		Subiaco Centro	-.21418	1.20415	.998	-3.3196	2.8913
	Wanneroo	Subiaco	-.31239	1.09116	.992	-3.1265	2.5017
		Ashby	.01908	1.19253	1.000	-3.0564	3.0946
		Subiaco Centro	-.52656	1.26033	.975	-3.7769	2.7238
	Ashby	Subiaco	-.33146	1.13299	.991	-3.2534	2.5905
		Wanneroo	-.01908	1.19253	1.000	-3.0946	3.0564
		Subiaco Centro	-.54564	1.29671	.975	-3.8898	2.7985
	Subiaco Centro	Subiaco	.21418	1.20415	.998	-2.8913	3.3196
		Wanneroo	.52656	1.26033	.975	-2.7238	3.7769
		Ashby	.54564	1.29671	.975	-2.7985	3.8898
MCS Mental Health composite score	Subiaco	Wanneroo	.75976	1.18612	.919	-2.2992	3.8187
		Ashby	.60784	1.23159	.961	-2.5684	3.7841
		Subiaco Centro	-.48308	1.30893	.983	-3.8588	2.8926
	Wanneroo	Subiaco	-.75976	1.18612	.919	-3.8187	2.2992
		Ashby	-.15193	1.29630	.999	-3.4950	3.1912
		Subiaco Centro	-1.24284	1.37000	.801	-4.7760	2.2903
	Ashby	Subiaco	-.60784	1.23159	.961	-3.7841	2.5684
		Wanneroo	.15193	1.29630	.999	-3.1912	3.4950
		Subiaco Centro	-1.09092	1.40955	.866	-4.7261	2.5443
	Subiaco Centro	Subiaco	.48308	1.30893	.983	-2.8926	3.8588
		Wanneroo	1.24284	1.37000	.801	-2.2903	4.7760
		Ashby	1.09092	1.40955	.866	-2.5443	4.7261

*. The mean difference is significant at the 0.05 level.

Appendix 7.4: Univariate analysis for construction of logistic regression models

		Physical Health Composite Score (PCS)			Physical Function			General Health		
		Median or below <i>n</i> =220	>Median <i>n</i> =220	Pearson Chi-Square	Median or below <i>n</i> =279	>Median <i>n</i> =161	Pearson Chi-Square	Median or below <i>n</i> =241	>Median <i>n</i> =199	Pearson Chi-Square
Neighbourhood				0.187			0.039			0.152
Wanneroo	114 <i>n</i>	67	47		85	29		69	45	
	%	58.8	41.2		74.6	25.4		60.5	39.5	
Subiaco	144 <i>n</i>	67	77		85	59		83	61	
	%	46.5	53.5		59.0	41.0		57.6	42.4	
Subiaco Centro	82 <i>n</i>	38	44		50	32		43	39	
	%	46.3	53.7		61.0	39.0		52.4	47.6	
Ashby	100 <i>n</i>	48	52		59	41		46	54	
	%	48.0	52.0		59.0	41.0		46.0	54.0	
Gender				0.163			0.823			0.000
Female	284 <i>n</i>	135	149		179	105		138	146	
	%	47.5	52.5		63.0	37.0		48.6	51.4	
Male	156 <i>n</i>	85	71		100	56		103	53	
	%	54.5	45.5		64.1	35.9		66.0	34.0	
Age				0.000			0.000			0.090
18-34	83 <i>n</i>	29	54		27	56		46	37	
	%	34.9	65.1		32.5	67.5		55.4	44.6	
35-54	184 <i>n</i>	76	108		104	80		90	94	
	%	41.3	58.7		56.5	43.5		48.9	51.1	
55+	172 <i>n</i>	114	58		148	24		104	68	
	%	66.3	33.7		86.0	14.0		60.5	39.5	
Cultural background				0.040			0.934			0.167
Australian	240 <i>n</i>	125	115		151	89		135	105	
	%	52.1	47.9		62.9	37.1		56.3	43.8	
British	111 <i>n</i>	61	50		72	39		65	46	
	%	55.0	45.0		64.9	35.1		58.6	41.4	
Other	89 <i>n</i>	34	55		56	33		41	48	
	%	38.2	61.8		62.9	37.1		46.1	53.9	
Weekly house income				0.005			0.000			0.463
\$1-499	69 <i>n</i>	46	23		55	14		42	27	
	%	66.7	33.3		79.7	20.3		60.9	39.1	
\$500-999	108 <i>n</i>	52	56		71	37		58	50	
	%	48.1	51.9		65.7	34.3		53.7	46.3	
\$1000-1499	93 <i>n</i>	42	51		59	34		54	39	
	%	45.2	54.8		63.4	36.6		58.1	41.9	
\$1500 +	137 <i>n</i>	56	81		65	72		69	68	
	%	40.9	59.1		47.4	52.6		50.4	49.6	
Educational qualifications				0.483			0.134			0.377
Secondary school	122 <i>n</i>	66	56		86	36		62	60	
	%	54.1	45.9		70.5	29.5		50.8	49.2	
TAFE or trade	112 <i>n</i>	57	55		73	39		67	45	
	%	50.9	49.1		65.2	34.8		59.8	40.2	
University degree	128 <i>n</i>	63	65		76	52		73	55	
	%	49.2	50.8		59.4	40.6		57.0	43.0	
Postgraduate degree	77 <i>n</i>	33	44		43	34		38	39	
	%	42.9	57.1		55.8	44.2		49.4	50.6	
Living arrangement				0.094			0.044			0.028
Single	100 <i>n</i>	48	52		59	41		63	37	
	%	48.0	52.0		59.0	41.0		63.0	37.0	
Couple no children at home	185 <i>n</i>	103	82		129	56		106	79	
	%	55.7	44.3		69.7	30.3		57.3	42.7	
Family with children	148 <i>n</i>	65	83		85	63		69	79	
	%	43.9	56.1		57.4	42.6		46.6	53.4	
Own or rent home				0.091			0.005			0.024
Rent or board	82 <i>n</i>	34	48		41	41		54	28	
	%	41.5	58.5		50.0	50.0		65.9	34.1	
Own or are buying	357 <i>n</i>	185	172		237	120		186	171	
	%	51.8	48.2		66.4	33.6		52.1	47.9	
Type of home				0.502			0.437			0.011
Townhouse, duplex or apartment	65 <i>n</i>	30	35		44	21		45	20	
	%	46.2	53.8		67.7	32.3		69.2	30.8	
House	375 <i>n</i>	190	185		235	140		196	179	
	%	50.7	49.3		62.7	37.3		52.3	47.7	

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			Physical Health Composite Score (PCS)			Physical Function			General Health		
			Median or below <i>n</i> =220	>Median <i>n</i> =220	Pearson Chi-Square	Median or below <i>n</i> =279	>Median <i>n</i> =161	Pearson Chi-Square	Median or below <i>n</i> =241	>Median <i>n</i> =199	Pearson Chi-Square
Size of garden			0.731			0.688			0.489		
Large yard/garden	148	<i>n</i> %	73 49.3	75 50.7		90 60.8	58 39.2		80 54.1	68 45.9	
Small/medium yard/garden	227	<i>n</i> %	117 51.5	110 48.5		148 65.2	79 34.8		121 53.3	106 46.7	
Balcony and/or courtyard	65	<i>n</i> %	30 46.2	35 53.8		41 63.1	24 36.9		40 61.5	25 38.5	
Time lived in neighbourhood			0.026			0.000			0.501		
<1 year	98	<i>n</i> %	39 39.8	59 60.2		52 53.1	46 46.9		47 48.0	51 52.0	
1-5 years	158	<i>n</i> %	80 50.6	78 49.4		93 58.9	65 41.1		88 55.7	70 44.3	
6-10 years	54	<i>n</i> %	23 42.6	31 57.4		31 57.4	23 42.6		28 51.9	26 48.1	
11-20 years	53	<i>n</i> %	29 54.7	24 45.3		41 77.4	12 22.6		32 60.4	21 39.6	
> 20 years	76	<i>n</i> %	48 63.2	28 36.8		61 80.3	15 19.7		45 59.2	31 40.8	
Favourite area nearby			0.509			0.607			0.782		
No	110	<i>n</i> %	52 47.3	58 52.7		72 65.5	38 34.5		59 53.6	51 46.4	
Yes	330	<i>n</i> %	168 50.9	162 49.1		207 62.7	123 37.3		182 55.2	148 44.8	
Visit green spaces			0.430			0.387			0.061		
<once per month	67	<i>n</i> %	39 58.2	28 41.8		48 71.6	19 28.4		38 56.7	29 43.3	
> once per month	46	<i>n</i> %	25 54.3	21 45.7		30 65.2	16 34.8		27 58.7	19 41.3	
>once per fortnight	76	<i>n</i> %	36 47.4	40 52.6		49 64.5	27 35.5		51 67.1	25 32.9	
> once per week	250	<i>n</i> %	120 48.0	130 52.0		151 60.4	99 39.6		125 50.0	125 50.0	
Conservation volunteer			0.139			0.245			0.001		
No, never wanted	130	<i>n</i> %	72 55.4	58 44.6		86 66.2	44 33.8		87 66.9	43 33.1	
No, thought about	204	<i>n</i> %	92 45.1	112 54.9		121 59.3	83 40.7		95 46.6	109 53.4	
Yes, current or past involvement	103	<i>n</i> %	55 53.4	48 46.6		70 68.0	33 32.0		58 56.3	45 43.7	
Proximity to larger/connective green spaces (ProxTV1)			0.880			0.962			0.473		
Low	147	<i>n</i> %	71 48.3	76 51.7		92 62.6	55 37.4		75 51.0	72 49.0	
Medium	134	<i>n</i> %	68 50.7	66 49.3		86 64.2	48 35.8		78 58.2	56 41.8	
High	159	<i>n</i> %	81 50.9	78 49.1		101 63.5	58 36.5		88 55.3	71 44.7	
Proximity to play/social green spaces(Prox TV3)			0.100			0.429			0.133		
High	135	<i>n</i> %	64 47.4	71 52.6		80 59.3	55 40.7		72 53.3	63 46.7	
Medium	158	<i>n</i> %	72 45.6	86 54.4		101 63.9	57 36.1		79 50.0	79 50.0	
Low	147	<i>n</i> %	84 57.1	63 42.9		98 66.7	49 33.3		90 61.2	57 38.8	
Retain bush and other green spaces (GSQTV1)			0.118			0.175			0.646		
Low	147	<i>n</i> %	75 51.0	72 49.0		102 69.4	45 30.6		82 55.8	65 44.2	
Medium	146	<i>n</i> %	81 55.5	65 44.5		87 59.6	59 40.4		83 56.8	63 43.2	
High	147	<i>n</i> %	64 43.5	83 56.5		90 61.2	57 38.8		76 51.7	71 48.3	

	Physical Health Composite Score (PCS)			Physical Function			General Health		
	Median or below <i>n</i> =220	>Median <i>n</i> =220	Pearson Chi-Square	Median or below <i>n</i> =279	>Median <i>n</i> =161	Pearson Chi-Square	Median or below <i>n</i> =241	>Median <i>n</i> =199	Pearson Chi-Square
Green space useability (GSQTV2)			0.953			0.439			0.002
Low 147 <i>n</i>	74	73		95	52		96	51	
%	50.3	49.7		64.6	35.4		65.3	34.7	
Medium 145 <i>n</i>	71	74		86	59		78	67	
%	49.0	51.0		59.3	40.7		53.8	46.2	
High 148 <i>n</i>	75	73		98	50		67	81	
%	50.7	49.3		66.2	33.8		45.3	54.7	
Not enough green space (GSQTV3)			0.403			0.164			0.402
High 147 <i>n</i>	74	73		100	47		76	71	
%	50.3	49.7		68.0	32.0		51.7	48.3	
Medium 146 <i>n</i>	67	79		84	62		78	68	
%	45.9	54.1		57.5	42.5		53.4	46.6	
Low 147 <i>n</i>	79	68		95	52		87	60	
%	53.7	46.3		64.6	35.4		59.2	40.8	
Feeling of belonging (NATV1)			0.120			0.151			0.051
Low 149 <i>n</i>	71	78		97	52		88	61	
%	47.7	52.3		65.1	34.9		59.1	40.9	
Medium 145 <i>n</i>	66	79		83	62		85	60	
%	45.5	54.5		57.2	42.8		58.6	41.4	
High 146 <i>n</i>	83	63		99	47		68	78	
%	56.8	43.2		67.8	32.2		46.6	53.4	
Identify with others (NATV2)			0.608			0.967			0.679
Low 147 <i>n</i>	78	69		94	53		84	63	
%	53.1	46.9		63.9	36.1		57.1	42.9	
Medium 146 <i>n</i>	69	77		93	53		76	70	
%	47.3	52.7		63.7	36.3		52.1	47.9	
High 147 <i>n</i>	73	74		92	55		81	66	
%	49.7	50.3		62.6	37.4		55.1	44.9	
Enjoy time in nature (EcoTV1)			0.915			0.895			0.315
Low 147 <i>n</i>	75	72		91	56		88	59	
%	51.0	49.0		61.9	38.1		59.9	40.1	
Medium 146 <i>n</i>	71	75		94	52		76	70	
%	48.6	51.4		64.4	35.6		52.1	47.9	
High 147 <i>n</i>	74	73		94	53		77	70	
%	50.3	49.7		63.9	36.1		52.4	47.6	
Sad to see nature destroyed (EcoTV2)			0.584			0.084			0.541
Low 148 <i>n</i>	69	79		86	62		86	62	
%	46.6	53.4		58.1	41.9		58.1	41.9	
Medium 145 <i>n</i>	76	69		102	43		79	66	
%	52.4	47.6		70.3	29.7		54.5	45.5	
High 147 <i>n</i>	75	72		91	56		76	71	
%	51.0	49.0		61.9	38.1		51.7	48.3	
Care about environmental issues (CareTV1)			0.096			0.708			0.040
Low 147 <i>n</i>	74	73		95	52		86	61	
%	50.3	49.7		64.6	35.4		58.5	41.5	
Medium 148 <i>n</i>	83	65		96	52		88	60	
%	56.1	43.9		64.9	35.1		59.5	40.5	
High 145 <i>n</i>	63	82		88	57		67	78	
%	43.4	56.6		60.7	39.3		46.2	53.8	

Appendix: Chapter 7

		Mental Health Composite Score (MCS)			Vitality			Mental Health		
		Median or below <i>n</i> =220	>Median <i>n</i> =220	Pearson Chi-Square	Median or below <i>n</i> =225	>Median <i>n</i> =215	Pearson Chi-Square	Median or below <i>n</i> =223	>Median <i>n</i> =217	Pearson Chi-Square
Neighbourhood				0.533			0.105			0.624
Ashby	114 <i>n</i>	56	44		55	45		49	51	
	%	56.0	44.0		55.0	45.0		49.0	51.0	
Wanneroo	144 <i>n</i>	54	60		65	49		57	57	
	%	47.4	52.6		57.0	43.0		50.0	50.0	
Subiaco	82 <i>n</i>	72	72		72	72		79	65	
	%	50.0	50.0		50.0	50.0		54.9	45.1	
Subiaco Centro	100 <i>n</i>	38	44		33	49		38	44	
	%	46.3	53.7		40.2	59.8		46.3	53.7	
Gender				0.073			0.580			0.045
Female	284 <i>n</i>	151	133		148	136		154	130	
	%	53.2	46.8		52.1	47.9		54.2	45.8	
Male	156 <i>n</i>	69	87		77	79		69	87	
	%	44.2	55.8		49.4	50.6		44.2	55.8	
Age				0.000			0.009			0.000
18-34	83 <i>n</i>	59	24		51	32		55	28	
	%	71.1	28.9		61.4	38.6		66.3	33.7	
35-54	184 <i>n</i>	108	76		100	84		103	81	
	%	58.7	41.3		54.3	45.7		56.0	44.0	
55+	172 <i>n</i>	52	120		73	99		65	107	
	%	30.2	69.8		42.4	57.6		37.8	62.2	
Cultural background				0.374			0.792			0.753
Australian	240 <i>n</i>	114	126		123	117		121	119	
	%	47.5	52.5		51.3	48.8		50.4	49.6	
British	111 <i>n</i>	56	55		59	52		54	57	
	%	50.5	49.5		53.2	46.8		48.6	51.4	
Other	89 <i>n</i>	50	39		43	46		48	41	
	%	56.2	43.8		48.3	51.7		53.9	46.1	
Weekly house income				0.158			0.033			0.175
\$1-499	69 <i>n</i>	38	31		40	29		37	32	
	%	55.1	44.9		58.0	42.0		53.6	46.4	
\$500-999	108 <i>n</i>	56	52		63	45		55	53	
	%	51.9	48.1		58.3	41.7		50.9	49.1	
\$1000-1499	93 <i>n</i>	54	39		50	43		55	38	
	%	58.1	41.9		53.8	46.2		59.1	40.9	
\$1500 +	137 <i>n</i>	60	77		57	80		61	76	
	%	43.8	56.2		41.6	58.4		44.5	55.5	
Educational qualifications				0.201			0.244			0.505
Secondary school	122 <i>n</i>	56	66		66	56		58	64	
	%	45.9	54.1		54.1	45.9		47.5	52.5	
TAFE or trade	112 <i>n</i>	52	60		51	61		54	58	
	%	46.4	53.6		45.5	54.5		48.2	51.8	
University degree	128 <i>n</i>	74	54		72	56		72	56	
	%	57.8	42.2		56.3	43.8		56.3	43.8	
Postgraduate degree	77 <i>n</i>	37	40		35	42		39	38	
	%	48.1	51.9		45.5	54.5		50.6	49.4	
Living arrangement				0.000			0.004			0.000
Single	100 <i>n</i>	59	41		59	41		66	34	
	%	59.0	41.0		59.0	41.0		66.0	34.0	
Couple no children at home	185 <i>n</i>	70	115		77	108		71	114	
	%	37.8	62.2		41.6	58.4		38.4	61.6	
Family with children	148 <i>n</i>	86	62		84	64		81	67	
	%	58.1	41.9		56.8	43.2		54.7	45.3	
Own or rent home				0.000			0.046			0.000
Rent or board	82 <i>n</i>	59	23		50	32		56	26	
	%	72.0	28.0		61.0	39.0		68.3	31.7	
Own or are buying	357 <i>n</i>	160	197		174	183		166	191	
	%	44.8	55.2		48.7	51.3		46.5	53.5	
Type of home				0.139			0.838			0.776
Townhouse, duplex or apartment	65 <i>n</i>	38	27		34	31		34	31	
	%	58.5	41.5		52.3	47.7		52.3	47.7	
House	375 <i>n</i>	182	193		191	184		189	186	
	%	48.5	51.5		50.9	49.1		50.4	49.6	

Appendix: Chapter 7

			Mental Health Composite Score (MCS)			Vitality			Mental Health		
			Median or below <i>n</i> =220	>Median <i>n</i> =220	Pearson Chi-Square	Median or below <i>n</i> =225	>Median <i>n</i> =215	Pearson Chi-Square	Median or below <i>n</i> =223	>Median <i>n</i> =217	Pearson Chi-Square
Size of garden			0.350			0.243			0.831		
Large yard/garden	148	<i>n</i> %	76 51.4	72 48.6		84 56.8	64 43.2		73 49.3	75 50.7	
Small/medium yard/garden	227	<i>n</i> %	107 47.1	120 52.9		110 48.5	117 51.5		115 50.7	112 49.3	
Balcony and/or courtyard	65	<i>n</i> %	37 56.9	28 43.1		31 47.7	34 52.3		35 53.8	30 46.2	
Time lived in neighbourhood			0.033			0.699			0.074		
<1 year	98	<i>n</i> %	56 57.1	42 42.9		49 50.0	49 50.0		54 55.1	44 44.9	
1-5 years	158	<i>n</i> %	87 55.1	71 44.9		84 53.2	74 46.8		80 50.6	78 49.4	
6-10 years	54	<i>n</i> %	25 46.3	29 53.7		28 51.9	26 48.1		32 59.3	22 40.7	
11-20 years	53	<i>n</i> %	25 47.2	28 52.8		30 56.6	23 43.4		29 54.7	24 45.3	
> 20 years	76	<i>n</i> %	27 44.7	49 55.3		34 44.7	42 55.3		28 36.8	48 63.2	
Favourite area nearby			0.378			0.295			0.169		
No	110	<i>n</i> %	59 53.6	51 46.4		61 55.5	49 44.5		62 56.4	48 43.6	
Yes	330	<i>n</i> %	161 48.8	169 51.2		164 49.7	166 50.3		161 48.8	169 51.2	
Visit green spaces			0.301			0.154			0.370		
<once per month	67	<i>n</i> %	39 58.2	28 41.8		40 59.7	27 40.3		36 53.7	31 46.3	
> once per month	46	<i>n</i> %	25 54.3	21 45.7		26 56.5	20 43.5		26 56.5	20 43.5	
>once per fortnight	76	<i>n</i> %	40 52.6	36 47.4		42 55.3	34 44.7		43 56.6	33 43.4	
> once per week	250	<i>n</i> %	116 46.4	134 53.6		116 46.4	134 53.6		118 47.2	132 52.8	
Conservation volunteer			0.286			0.045			0.373		
No, never wanted	130	<i>n</i> %	73 56.2	57 43.8		78 60.0	52 40.0		73 56.2	57 43.8	
No, thought about	204	<i>n</i> %	98 48.0	106 52.0		100 49.0	104 51.0		99 48.5	105 51.5	
Yes, current or past involvement	103	<i>n</i> %	49 47.6	54 52.4		46 44.7	57 55.3		51 49.5	52 50.5	
Proximity to larger/connective green spaces (ProxTV1)			0.588			0.990			0.661		
Low	147	<i>n</i> %	78 53.1	69 46.9		75 51.0	72 49.0		74 50.3	73 49.7	
Medium	134	<i>n</i> %	67 50.0	67 50.0		68 50.7	66 49.3		72 53.7	62 46.3	
High	159	<i>n</i> %	75 47.2	84 52.8		82 51.6	77 48.4		77 48.4	82 51.6	
Proximity to play/social green spaces(Prox TV3)			0.066			0.022			0.283		
High	135	<i>n</i> %	63 46.7	72 53.3		59 43.7	76 56.3		67 49.6	68 50.4	
Medium	158	<i>n</i> %	72 45.6	86 54.4		78 49.4	80 50.6		74 46.8	84 53.2	
Low	147	<i>n</i> %	85 57.8	62 42.2		88 59.9	59 40.1		82 55.8	65 44.2	

Appendix: Chapter 7

	Mental Health Composite Score (MCS)			Vitality			Mental Health		
	Median or below <i>n</i> =220	>Median <i>n</i> =220	Pearson Chi-Square	Median or below <i>n</i> =225	>Median <i>n</i> =215	Pearson Chi-Square	Median or below <i>n</i> =223	>Median <i>n</i> =217	Pearson Chi-Square
Retain bush and other green spaces (GSQTV1)			0.496			0.553			0.496
Low 147 <i>n</i>	79	68		73	74		80	67	
%	53.7	46.3		49.7	50.3		54.4	45.6	
Medium 146 <i>n</i>	72	74		80	66		73	73	
%	49.3	50.7		54.8	45.2		50.0	50.0	
High 147 <i>n</i>	69	78		72	75		70	77	
%	46.9	53.1		49.0	51.0		47.6	52.4	
Green space useability (GSQTV2)			0.120			0.010			0.098
Low 147 <i>n</i>	83	64		90	57		84	63	
%	56.5	43.5		61.2	38.8		57.1	42.9	
Medium 145 <i>n</i>	71	74		69	76		73	72	
%	49.0	51.0		47.6	52.4		50.3	49.7	
High 148 <i>n</i>	66	82		66	82		66	82	
%	44.6	55.4		44.6	55.4		44.6	55.4	
Not enough green space (GSQTV3)			0.225			0.053			0.475
High 147 <i>n</i>	70	77		71	76		77	70	
%	47.6	52.4		48.3	51.7		52.4	47.6	
Medium 146 <i>n</i>	68	78		67	79		68	78	
%	46.6	53.4		45.9	54.1		46.6	53.4	
Low 147 <i>n</i>	82	65		87	60		78	69	
%	55.8	44.2		59.2	40.8		53.1	46.9	
Feeling of belonging (NATV1)			0.015			0.048			0.012
Low 149 <i>n</i>	88	61		88	61		88	61	
%	59.1	40.9		59.1	40.9		59.1	40.9	
Medium 145 <i>n</i>	70	75		71	74		74	71	
%	48.3	51.7		49.0	51.0		51.0	49.0	
High 146 <i>n</i>	62	84		66	80		61	85	
%	42.5	57.5		45.2	54.8		41.8	58.2	
Identify with others (NATV2)			0.292			0.380			0.777
Low 147 <i>n</i>	79	68		82	65		76	71	
%	53.7	46.3		55.8	44.2		51.7	48.3	
Medium 146 <i>n</i>	75	71		72	74		76	70	
%	51.4	48.6		49.3	50.7		52.1	47.9	
High 147 <i>n</i>	66	81		71	76		71	76	
%	44.9	55.1		48.3	51.7		48.3	51.7	
Enjoy time in nature (EcoTV1)			0.312			0.945			0.599
Low 147 <i>n</i>	69	78		76	71		77	70	
%	46.9	53.1		51.7	48.3		52.4	47.6	
Medium 146 <i>n</i>	70	76		73	73		69	77	
%	47.9	52.1		50.0	50.0		47.3	52.7	
High 147 <i>n</i>	81	66		76	71		77	70	
%	55.1	44.9		51.7	48.3		52.4	47.6	
Sad to see nature destroyed (EcoTV2)			0.980			0.804			0.915
Low 148 <i>n</i>	73	75		78	70		73	75	
%	49.3	50.7		52.7	47.3		49.3	50.7	
Medium 145 <i>n</i>	73	72		71	74		74	71	
%	50.3	49.7		49.0	51.0		51.0	49.0	
High 147 <i>n</i>	74	73		76	71		76	71	
%	50.3	49.7		51.7	48.3		51.7	48.3	
Care about environmental issues (CareTV1)			0.345			0.684			0.954
Low 147 <i>n</i>	67	80		73	74		73	74	
%	45.6	54.4		49.7	50.3		49.7	50.3	
Medium 148 <i>n</i>	80	68		80	68		76	72	
%	54.1	45.9		54.1	45.9		51.4	48.6	
High 145 <i>n</i>	73	72		72	73		74	73	
%	50.3	49.7		49.7	50.3		51.0	49.0	

Appendix 7.5: Forced entry logistic regression model: Physical health component score (PCS)

Case Processing Summary

Unweighted Cases ^a		N	Percent
Selected Cases	Included in Analysis	397	90.2
	Missing Cases	43	9.8
	Total	440	100.0
Unselected Cases		0	.0
Total		440	100.0

a. If weight is in effect, see classification table for the total number of cases.

Classification Table^a

			Predicted		
			PCSMedian2		Percentage Correct
			Median and below	Above median	
Observed					
Step 1	PCSMedian2	Median and below	119	72	62.3
		Above median	65	141	68.4
Overall Percentage					65.5

a. The cut value is .500

Variables in the Equation

Step		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I. for EXP(B)	
								Lower	Upper
Step 1 ^a	NhoodPCSRank			1.534	3	.675			
	NhoodPCSRank(1)	.195	.338	.334	1	.563	1.216	.627	2.358
	NhoodPCSRank(2)	.363	.485	.559	1	.454	1.438	.555	3.722
	NhoodPCSRank(3)	-.175	.413	.179	1	.672	.840	.374	1.886
	gender(1)	-.167	.245	.464	1	.496	.846	.523	1.368
	AgeMERGE			9.484	2	.009			
	AgeMERGE(1)	-.285	.325	.769	1	.381	.752	.398	1.422
	AgeMERGE(2)	-1.096	.388	7.967	1	.005	.334	.156	.715
	CulturalMERGE			5.384	2	.068			
	CulturalMERGE(1)	.222	.275	.649	1	.420	1.248	.728	2.142
	CulturalMERGE(2)	.709	.306	5.370	1	.020	2.031	1.115	3.698
	LivingLRx3Merge			.212	2	.899			
	LivingLRx3Merge(1)	-.098	.308	.101	1	.751	.907	.495	1.659
	LivingLRx3Merge(2)	-.152	.332	.208	1	.648	.859	.448	1.648
	Ownorrent(1)	.070	.328	.046	1	.830	1.073	.564	2.039
	time			2.398	4	.663			
	time(1)	-.481	.317	2.295	1	.130	.618	.332	1.152
	time(2)	-.476	.447	1.133	1	.287	.621	.259	1.493
	time(3)	-.358	.467	.587	1	.443	.699	.280	1.747
	time(4)	-.405	.464	.761	1	.383	.667	.269	1.656
	GreenVolyLRmerge			2.761	2	.251			
	GreenVolyLRmerge(1)	.444	.268	2.759	1	.097	1.560	.923	2.635
	GreenVolyLRmerge(2)	.270	.314	.736	1	.391	1.309	.707	2.424
	DivProxTV3HML			2.116	2	.347			
	DivProxTV3HML(1)	.178	.300	.351	1	.554	1.194	.663	2.150
	DivProxTV3HML(2)	.394	.272	2.096	1	.148	1.483	.870	2.527
	GSQualityTV1LMH			3.441	2	.179			
	GSQualityTV1LMH(1)	.010	.301	.001	1	.973	1.010	.560	1.822
	GSQualityTV1LMH(2)	.475	.311	2.328	1	.127	1.608	.874	2.959
	NAttachTV1LMH			2.222	2	.329			
	NAttachTV1LMH(1)	.008	.275	.001	1	.976	1.008	.589	1.727
	NAttachTV1LMH(2)	-.374	.295	1.609	1	.205	.688	.386	1.226
	CareTV1LMH			3.772	2	.152			
	CareTV1LMH(1)	-.446	.280	2.534	1	.111	.640	.370	1.109
	CareTV1LMH(2)	.035	.281	.015	1	.902	1.035	.596	1.797
	weekincome			5.031	3	.170			
	weekincome(1)	.552	.361	2.339	1	.126	1.737	.856	3.524
	weekincome(2)	.727	.395	3.384	1	.066	2.070	.954	4.492
	weekincome(3)	.889	.405	4.814	1	.028	2.434	1.100	5.387
	Constant	-.244	.651	.140	1	.708	.784		

a. Variable(s) entered on step 1: NhoodPCSRank, gender, AgeMERGE, CulturalMERGE, LivingLRx3Merge, Ownorrent, time, GreenVolyLRmerge, DivProxTV3HML, GSQualityTV1LMH, NAttachTV1LMH, CareTV1LMH, weekincome.

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Appendix 7.6: Forced entry logistic regression model: Physical function

Case Processing Summary

Unweighted Cases ^a		N	Percent
Selected Cases	Included in Analysis	396	90.0
	Missing Cases	44	10.0
	Total	440	100.0
Unselected Cases		0	.0
Total		440	100.0

a. If weight is in effect, see classification table for the total number of cases.

Classification Table^a

			Predicted		
			PhysFuncMed2		Percentage Correct
			Median and below	Above median	
Step 1	PhysFuncMed2	Median and below	197	45	81.4
		Above median	59	95	61.7
Overall Percentage					73.7

a. The cut value is .500

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I. for EXP(B)	
								Lower	Upper
Step 1	weekincome			9.583	3	.022			
	weekincome(1)	.075	.435	.030	1	.863	1.078	.459	2.529
	weekincome(2)	.421	.469	.806	1	.369	1.524	.607	3.825
	weekincome(3)	1.116	.477	5.471	1	.019	3.054	1.198	7.782
	qual			.752	3	.861			
	qual(1)	-.050	.362	.019	1	.890	.951	.468	1.932
	qual(2)	-.185	.366	.254	1	.614	.831	.406	1.704
	qual(3)	.110	.406	.073	1	.787	1.116	.504	2.474
	NhoodPCSRank			.913	3	.822			
	NhoodPCSRank(1)	.207	.403	.264	1	.607	1.230	.558	2.711
	NhoodPCSRank(2)	.370	.544	.462	1	.497	1.448	.498	4.207
	NhoodPCSRank(3)	-.089	.466	.036	1	.849	.915	.367	2.281
	LivingLRx3Merge			2.955	2	.228			
	LivingLRx3Merge(1)	-.480	.351	1.873	1	.171	.619	.311	1.230
	LivingLRx3Merge(2)	-.589	.355	2.760	1	.097	.555	.277	1.112
	Ownorrent(1)	.047	.345	.018	1	.892	1.048	.533	2.060
	time			2.205	4	.698			
	time(1)	-.168	.336	.250	1	.617	.845	.437	1.634
	time(2)	-.416	.487	.730	1	.393	.660	.254	1.713
	time(3)	-.702	.518	1.841	1	.175	.495	.180	1.366
	time(4)	-.161	.523	.095	1	.758	.852	.306	2.372
	GreenVolyLRmerge			1.872	2	.392			
	GreenVolyLRmerge(1)	.359	.299	1.448	1	.229	1.432	.798	2.571
	GreenVolyLRmerge(2)	.029	.361	.006	1	.936	1.030	.508	2.089
	GSQualityTV1LMH			3.314	2	.191			
	GSQualityTV1LMH(1)	.515	.333	2.389	1	.122	1.674	.871	3.219
	GSQualityTV1LMH(2)	.596	.360	2.749	1	.097	1.815	.897	3.674
	GSQualityTV3HML			3.755	2	.153			
	GSQualityTV3HML(1)	-.364	.334	1.190	1	.275	.695	.361	1.337
	GSQualityTV3HML(2)	.251	.310	.658	1	.417	1.286	.701	2.359
	NAttachTV1LMH			2.426	2	.297			
	NAttachTV1LMH(1)	.472	.305	2.392	1	.122	1.602	.882	2.913
	NAttachTV1LMH(2)	.320	.331	.934	1	.334	1.377	.720	2.634
	EcoTV2LMH			3.548	2	.170			
	EcoTV2LMH(1)	-.295	.307	.924	1	.336	.744	.408	1.359
	EcoTV2LMH(2)	.297	.318	.874	1	.350	1.346	.722	2.512
	AgeMERGE			40.980	2	.000			
	AgeMERGE(1)	-1.120	.338	11.002	1	.001	.326	.168	.632
	AgeMERGE(2)	-2.804	.440	40.624	1	.000	.061	.026	.143
	Constant	.114	.732	.024	1	.876	1.121		

a. Variable(s) entered on step 1: weekincome, qual, NhoodPCSRank, LivingLRx3Merge, Ownorrent, time, GreenVolyLRmerge, GSQualityTV1LMH, GSQualityTV3HML, NAttachTV1LMH, EcoTV2LMH, AgeMERGE.

Appendix 7.7: Forced entry logistic regression model: General health**Case Processing Summary**

Unweighted Cases ^a		N	Percent
Selected Cases	Included in Analysis	427	97.0
	Missing Cases	13	3.0
	Total	440	100.0
Unselected Cases		0	.0
Total		440	100.0

a. If weight is in effect, see classification table for the total number of cases.

Classification Table^a

			Predicted		
			GenHealthMed2		Percentage Correct
			Median and below	Above median	
Step 1	GenHealthMed2	Median and below	173	62	73.6
		Above median	79	113	58.9
Overall Percentage					67.0

a. The cut value is .500

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I. for EXP(B)	
								Lower	Upper
Step 1	gender(1)	-.503	.241	4.373	1	.037	.605	.377	.969
	AgeMERGE			1.672	2	.433			
	AgeMERGE(1)	.186	.320	.337	1	.562	1.204	.643	2.253
	AgeMERGE(2)	-.192	.364	.279	1	.598	.825	.405	1.683
	CulturalMERGE			6.389	2	.041			
	CulturalMERGE(1)	.043	.276	.025	1	.875	1.044	.608	1.794
	CulturalMERGE(2)	.711	.290	6.020	1	.014	2.037	1.154	3.595
	NhoodPCSRank			11.080	3	.011			
	NhoodPCSRank(1)	.037	.303	.015	1	.902	1.038	.573	1.880
	NhoodPCSRank(2)	1.086	.450	5.833	1	.016	2.964	1.227	7.157
	NhoodPCSRank(3)	.766	.338	5.143	1	.023	2.151	1.110	4.169
	LivingLRx3Merge			.725	2	.696			
	LivingLRx3Merge(1)	.073	.310	.055	1	.814	1.075	.586	1.973
	LivingLRx3Merge(2)	.267	.338	.627	1	.429	1.307	.674	2.533
	Ownorrent(1)	.478	.326	2.140	1	.144	1.612	.850	3.057
	HomeLRmerge(1)	1.013	.438	5.351	1	.021	2.754	1.167	6.499
	VisitparkMERGE			2.704	3	.440			
	VisitparkMERGE(1)	-.137	.447	.094	1	.760	.872	.363	2.096
	VisitparkMERGE(2)	-.459	.403	1.299	1	.254	.632	.287	1.391
	VisitparkMERGE(3)	.050	.334	.022	1	.881	1.051	.547	2.021
	GreenVolyLRmerge			11.255	2	.004			
	GreenVolyLRmerge(1)	.909	.271	11.244	1	.001	2.482	1.459	4.223
	GreenVolyLRmerge(2)	.589	.317	3.453	1	.063	1.801	.968	3.352
	DivProxTV3HML			2.306	2	.316			
	DivProxTV3HML(1)	-.103	.300	.118	1	.732	.902	.501	1.623
	DivProxTV3HML(2)	.304	.269	1.278	1	.258	1.355	.800	2.294
	GSQualityTV2LMH			6.173	2	.046			
	GSQualityTV2LMH(1)	.418	.282	2.197	1	.138	1.519	.874	2.642
	GSQualityTV2LMH(2)	.730	.295	6.149	1	.013	2.076	1.165	3.697
	NAttachTV1LMH			2.709	2	.258			
	NAttachTV1LMH(1)	-.015	.274	.003	1	.957	.985	.576	1.685
	NAttachTV1LMH(2)	.410	.294	1.939	1	.164	1.506	.846	2.680
	CareTV1LMH			3.698	2	.157			
	CareTV1LMH(1)	.044	.271	.026	1	.872	1.045	.614	1.777
	CareTV1LMH(2)	.477	.279	2.923	1	.087	1.611	.933	2.783
	Constant	-3.264	.704	21.473	1	.000	.038		

a. Variable(s) entered on step 1: gender, AgeMERGE, CulturalMERGE, NhoodPCSRank, LivingLRx3Merge, Ownorrent, HomeLRmerge, VisitparkMERGE, GreenVolyLRmerge, DivProxTV3HML, GSQualityTV2LMH, NAttachTV1LMH, CareTV1LMH.

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Appendix 7.8: Forced entry logistic regression model: Mental health component score (MCS)

Case Processing Summary

Unweighted Cases ^a		N	Percent
Selected Cases	Included in Analysis	398	90.5
	Missing Cases	42	9.5
	Total	440	100.0
Unselected Cases		0	.0
Total		440	100.0

a. If weight is in effect, see classification table for the total number of cases.

Classification Table^a

			Predicted		
			MCSMedian2		Percentage Correct
			Median and below	Above median	
Step 1	MCSMedian2	Median and below	142	59	70.6
		Above median	61	136	69.0
Overall Percentage					69.8

a. The cut value is .500

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I. for EXP(B)	
								Lower	Upper
Step 1	gender(1)	.103	.253	.167	1	.683	1.109	.675	1.820
	AgeMERGE			23.579	2	.000			
	AgeMERGE(1)	.577	.325	3.138	1	.077	1.780	.940	3.368
	AgeMERGE(2)	1.838	.394	21.770	1	.000	6.281	2.903	13.591
	weekincome			7.401	3	.060			
	weekincome(1)	.642	.375	2.936	1	.087	1.900	.912	3.961
	weekincome(2)	.376	.402	.876	1	.349	1.457	.663	3.202
	weekincome(3)	.998	.404	6.106	1	.013	2.713	1.229	5.987
	qual			4.443	3	.217			
	qual(1)	.024	.323	.005	1	.942	1.024	.544	1.928
	qual(2)	-.565	.328	2.974	1	.085	.568	.299	1.080
	qual(3)	-.418	.372	1.268	1	.260	.658	.318	1.363
	LivingLRx3Merge			.692	2	.708			
	LivingLRx3Merge(1)	.260	.314	.688	1	.407	1.297	.701	2.398
	LivingLRx3Merge(2)	.151	.336	.201	1	.654	1.163	.601	2.249
	Ownorrent(1)	.749	.328	5.231	1	.022	2.116	1.113	4.022
	HomeLRmerge(1)	.279	.369	.569	1	.451	1.321	.641	2.725
	time			1.744	4	.783			
	time(1)	-.332	.307	1.166	1	.280	.718	.393	1.311
	time(2)	-.265	.404	.429	1	.512	.767	.347	1.695
	time(3)	-.500	.422	1.402	1	.236	.607	.265	1.387
	time(4)	-.247	.415	.353	1	.552	.781	.346	1.763
	DivProxTV3HML			3.955	2	.138			
	DivProxTV3HML(1)	.533	.303	3.094	1	.079	1.704	.941	3.088
	DivProxTV3HML(2)	.484	.284	2.905	1	.088	1.623	.930	2.831
	GSQualityTV2LMH			1.291	2	.524			
	GSQualityTV2LMH(1)	.316	.293	1.161	1	.281	1.371	.772	2.435
	GSQualityTV2LMH(2)	.276	.313	.781	1	.377	1.318	.714	2.432
	GSQualityTV3HML			.167	2	.920			
	GSQualityTV3HML(1)	.114	.283	.163	1	.686	1.121	.644	1.952
	GSQualityTV3HML(2)	.042	.294	.020	1	.887	1.043	.586	1.857
	NAttachTV1LMH			.894	2	.640			
	NAttachTV1LMH(1)	.147	.279	.277	1	.598	1.158	.670	2.001
	NAttachTV1LMH(2)	.290	.308	.887	1	.346	1.336	.731	2.441
	Constant	-2.808	.699	16.140	1	.000	.060		

a. Variable(s) entered on step 1: gender, AgeMERGE, weekincome, qual, LivingLRx3Merge, Ownorrent, HomeLRmerge, time, DivProxTV3HML, GSQualityTV2LMH, GSQualityTV3HML, NAttachTV1LMH.

Appendix 7.9: Forced entry logistic regression model: Vitality**Case Processing Summary**

Unweighted Cases ^a		N	Percent
Selected Cases	Included in Analysis	396	90.0
	Missing Cases	44	10.0
	Total	440	100.0
Unselected Cases		0	.0
Total		440	100.0

a. If weight is in effect, see classification table for the total number of cases.

Classification Table^a

			Predicted		
			VitalityMed2		Percentage Correct
			Median and below	Above median	
Step 1	Observed				
	VitalityMed2	Median and below	138	63	68.7
		Above median	71	124	63.6
	Overall Percentage				66.2

a. The cut value is .500

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I. for EXP(B)	
								Lower	Upper
Step 1	AgeMERGE			4.997	2	.082			
	AgeMERGE(1)	.334	.321	1.085	1	.297	1.396	.745	2.617
	AgeMERGE(2)	.824	.376	4.809	1	.028	2.280	1.092	4.764
	weekincome			5.169	3	.160			
	weekincome(1)	.194	.355	.298	1	.585	1.214	.606	2.433
	weekincome(2)	.398	.392	1.032	1	.310	1.488	.691	3.206
	weekincome(3)	.835	.410	4.152	1	.042	2.305	1.032	5.146
	qual			5.844	3	.119			
	qual(1)	.333	.312	1.139	1	.286	1.395	.757	2.570
	qual(2)	-.446	.328	1.855	1	.173	.640	.337	1.217
	qual(3)	-.082	.369	.050	1	.824	.921	.447	1.899
	NhoodMCSRank			3.354	3	.340			
	NhoodMCSRank(1)	-.278	.367	.573	1	.449	.757	.369	1.555
	NhoodMCSRank(2)	-.430	.370	1.347	1	.246	.651	.315	1.344
	NhoodMCSRank(3)	.398	.578	.476	1	.490	1.489	.480	4.619
	LivingLRx3Merge			1.187	2	.552			
	LivingLRx3Merge(1)	.241	.311	.604	1	.437	1.273	.692	2.340
	LivingLRx3Merge(2)	-.042	.339	.016	1	.900	.958	.493	1.862
	Ownorrent(1)	.035	.317	.012	1	.913	1.035	.557	1.925
	GardenLRmerge			1.193	2	.551			
	GardenLRmerge(1)	.534	.538	.986	1	.321	1.706	.595	4.891
	GardenLRmerge(2)	.384	.585	.431	1	.512	1.468	.467	4.617
	VisitparkMERGE			3.495	3	.321			
	VisitparkMERGE(1)	.689	.462	2.225	1	.136	1.991	.805	4.921
	VisitparkMERGE(2)	.491	.413	1.413	1	.235	1.635	.727	3.676
	VisitparkMERGE(3)	.616	.346	3.176	1	.075	1.852	.940	3.648
	GreenVolyLRmerge			3.353	2	.187			
	GreenVolyLRmerge(1)	.388	.264	2.156	1	.142	1.474	.878	2.473
	GreenVolyLRmerge(2)	.534	.311	2.942	1	.086	1.706	.927	3.139
	DivProxTV3HML			2.172	2	.338			
	DivProxTV3HML(1)	.389	.300	1.685	1	.194	1.476	.820	2.656
	DivProxTV3HML(2)	.339	.272	1.557	1	.212	1.403	.824	2.390
	GSQualityTV2LMH			3.873	2	.144			
	GSQualityTV2LMH(1)	.517	.284	3.323	1	.068	1.677	.962	2.924
	GSQualityTV2LMH(2)	.481	.304	2.512	1	.113	1.618	.892	2.933
	GSQualityTV3HML			1.760	2	.415			
	GSQualityTV3HML(1)	.278	.275	1.028	1	.311	1.321	.771	2.263
	GSQualityTV3HML(2)	-.067	.288	.054	1	.816	.935	.531	1.645
	NAttachTV1LMH			.940	2	.625			
	NAttachTV1LMH(1)	.135	.271	.247	1	.619	1.144	.673	1.947
	NAttachTV1LMH(2)	.290	.300	.939	1	.333	1.337	.743	2.405
	Constant	-2.817	.851	10.958	1	.001	.060		

a. Variable(s) entered on step 1: AgeMERGE, weekincome, qual, NhoodMCSRank, LivingLRx3Merge, Ownorrent, GardenLRmerge, VisitparkMERGE, GreenVolyLRmerge, DivProxTV3HML, GSQualityTV2LMH, GSQualityTV3HML, NAttachTV1LMH.

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Appendix 7.10: Forced entry logistic regression model: Mental health

Case Processing Summary

Unweighted Cases ^a		N	Percent
Selected Cases	Included in Analysis	399	90.7
	Missing Cases	41	9.3
	Total	440	100.0
Unselected Cases		0	.0
Total		440	100.0

a. If weight is in effect, see classification table for the total number of cases.

Classification Table^a

			Predicted		
			MenHealthMed2		Percentage Correct
			Median and below	Above median	
Step 1	Observed				
	MenHealthMed2	Median and below	137	66	67.5
		Above median	72	124	63.3
	Overall Percentage				65.4

a. The cut value is .500

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I. for EXP(B)	
								Lower	Upper
Step 1	gender(1)	.309	.243	1.628	1	.202	1.363	.847	2.192
	AgeMERGE			5.389	2	.068			
	AgeMERGE(1)	.353	.308	1.317	1	.251	1.423	.779	2.601
	AgeMERGE(2)	.830	.361	5.282	1	.022	2.294	1.130	4.655
	weekincome			4.003	3	.261			
	weekincome(1)	.358	.355	1.015	1	.314	1.430	.713	2.870
	weekincome(2)	-.139	.373	.140	1	.708	.870	.419	1.806
	weekincome(3)	.368	.352	1.097	1	.295	1.445	.726	2.879
	LivingLRx3Merge			7.734	2	.021			
	LivingLRx3Merge(1)	.829	.298	7.725	1	.005	2.290	1.277	4.108
	LivingLRx3Merge(2)	.557	.319	3.047	1	.081	1.745	.934	3.261
	Ownorrent(1)	.688	.301	5.218	1	.022	1.989	1.103	3.588
	time			5.450	4	.244			
	time(1)	.006	.293	.000	1	.983	1.006	.567	1.785
	time(2)	-.563	.390	2.087	1	.149	.569	.265	1.223
	time(3)	-.542	.404	1.801	1	.180	.581	.263	1.284
	time(4)	.131	.395	.110	1	.740	1.140	.525	2.474
	favour(1)	.097	.267	.132	1	.716	1.102	.653	1.859
	GSQualityTV2LMH			2.463	2	.292			
	GSQualityTV2LMH(1)	.364	.275	1.751	1	.186	1.439	.839	2.467
	GSQualityTV2LMH(2)	.407	.287	2.007	1	.157	1.503	.855	2.640
	NAttachTV1LMH			1.587	2	.452			
	NAttachTV1LMH(1)	.250	.267	.877	1	.349	1.284	.761	2.166
	NAttachTV1LMH(2)	.352	.294	1.440	1	.230	1.422	.800	2.528
	Constant	-2.314	.536	18.610	1	.000	.099		

a. Variable(s) entered on step 1: gender, AgeMERGE, weekincome, LivingLRx3Merge, Ownorrent, time, favour, GSQualityTV2LMH, NAttachTV1LMH.