

Figure 4.1. Location of the Lourens River quaternary catchment: a) within South Africa as shown by the box and b) within the City of Cape Town.

erstwhile municipalities of Somerset West and Strand. The households mostly have an annual income over R38 400. They are distributed between the middle and high income brackets (Willemse 2010). The national land use/land cover types found in the catchment in 2009 are: cultivated land, mines, natural land, plantations, urban built up and waterbodies (SANBI 2009). From the national land use/land cover types, the major categories are the natural land, cultivated land, plantations and urban built

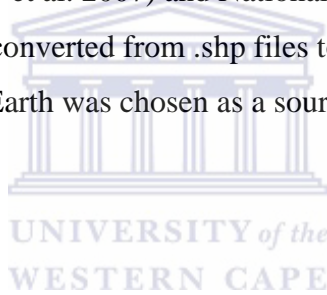
up. Most of the natural vegetation is in the higher altitude portions of the catchment to the north east and east. Below the natural vegetation in the eastern part of the catchment are cultivated lands and plantations. The central and southern portions of the catchment are dominated by the urban built up landuse/landcover category which reaches the coast in the southern part of the catchment (SANBI 2009). The catchment is part of the Cape Floristic Region which is a biodiversity hotspot (Myers et al. 2000) so all natural remnants in the city boundary are critical for the conservation of biodiversity (O'Farrell et al. 2012).

Materials and Methods

Data Collection

Preparation

The boundaries of the study area and the 500 m contour were obtained from Biodiversity GIS (Willoughby et al. 2007) and National Geospatial Information respectively as .shp files and converted from .shp files to .kml files using Shp2kml (see Appendix 4.1). Google Earth was chosen as a source of imagery because of its ready availability.



Digitizing

The open spaces below the 500 m contour were digitized in Google Earth for the quaternary catchment of the Lourens River. It was assumed that the images had the same resolution (~0.75 m) or resolution similar enough not to compromise the analyses.

Space on the catchment boundary that went over it was included. An attempt has been made to avoid/exclude water bodies and rivers in the urban areas and water bodies in the non-urban areas but it is not always possible to see the course of a river because of trees on its banks. Narrow sidewalks have been left out because of the difficulty of identifying them and because they usually are not vegetated. Water bodies and structures in what is otherwise open space were also digitized so that they could be removed from the open space area at a later stage. Private gardens have been left out as far as possible but not gardens opened to the public such as Vergelegen. Tarred tracks were mostly not digitized. Open spaces extending a long

way beyond the boundaries of the catchment were stopped at visually convenient points such as tracks or bridges.

The digitizing started with the section of the Lourens River quaternary catchment for which the earliest Google Earth coverage was 23 March 2005. At any listed date on Google Earth, the coverage is a composite of images that do not necessarily match the listed date (pers. obs.). Some open spaces come from images from 15 February 2005. The two dates were digitized separately. Approximately 1450 separate spaces, structures and waterbodies were digitised. The digitized spaces were saved as .kml files.

Google Earth coverages for different dates are not aligned either with each other or with actual geographical coordinates. Google Earth files were saved by date so that spaces that overlapped different dates were split and saved separately as .kml files and joined later after realignment.

Acquisition of other data

Digital photographs and information layers (stations, bus routes, taxi routes) were acquired from the City of Cape Town Municipality. The City Parks Department supplied a layer of spaces that fall under their care. Mr Martin Cocks of UWC, Bellville and SANBI, Kirstenbosch supplied a point format schools layer.

File Preparation for Analysis

The .kml files were converted to .shp files using DNR Garmin Application 5.4.1 (Minnesota Department of Natural Resources – see Appendix 4.1). The files were in a latlong projection.

Where necessary, water bodies and buildings were removed from the open space. All spaces were then checked in Google Earth by Dr R.R. Raitt and checked by the digitizer using imprecisely dated 2005 imagery from the City of Cape Town in a GIS. This resulted in the identification of some missed spaces, cut outs and inconsistencies which were then dealt with.

The open spaces digitized from 15 February 2005 imagery have a different alignment in Google Earth to those digitized from 23 March 2005 imagery. This was manually shifted four to five metres for an approximate match to 23 March using control points. After realignment, the 500 m contour borders were corrected and continuous space, that was separated because of different dates and alignments, was joined. All of the about 1025 spaces were combined into one file with a latlong projection. Further realignment was not undertaken so as to allow the final product to be displayed in Google Earth as part of the MAPA project (MAPA Team Undated). The combined file was reprojected to Gauss-Kruger LO 19 Haartebeeshoek 1994.

The area of each space was calculated in square meters. Unvegetated spaces were excluded. Space greater than or equal to 900 m² (the area of a 30 m x 30 m pixel) with a cross section of at least 15 m (half of a side of a 30 m x 30 m pixel) was selected for analysis. This was done to allow the option of raster modeling. A set of 593 spaces met these criteria.

Train stations in or within 900 m of the study area were identified from data from the City of Cape Town. These were Firgrove Station (about 500 m outside of the catchment), Somerset West Station and Van der Stel Station. Probable access points (stations have limited access) were identified and marked in Google Earth on the 23 March 2005 imagery so as to match the alignment of the open space. The points were converted from .kml to .shp using the same program as was used for the open space. The points were combined.

Bus and taxi routes within the catchment were identified. Points were put at junctions in Google Earth on the 23 March 2005 imagery. The .kml files were converted to .shp files and combined. Copies of the bus and taxi route data were then moved to align with the points so as to approximate the Google Earth alignment.

It should be noted that the minibus taxis which are dealt with here function in a manner similar to buses travelling on fixed routes rather than taking a passenger from door to door. This means that the buses and taxis are in competition with each other as they fulfil the same role.

Schools within the Lourens quaternary catchment and within 900 m of the said catchment were identified from a schools layer. Polygons were created in Google Earth on the 23 March 2005 imagery for all identified schools as access points were not clear. The polygons were converted .kml to .shp using the same program as with the spaces and combined.

From the literature, 300, 500, 800 and 900 m distances were found. English Nature recommended a maximum distance to live from open space of 300 m (Barbosa et al. 2007). A California study by Wolch et al. (2011) used 500 m. People with their children were prepared to walk 800 m to reach open space in Australia (Crawford et al. 2008) and a New Zealand study by Witten et al. (2012) used the same distance. The European Environment Agency recommended 900 m as a maximum distance to live from open space (Barbosa et al. 2007). These distances were selected to analyse proximity (Euclidean distance) to open space in the Lourens quaternary catchment.

Analysis

All the 900 m² vegetated spaces were buffered by the selected distances starting with a radius of 300 m to determine walking proximity. Buffers were then placed around schools to determine walking proximity. The proximity of ≥ 900 m² vegetated spaces from public transport (bus routes, taxi routes and train stations) was determined by buffering the aforementioned public transport. The application of the buffer was followed by buffer analysis.

Results

In 2005, there were only two houses (on Goedehoop Road where it connects to Firmount Road at 34.0692445°S, 18.843864°E and 34.0691760°S, 18.844172°E) in the Lourens quaternary catchment that were further than 300 m from a ≥ 900 m² vegetated open space though the middle of a dam was also beyond 300 m from such space and no place in the Lourens quaternary catchment that was further than 500 m from such a space (Figure 4.2). All the schools in this study had ≥ 900 m² vegetated open spaces within 300 m of them excluding their own grounds (Figure 4.3).

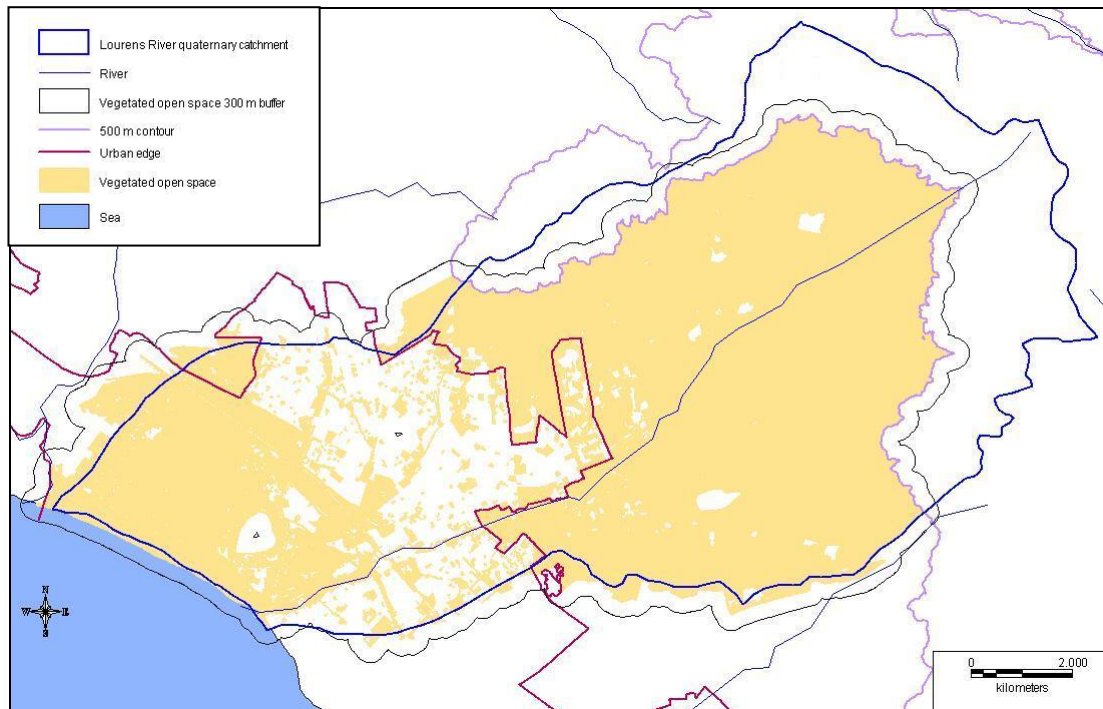


Figure 4.2. Vegetated open space in the Lourens River quaternary catchment, Cape Town in 2005 digitized from Google Earth and converted for use in a GIS with a distance of 300 m all around (single buffer for all open spaces) to show proximity to the vegetated open space. The river within the catchment boundary is the Lourens River.

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Firgrove Station is within 300 m of open space contiguous with open space in the Lourens quaternary catchment. Both stations within the catchment are within 300 m of $\geq 900 \text{ m}^2$ vegetated open spaces (Figure 4.4). Open space could be reached within 300 m of both bus and taxi routes (Figures 4.5 & 4.6).

Discussion

The Lourens quaternary catchment was well provided for in terms of open space in 2005. This is in keeping with the upmarket part of Cape Town that falls within it - middle to high income areas (Willemse 2010). Unfortunately, most of this space is not formally designated as open space (City Parks 2013, Willemse 2010) or is privately owned and as such is not ‘protected’ from development. Only 111 community parks are found in the Lourens River quaternary catchment of which 11 had an area of less than 900 m^2 (City Parks 2013).

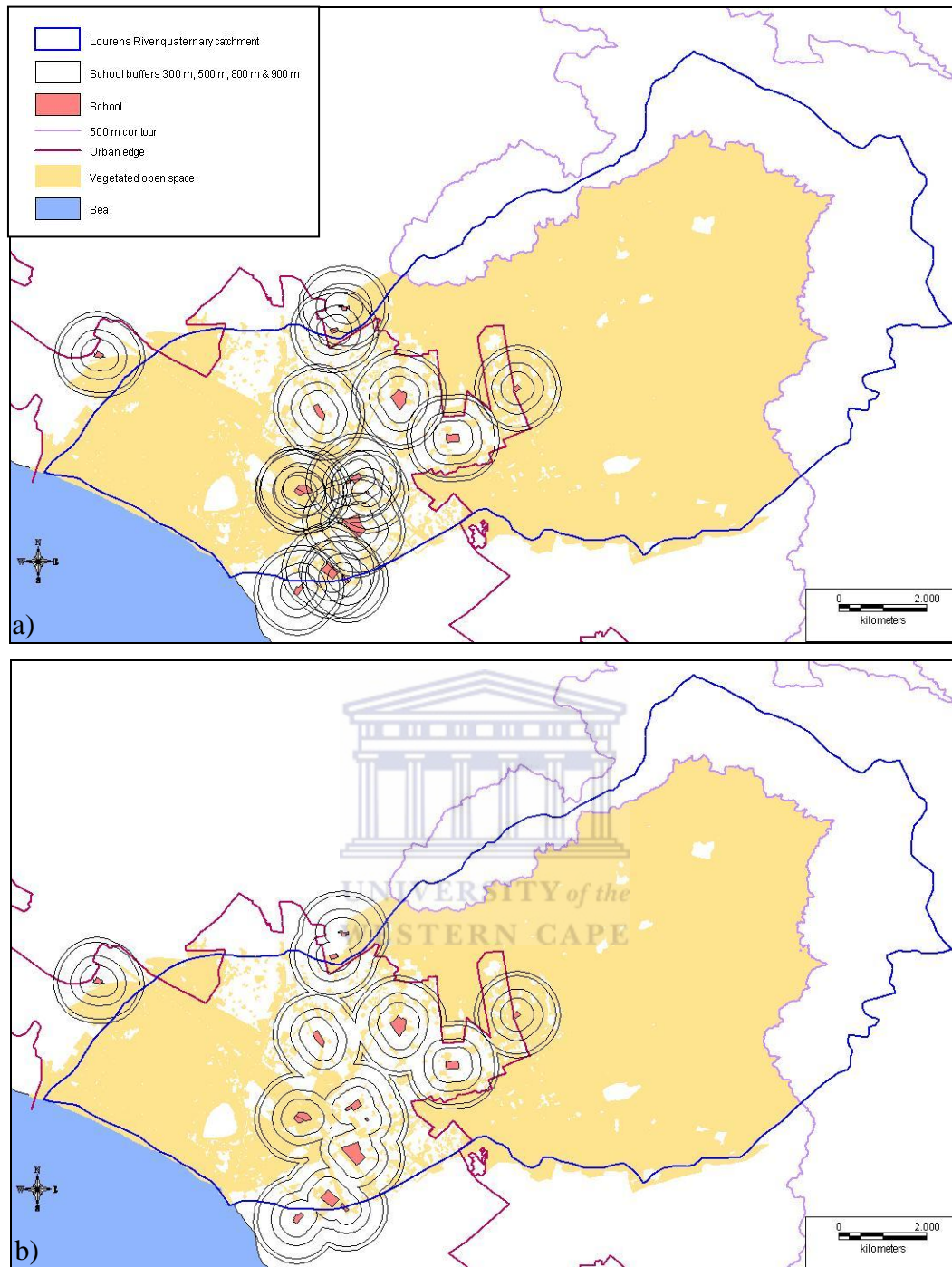


Figure 4.3. Schools with concentric distances of 300 m, 500 m, 800 m and 900 m to show the proximity of the schools to various vegetated open spaces within the Lourens River quaternary catchment, Cape Town. In a), individual buffers are used and in b), one buffer per distance is used for all schools.

Both availability and access to open space are important but do not indicate use of such space (Cilliers et al. 2012, Wendel et al. 2012). This article considers proximity to open space but not the factors affecting the use thereof such as size of the space,

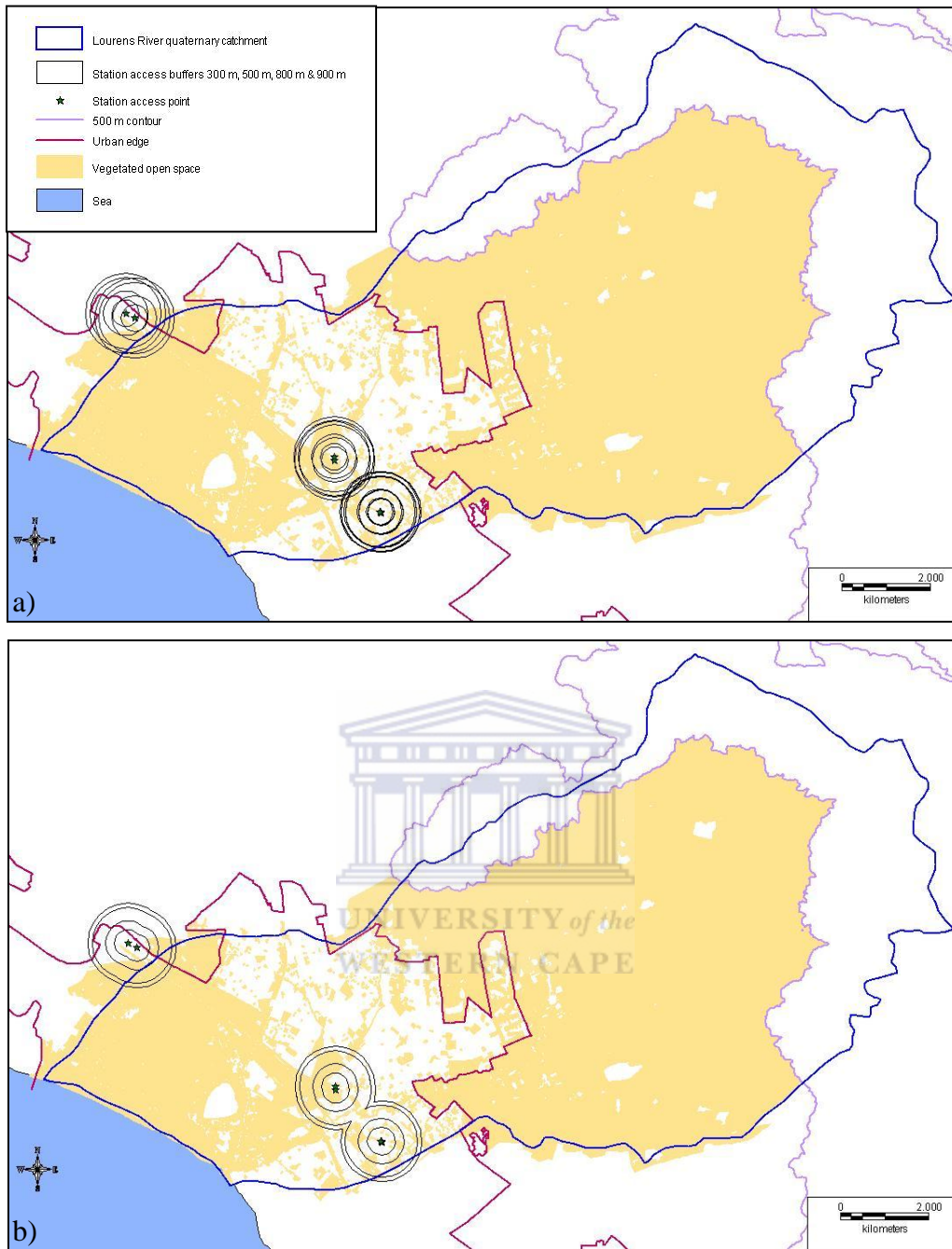


Figure 4.4. Stations with concentric distances of 300 m, 500 m, 800 m and 900 m to show the proximity of the stations to various vegetated open spaces within the Lourens River quaternary catchment, Cape Town. In a), individual buffers are used and in b), one buffer per distance is used for all stations.

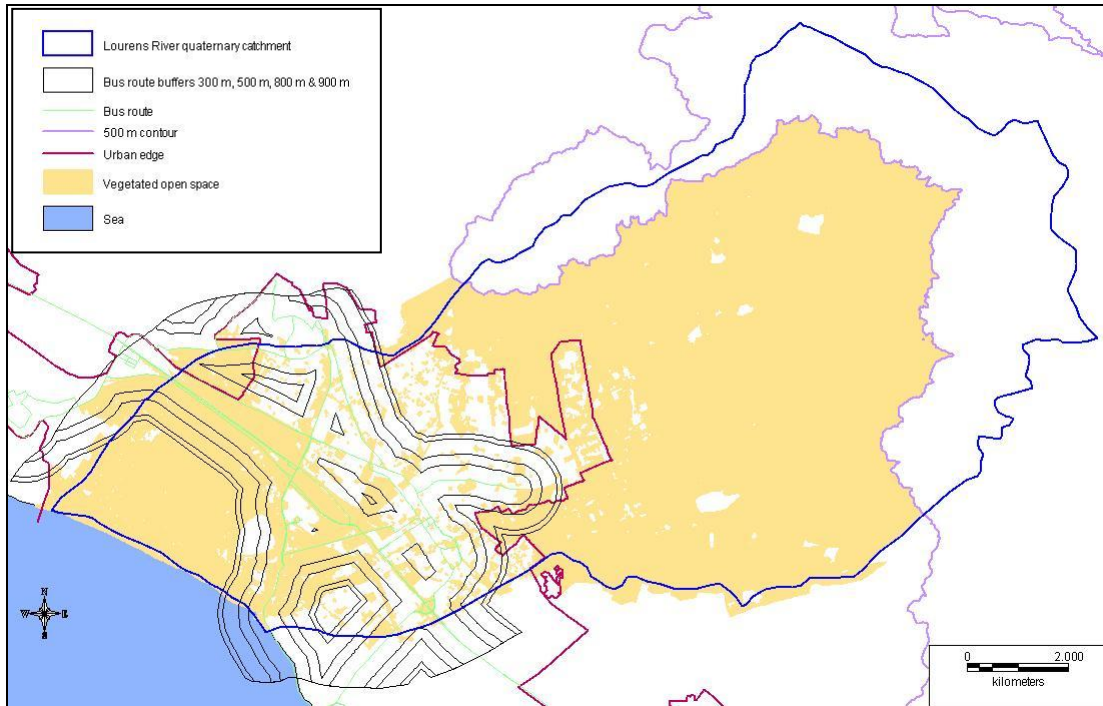


Figure 4.5. Bus routes with concentric distances of 300 m, 500 m, 800 m and 900 m to show the proximity of the routes to various vegetated open spaces within the Lourens River quaternary catchment, Cape Town.

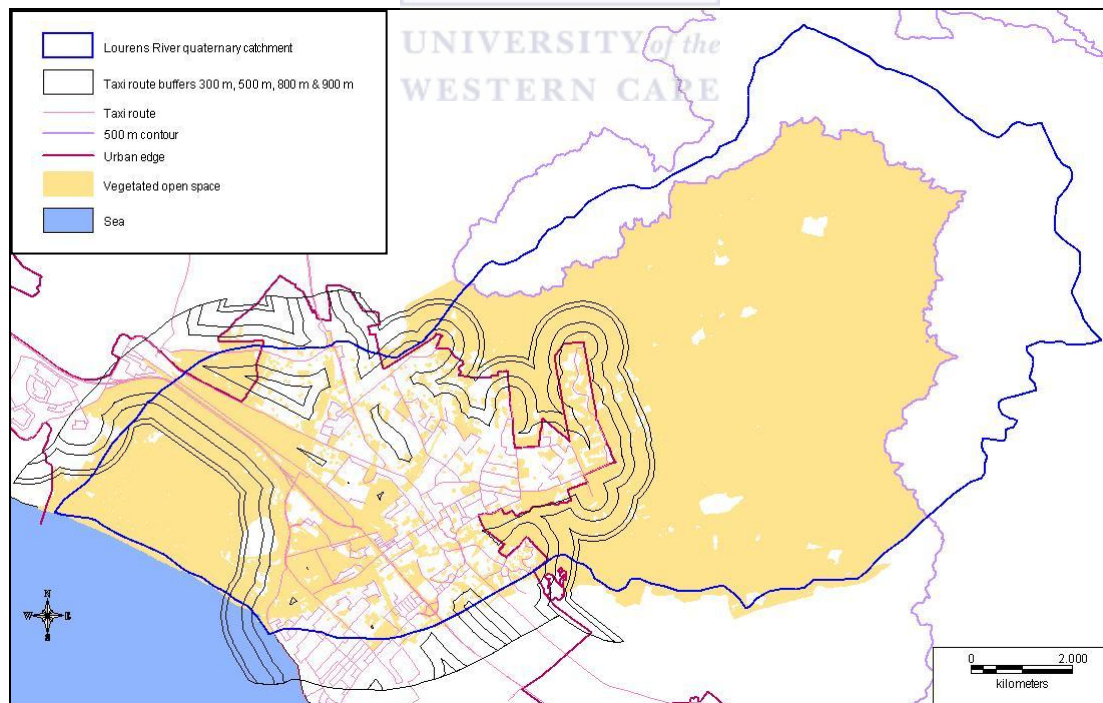


Figure 4.6. Taxi routes with concentric distances of 300 m, 500 m, 800 m and 900 m to show the proximity of the routes to various vegetated open spaces within the Lourens River quaternary catchment, Cape Town.

quality of the space, neighbourhood attributes and individual and collective perceptions of the open space (Cilliers et al. 2012, Giles-Corti et al. 2005). Some factors may act as barriers to use including lack of safety, distance from green space, neighbourhood walkability, lack of desirable space nearby, no time to visit open space (Wendel et al. 2012, Wolch et al. 2011) and social factors (Ball 2006).

The quality of open space affects its use (Giles-Corti et al. 2005). The importance of this factor is such that tools (e.g. POST and C-POST) have been developed and used to judge the quality of open space (Taylor et al. 2011, Crawford et al. 2008, Giles-Corti et al. 2005). Tools (e.g. NEWS and NDAI) have also been developed and used to assess neighbourhood qualities affecting outdoor activity (Witten et al. 2012, Gebel et al. 2011). Quality might be a cultural perception or even a personal one. It is likely that such tools would need to be calibrated for use in countries other than where they were created. The author would not be pleased to see lights in any neighbourhood public space for two reasons. The first is a reduction in the perception of personal safety as opposed to the usual feeling of increased safety. The second is the harm that artificial light does to nocturnal biodiversity (see Hölker et al. 2010). The author finds endless mowed lawns dull. Kaplan et al. (2004) note that conventional landscaping (lawns) leads to environmental degradation and does not provide the sense of well-being generated by more natural landscapes. Lawn care chemicals are also harmful to human health (Jackson 2003a).

Larger parks are generally preferred (Wendel et al. 2012, Giles-Corti et al. 2005) contributing to the choice of larger spaces for analysis but this does not mean small spaces are not used. The author has seen people using very small pieces of lawn near a local shopping centre.

The safety of the neighbourhood also affects the use of open space. In South Africa, open space is often perceived as unsafe (Cilliers et al. 2012, Van Zyl & Leiman 2002). It is also clear that many fail to see the need for open space (Pitt & Boule 2010) to the extent that no income group feels that open space provision is a service that requires improvement (Willemse 2010). This may be due to lack of personal experience of such space.

However, lack of use does not make the vegetated open space useless; people still benefit from open space without using it (Francis et al. 2012b, Kearney 2006) via the psychological benefits provided by the sight of vegetation (Taylor et al. 2002, Kuo & Sullivan 2001), the employment required for the maintenance of these spaces (Fausold & Lilieholm 1999) and ecosystem services vegetated open space provides (Cilliers et al. 2012).

While the digitizing was painstakingly done, it is not accurate. The digitizer was relatively inexperienced (as can be seen by the varying distance between points on polygons indicating varying degrees of zoom) and trees obscure whatever is under them. However, this approximation still shows a broad overview which is unlikely to change significantly due to more precise work.

Buffering gives absolute distance but not actual access distance as walking access is usually via the road network. The bus and taxi data were in the form of polylines (with no area) so the buffering provides an inaccurate estimate of the distance. The data did not include specific stopping points on these routes making proximity to the route an unreliable guide to potential access.

This paper looks at physical proximity to open space but there are also socio-political factors that affect access to open space. How 'the public' is defined is one of these factors (Mitchell 1995). Another is the fluid nature of the boundary between public and private space (Dixon et al. 2006).

This study considered proximity to space in the Lourens quaternary catchment in 2005. Since then there has been considerable development in the area. There is a lack of research looking at the changes in open space over time. In the light of the literature on the importance of the quality of open space, research on the management of such space and its impacts would provide useful information.

Conclusion

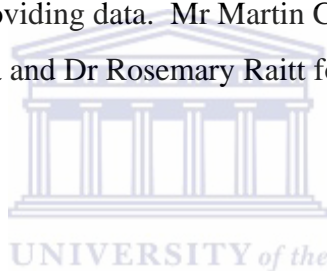
What was the potential access (proximity) to vegetated open space of at least 900 m² in the Lourens River quaternary catchment in 2005? The Lourens River quaternary

catchment was well provided with open space with an area of more than 900 m² in 2005. All but two houses met the most stringent suggestion for proximity to space found in the literature – that of English Nature of 300 m – as did all the schools and forms of public transport considered in this study (Barbosa et al. 2007).

However, most of this space was not formally designated as open space and may be lost to development. Thus this positive picture is partially an illusion. Formal action is needed to ensure that proximity to open space remains a positive feature of living in the Lourens River quaternary catchment.

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Appendix 4.1 Online Programme Sources

Shp2kml is available from <http://www.zonums.com/shp2kml.html>.

DNR Garmin Application 5.4.1 (Minnesota Department of Natural Resources) is available at

<http://www.dnr.state.mn.us/mis/gis/tools/arcview/extensions/DNRGarmin/DNRGarmin.html>).



Chapter 5 Open Space and Conservation in the Lourens River Quaternary Catchment

Abstract

Urban conservation is necessary to retain biodiversity and to retain the will to conserve. Environmental knowledge is correlated with exposure which, for most people, will take place in an urban setting. Urban conservation is complicated by impacts from the surrounding environment and perceptions that remnants are not worth saving and pose safety hazards. The value of urban remnants goes beyond habitat value because of their role in education. Protected areas need to be considered in the context of their surroundings. Concentrating on patches may fail to achieve conservation goals. The focus needs to be on the landscape mosaic. This study looks at the occurrence of open space in the urban matrix in the Lourens River quaternary catchment, Cape Town, South Africa. Vegetated open space in 2005 was digitized in Google Earth and transferred to a GIS to use as a baseline. Data on protected open space was then compared to this in terms of number of spaces and area. Of 124 protected spaces, only one was a nature reserve. The western part of the catchment lacked protected space. The Lourens River quaternary catchment's urban matrix includes more disturbed open space than natural open space. This space could still be of conservation value. The challenge is to work with schools and City Parks to achieve management that is sympathetic to biodiversity.

Introduction

Urban conservation is necessary (Rebelo et al. 2011, Pitt & Boule 2010, Crane & Kinzig 2005, Niemelä 1999). Cities located in environmentally sensitive biodiversity hotspots have natural habitat within them that may be of global significance as it is in São Paulo in Brazil and Cape Town in South Africa, for example (Crane & Kinzig 2005). Urban open space can thus be critical for the conservation of rare and endangered species (Niemelä 1999) and this is true for Cape Town which contains 319 IUCN Red List species (Rebelo et al. 2011). Natural spaces within cities are also necessary for the maintenance of public will to conserve (Pitt & Boule 2010) since environmental knowledge is correlated with exposure to the natural environment. It is not correlated to education (McDaniel & Alley 2005). With increasing urbanization, contact with nature will take place in an urban setting for the majority of people

(Crane & Kinzig 2005). People-centred conservation along with community-based resource management are needed for communities to learn to value their natural heritage (Rebelo et al. 2011). People use their memories of the natural environment they experienced as children as a baseline to judge environmental degradation which means each generation's view is less realistic than the previous generation's view – called the shifting baseline (Lindenmayer et al. 2008, Miller 2006) so urban nature is critical for the formation of realistic baselines. The shifting baseline is also known as environmental generational amnesia (Miller 2006).

Conservation in urban areas is complicated (Pitt & Boule 2010). Reasons for this include that development tends to leave odd patches and corridors which are impacted by pollution and nonnative species from the surrounding built environment which is persistent and expanding (Vimal et al. 2012, Pitt & Boule 2010, McKinney 2002, Baschak & Brown 1995 citing Cook 1991). Development may separate ecosystems from supporting structures. Patches may be overused for subsistence or recreation or even formally developed into parks that suit humans rather than the native species (Pitt & Boule 2010, Baschak & Brown 1995 citing Cook 1991). The fact that remnants are not ecologically pristine gives rise to perceptions that these remnants are not worth conserving (Pitt & Boule 2010, Baschak & Brown 1995). Urbanization leads to biotic homogenization and the spread of alien species (Miller 2006, McKinney 2002). People-wildlife conflicts have to be dealt with (Savard et al. 2000) which requires community and other stakeholder engagement which can only be achieved if negative perceptions of conservation are overcome (Gallo & Goodchild 2012, Rebelo et al. 2011, Pitt & Boule 2010, Ancrenaz et al. 2007). Botanical conservation in Cape Town is hampered by the perception that natural veld poses security and fire risks (Rebelo et al. 2011, Van Zyl & Leiman 2002).

Human landscape change (direct and indirect) is accelerating (Lindenmayer et al. 2008, Thomas et al. 2004). Increasing urbanization means that natural areas with significant ecological value are disappearing from cities (Baschak & Brown 1995). This may lead to the inaccurate perception that existing remnants are not valuable to conservation (Pitt & Boule 2010). In reality, the value of such sites goes beyond the immediate habitat value because they allow urbanites to experience nature which can

improve their education and quality of life and thus promote conservation (Miller 2006, Savard et al. 2000).

For protected areas to survive, they must be considered in the context of the landscape around them (the matrix) (Robinson & Ginsberg 2004, Golley 1989). Natural patches are part of a terrestrial matrix in which migrants may find temporary resources (Golley 1989). Conservation must include interfaces between the freshwater, marine and terrestrial realms (Beger et al. 2010). Having continuous greenspace does not guarantee a habitat connection (Jim & Chen 2003) but greenspace may provide habitat connections (Milanovich et al. 2012). A city is a system (Pickett et al. 2011). Urban ecosystems are very dynamic (Savard et al. 2000). Ecological processes occur throughout the city, not just in green space (Pickett et al. 2011). Focusing solely on patches may not achieve the planned conservation goals (Fischer et al. 2005). Species react uniquely to landscape change. Behavioural studies may be the best way to determine connectivity (Shreeve & Dennis 2011). Brady et al. (2011) found that the properties of the matrix determined isolation more than the distance to the nearest patch did. The nature (extent, degree and permanence) of changes to the matrix impact the area and isolation effects of patches. It is necessary to move from a patch focus to a landscape mosaic focus (Kupfer et al. 2006).

This article looks at one aspect of the urban matrix that can benefit conservation– the occurrence of protected open space – within the urban edge in the Lourens River quaternary catchment. The Lourens River quaternary catchment is in the City of Cape Town Municipality, South Africa (Figure 5.1). The research question is, ‘What spaces within the urban edge in the Lourens River quaternary catchment can be said to have some protection from development?’

Methods

The data for this article were drawn from a larger study.

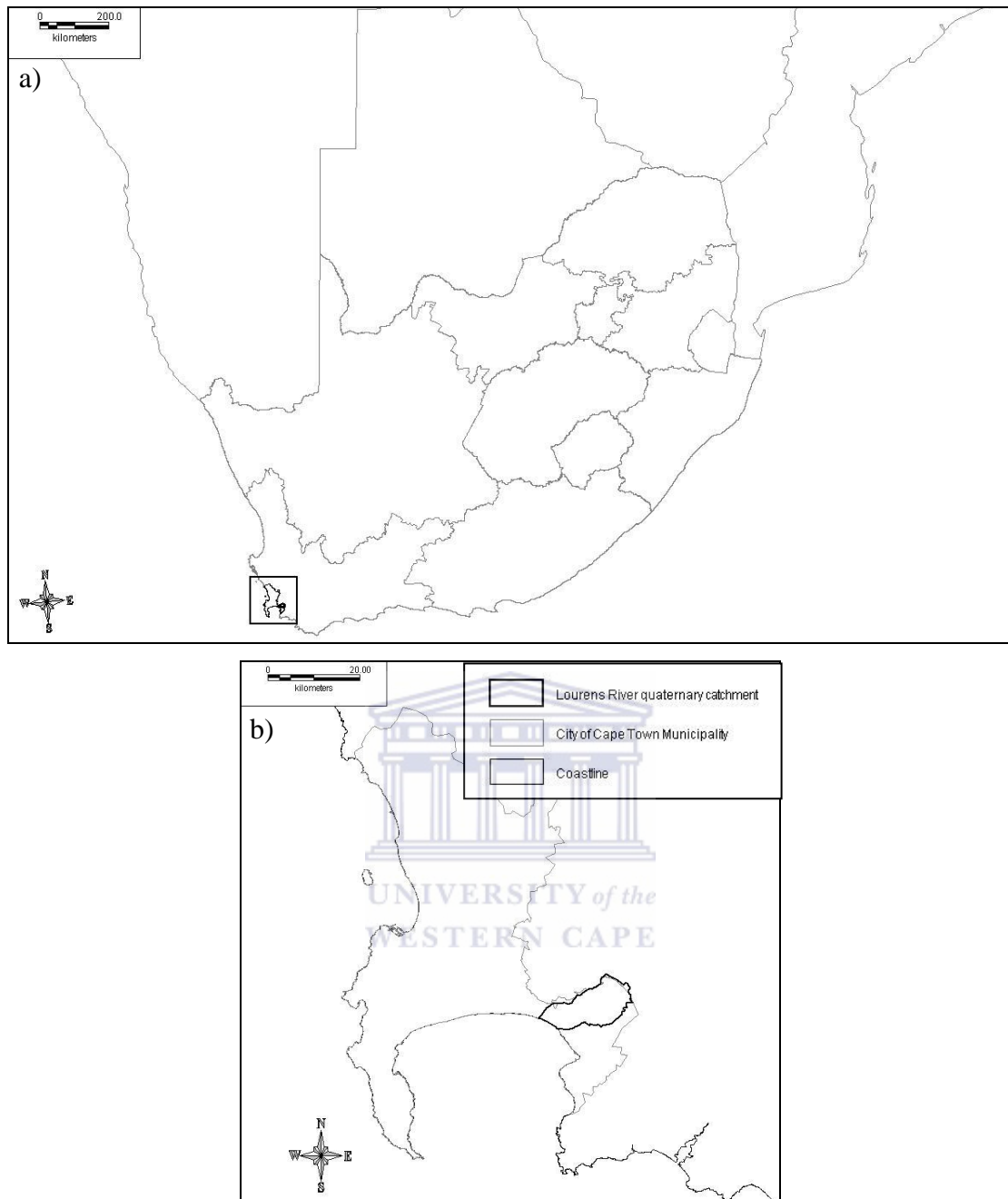


Figure 5.1. Location of the Lourens River quaternary catchment: a) within South Africa as shown by the box and b) within the City of Cape Town.

Data Collection

Preparation

The .shp file of the boundaries of the Lourens River quaternary catchment was obtained from Biodiversity GIS (Willoughby et al. 2007) and the .shp file of the 500 m contour was obtained from National Geospatial Information. The .shp files were

converted to .kml files using Shp2kml (see Appendix 5.1). Google Earth was the chosen source of imagery because of easy access.

Digitizing

The open spaces in the Lourens River quaternary catchment below the 500 m contour were digitized in GoogleEarth. The resolution of the different images was assumed to be the same (~0.75 m) or similar enough not to compromise the analyses.

Peripheral spaces that went over the catchment boundary were included. As far as possible, rivers and water bodies in the urban areas and water bodies in the non-urban areas have been avoided/excluded but the course of a river may be hidden by the trees on its banks. Narrow sidewalks are difficult to identify and are seldom vegetated so they have consequently been excluded. Structures and water bodies within otherwise open space were also digitized to allow their removal from the open space area prior to analysis. Private gardens have been excluded as far as possible but not gardens that are opened to the public such as Vergelegen. Tarred tracks have mostly not been digitized. Open spaces that continue a long way beyond the catchment boundaries were ended at visually convenient points such as tracks or bridges.

The digitizing started at the coast of the Lourens River quaternary catchment. The earliest Google Earth coverage for this section was 23 March 2005. A Google Earth coverage at any listed date is a composite of images which may not all match the listed date (pers. obs.). So, for the Lourens River quaternary catchment, some of the open spaces were digitized from images dated 15 February 2005. The different dates were digitized separately. Approximately 1450 separate spaces, structures and waterbodies were digitised. All digitized spaces were stored as .kml files.

Google Earth coverages from different dates do not align either with each other or with actual geographical coordinates. Google Earth files were saved by date so spaces that overlapped different dates were split and saved separately as .kml files and joined later after realignment.

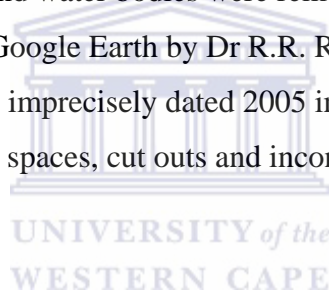
Acquisition of Other Data

Digital photographs were acquired from the City of Cape Town Municipality. The Municipal Parks Department supplied data on spaces that fall under their care. Mr Martin Cocks of UWC, Bellville and SANBI, Kirstenbosch supplied a point format schools layer. The City of Cape Town's Biodiversity Network, which identifies spaces regarded as important for conservation, was downloaded from Biodiversity GIS (Willoughby et al. 2007).

File Preparation for Analysis

DNR Garmin Application 5.4.1 (Minnesota Department of Natural Resources – see Appendix 1) was used to convert the .kml files to .shp files. The files were in a latlong projection.

Where necessary, structures and water bodies were removed from open space. All spaces were then checked in Google Earth by Dr R.R. Raitt. The spaces were also checked by the digitizer using imprecisely dated 2005 imagery from the City of Cape Town in a GIS. Some missed spaces, cut outs and inconsistencies were identified and dealt with.



The open spaces digitized from 15 February 2005 imagery have a different alignment in Google Earth to those digitized from 23 March 2005 imagery. Realignment was done manually (a shift of four to five metres) using control points to get an approximate match to 23 March. The 500 m contour borders were corrected after realignment and continuous space that was separated because of different dates and alignments was joined. All of the about 1025 spaces were combined into one file with a latlong projection. Further realignment was not undertaken so as to allow the final product to be displayed in Google Earth as part of the MAPA project (MAPA Team Undated). The combined file was reprojected to Gauss-Kruger LO 19 Haartebeeshoek 1994 which is the projection favoured by the City of Cape Town Municipality.

The area of each space was calculated in square meters. Unvegetated spaces were excluded. Space greater than or equal to 900 m² (the area of a 30 m x 30 m pixel)

with a cross section of at least 15 m (half the side of a 30 m x 30 m pixel) was selected for analysis. This was done to allow the option of raster modeling. A set of 593 spaces met these criteria. From this set, a further set falling mainly within the urban edge was selected for analysis.

From the BioNet data, the data within the urban edge in the Lourens River quaternary catchment were selected and saved as a new file. Areas protected in perpetuity were selected from the file of the BioNet data within the urban edge in the Lourens River quaternary catchment and saved in a file as were areas otherwise marked as important to the biodiversity network though not formally protected and the natural areas not considered important for the BioNet.

From the City Parks data, the data within the urban edge in the Lourens River quaternary catchment were selected and saved as a new file. The community parks and cemetery data were selected from the file of the City Parks data within the urban edge in the Lourens River quaternary catchment and saved. It should be noted that on site signage and database designation do not always agree. The community parks data is the best quality portion of the City Parks data (pers. comm. Mr Gregory Benskin). Community parks have definite protection against development but the author is unclear how much protection greenbelt areas and drainage lines would have.

The school layer was in a point format so the layer was projected over the City of Cape Town aerial photographs which were used to digitize the school grounds and the open space within the school grounds that met the aforementioned conditions. The point data were not entirely accurate so, for the Somerset West Met. Primary School, the site selected may be inaccurate though it matches where the point is located (the school lacks extensive grounds and is not known to the digitizer).

Analysis

The number of units and total area were calculated for cemeteries, community parks, natural areas protected in perpetuity, school open space, unprotected biodiversity areas and vegetated open space in 2005 falling mainly within the boundaries of the Lourens River quaternary catchment (Table 5.1).

Table 5.1. Forms of protected open space in relation to total open space in 2005 within the urban edge in or partially in the Lourens River quaternary catchment. The areas are taken from the boundaries in the GIS data and are consequently estimates of the actual area. Data used from the City of Cape Town and this study

Type of open space	Number	Area (ha)	Minimum Area (ha) ¹	Mean Area (ha)	Maximum Area (ha)
Open space all or mostly inside the urban edge with $\geq 900 \text{ m}^2$ in 2005 ²	583	2 070.33	0.091	3.551	456.635
Unprotected areas of interest for conservation ³	14	414.783	0.425	29.627	265.921
Natural remnants not selected for the biodiversity network	9	10.83	0.236	1.203	3.355
Natural areas protected in perpetuity	1	4.967	4.967	4.967	4.967
Cemeteries ⁴	2	8.21	2.706	4.105	5.504
Schools ⁵	10	33.58	0.091	1.599	6.097
Community Parks ⁶	111	155.04	0.008	1.259	26.564
Total 'Protected' Space	124	201.8	0.008	1.495	26.564

¹ The vegetated open space and schools open space have a minimum threshold of 900 m^2 (= 0.09 ha). The community parks do not have this threshold - 11 are less than 900 m^2 in area. The selection algorithm used to obtain the set of the minimum number of areas needing to be acquired to meet conservation targets for the biodiversity network did not have an area threshold. However, the tenth tie break rule (rule used to choose between otherwise equal value sites) was to take the larger area (Holmes et al. 2012).

² Open spaces with the bulk outside of the urban edge were not included so the area here is even more of an approximation than the rest of the data.

³ Parts of these areas of conservation interest lie outside of the urban edge (Figure 5.5). Further several of these areas are contiguous though treated separately. If joined, the count would change to ten. If formally protected, these areas would help Cape Town to meet its conservation targets and also contribute to national conservation targets (Holmes et al. 2012).

⁴ Not all the cemetery is green space but for convenience the entire area has been used.

⁵ Not all the schools have vegetated open space around them. Some non-vegetated open space is included. The space measured is that which matches the criteria used for open space: more than 900 m^2 and at least 15 m wide. This means that, while there are ten school grounds, there are twenty-one open spaces.

⁶ This is 2013 data. There were fewer parks in 2005. City Parks is improving its GIS database (pers. comm. Mr Gregory Benskin 3.07.2013).

Results

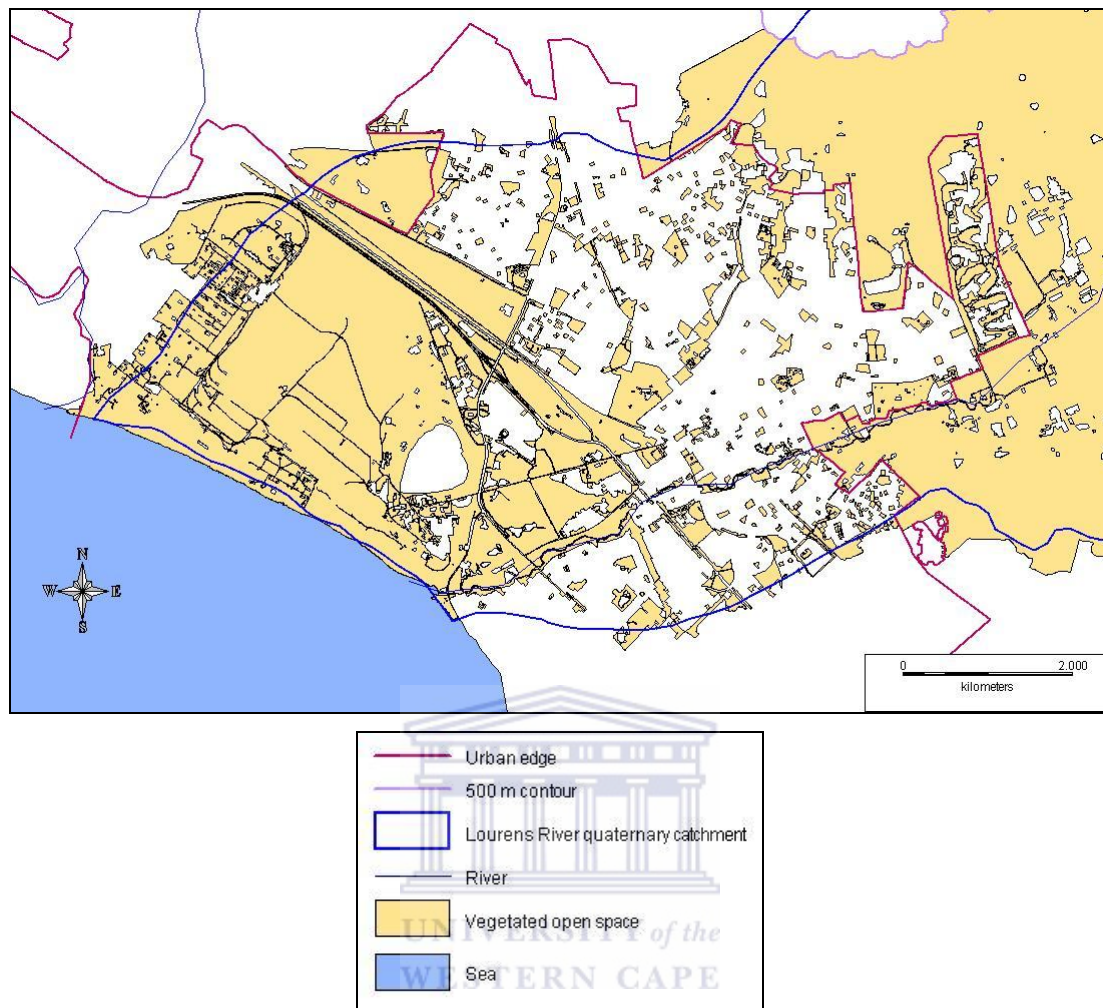


Figure 5.2. Vegetated open space within the urban edge in the Lourens River quaternary catchment, Cape Town in 2005 digitized from Google Earth and converted for use in a GIS. The river within the catchment is the Lourens River.

In 2005, open space was widespread within the urban edge in the Lourens River quaternary catchment (Figure 5.2). Within the urban edge in the Lourens River quaternary catchment there is only one permanently protected natural area (Silwerboom Kloof) (See Table 5.1, Figure 5.3). Helderberg Nature Reserve is outside of the urban edge. Protected open space is less widely distributed with the western portion of the catchment noticeably lacking protected space (Figure 5.4) though the sites of conservation interest would help to fill this gap (Figure 5.5). Most protected spaces have less than one hectare (Figure 5.6). Tie break rule (a rule used to choose between otherwise equal value sites) number ten for selection of sites for

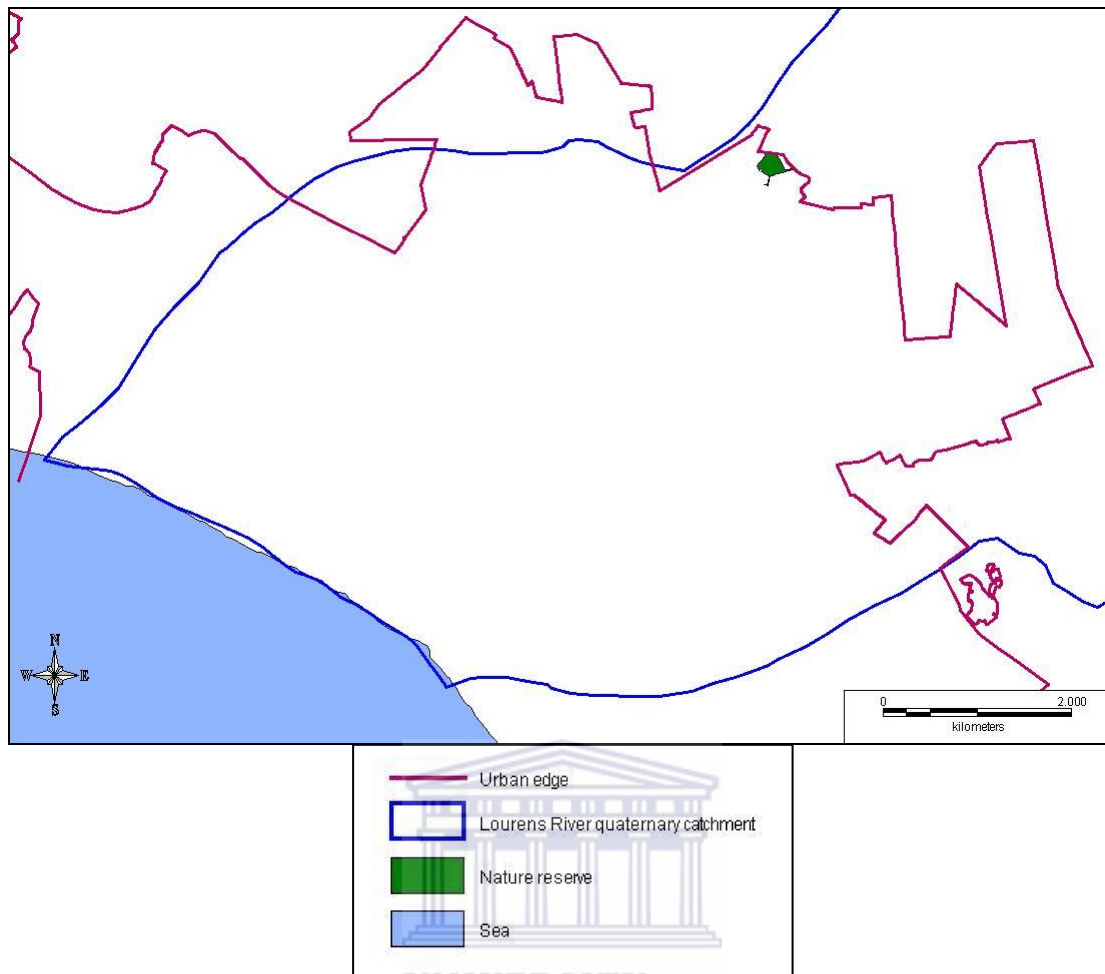


Figure 5.3. Nature reserve within the urban edge in the Lourens River quaternary catchment, Cape Town. Data from the City of Cape Town.

conservation selects for the larger site (Holmes et al. 2012). This means that the fourteen sites of conservation interest do not have the same size distribution but the addition of these sites does not change the profile (Table 5.1, Figure 5.7).

Discussion

Conservationists must consider the issues of urbanization (Miller & Hobbs 2002). Protected areas lie within a matrix of other land uses. Conservationists need to think beyond the protected areas to consider how the matrix can be used to promote conservation objectives. Open spaces, while not natural veld, can and do provide habitats for some native plant species (mostly geophytes – pers. obs.) and connectivity for some bird species (see for e.g. Litteral & Wu 2012). Areas that are not ‘natural’ can be used to aid conservation of natural areas e.g. the flower beds at Kenilworth

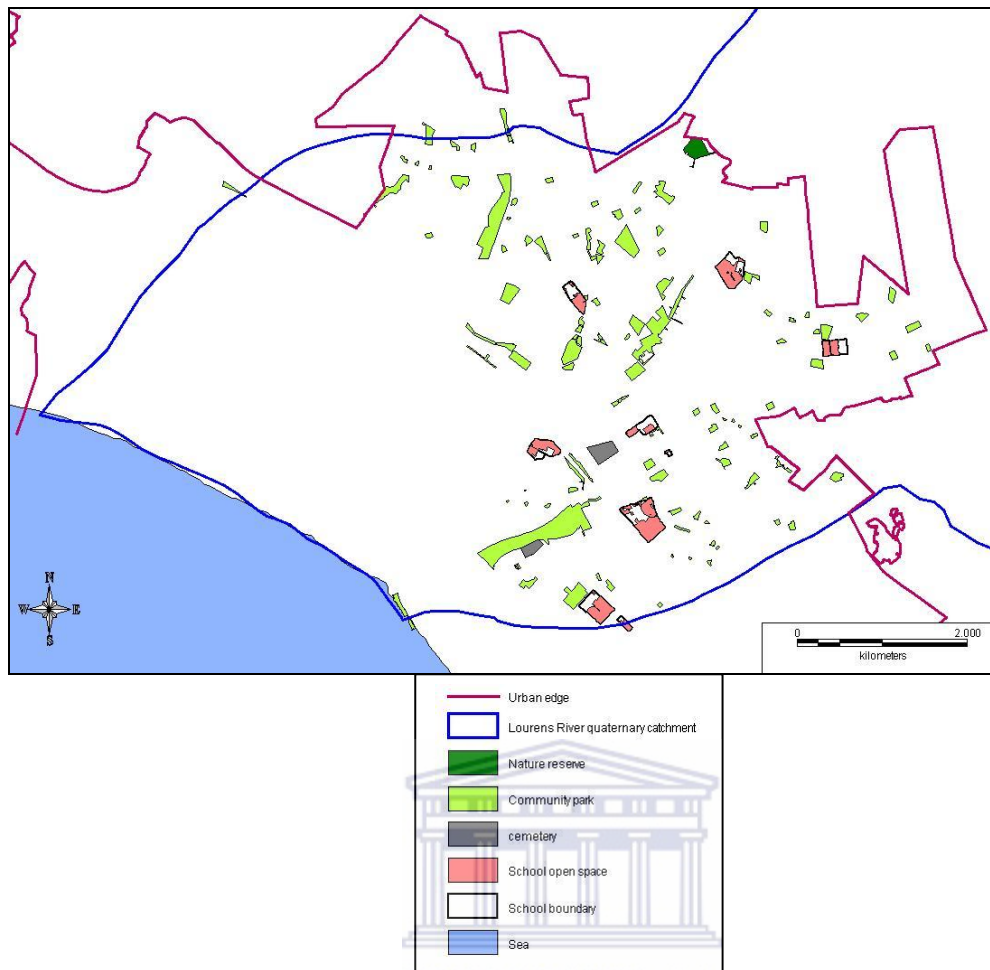


Figure 5.4. Protected open space within the urban edge in the Lourens River quaternary catchment, Cape Town. Data from the City of Cape Town and for school open space digitized from 2005 imagery supplied by the City of Cape Town.

Racecourse are planted with flowers that attract sunbirds which are necessary pollinators in the Renosterveld conserved there (pers. comm. Dalton Gibbs).

Areas such as cemeteries, community parks and school grounds enjoy some degree of protection from development and are readily accessible to the urban population. In the urban matrix in the Lourens River quaternary catchment, these spaces provide about 197 ha of green space to humans and other species – far exceeding the amount of protected natural space unless the sites of conservation interest can be protected (Table 5.1, Figures 5.3—5.5). The three largest protected spaces in the catchment are not natural though that would change if the sites of conservation interest were protected (Figures 5.6, 5.7). Protecting the sites that are of conservation interest would also mean more protected open space in the western part of the catchment

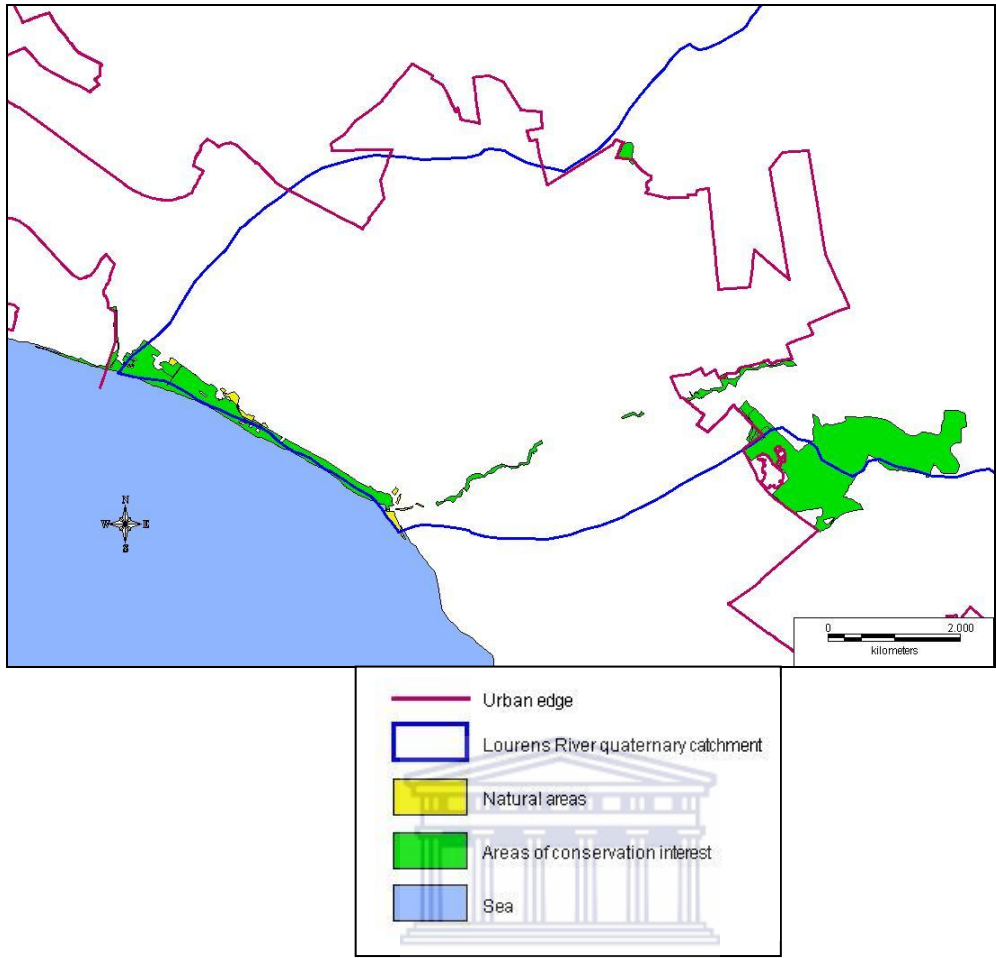


Figure 5.5. Unprotected space with natural vegetation within the urban edge in the Lourens River quaternary catchment, Cape Town. Data from the City of Cape Town.

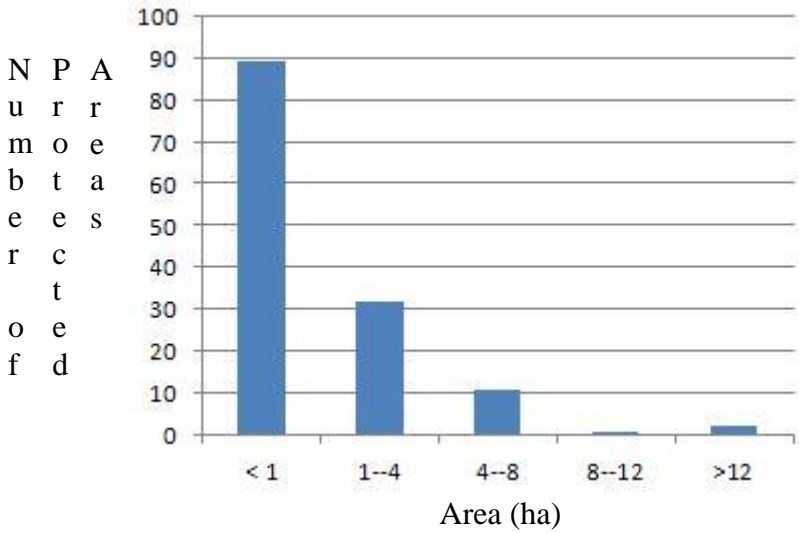


Figure 5.6. Distribution of protected open space in terms of area. Data from the City of Cape Town.

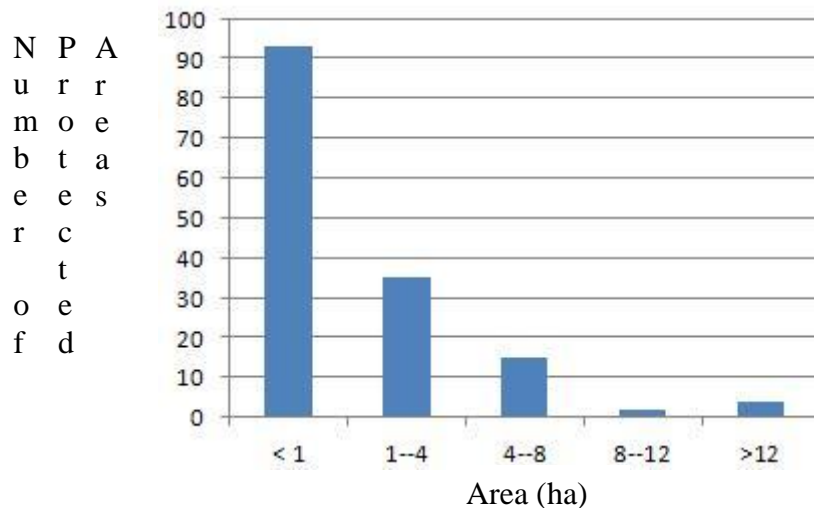


Figure 5.7. Distribution of protected open space and space of conservation interest in terms of area. Data from the City of Cape Town.

(Figure 5.5) which otherwise has little protected space – probably because of its history as business property (Heap 1977).

The words ‘nature’ and ‘environment’ tend to mean ‘outdoors’ and ‘my surroundings’ to the urbanite – both of which may be exceedingly unnatural. In view of the perception that any green space is natural, it may be a good idea to push to make sure that some native species are present on such spaces however unnatural the open spaces will still be.

Most of the open spaces within the Lourens River Quaternary Catchment are not considered natural as demonstrated by the fact that they are not included or considered in the biodiversity network (Holmes et al. 2012, Figures 5.2, 5.3 & 5.5) and consequently they are not likely to have many native species. The challenge is to reduce the disturbance and use these spaces to promote the preservation of spaces that are remnants or can be restored. Environmental awareness needs to be part of everyone in society not just those who have made conservation their profession. Conservation needs to focus resources on educating the population and working with schools would be a logical place to start. Children have a great capacity for learning (Balmford 2002) but conservationists need to be careful not to overemphasize the problems facing the environment and conservation as doing so may lead to action

paralysis and a decrease in the commitment to conserve (Jensen 2004). Public education would not only benefit conservation areas but would also potentially enable City Parks Managers to manage parks in a more ecologically sound manor. Regular mowing including during flowering/seedset is known problem in Cape Town (Pitt & Boule 2010). What is perhaps less well known is that the emphasis on mowing at biologically disastrous times is due to public perceptions and consequent demands for mowing. City parks officials have horticultural training but they are constrained by complaints from local residents if their contractors do not mow regularly (pers. comm. George Frost). It is with locals and local rate payers associations, ward councils and other local groups that conservationists need to work to achieve better management of open space in Cape Town. Representatives of such groups could discuss management of public open spaces with the local City Parks area manager and bring about change.

Conservationists are also residents of a particular area. Conservation should start at home. What about local community parks? Action in the local community may be as valuable as formal employment in conservation.

Conclusion and Recommendations

What spaces within the urban edge in the Lourens River quaternary catchment can be said to have some protection from development? This paper identified 124 protected open spaces in the form of a nature reserve, two cemeteries, 111 community parks and 10 school grounds within the Lourens River quaternary catchment's urban matrix but more of these open spaces are disturbed than are natural open spaces. This disturbed space could still be of conservation value. The challenge is to work with schools and City Parks to achieve management that is sympathetic to biodiversity. A resource person for schools is recommended since, as Raitt (2011) pointed out, teachers tend to find it difficult to teach ecology. A liaison with rate payers' associations and ward councils is advised to promote the acceptance of different management practices to be implemented by City Parks.

Acknowledgements

The author thanks Mr Erin Laubscher and Mr Eben van Dyke of the Mapping Section of the City of Cape Town Municipality for providing data, Mr Gregory Benskin of

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Personal Communications

Mr Dalton Gibbs, conservationist for City of Cape Town Municipality in 2010.

Mr Gregory Benskin, Principal GIS Technician, City Parks North, Community Services, City of Cape Town at his office in Millpark Office Block, Ixia Road, Milnerton on 3 July 2013.

Mr George Frost, Head of Administrative Support, City Parks North, Community Services, City of Cape Town at his office in Millpark Office Block, Ixia Road, Milnerton on 3 July 2013.



Appendix 5.1 Online Programme Sources

Shp2kml is available from <http://www.zonums.com/shp2kml.html>.

DNR Garmin Application 5.4.1 (Minnesota Department of Natural Resources) is available at
<http://www.dnr.state.mn.us/mis/gis/tools/arcview/extensions/DNRGarmin/DNRGarmin.html>).

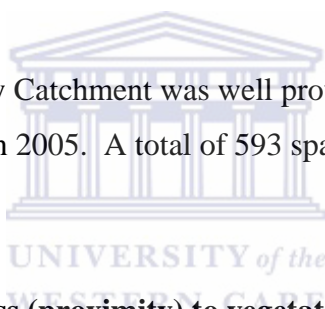
Chapter 6 Conclusion

Since GoogleEarth is easily and widely accessible, does it provide a suitable source of imagery for spatial analysis of landscapes without post geospatial rectification?

This study made use of Google Earth imagery. The images were not accurately aligned and alignment differs between different dates as with aerial photography. This makes Google Earth a poor choice of image source for spatial research without post geospatial corrections. However, the relative ease of access may make Google Earth a more practical option than the alternatives, e.g. aerial photographs from National Geospatial Information.

How many open spaces with an area of at least 900 m² were present in the Lourens River quaternary catchment in 2005 (the first year with continuous imagery in GoogleEarth)?

The Lourens River Quaternary Catchment was well provided with open spaces with an area of more than 900 m² in 2005. A total of 593 spaces in or partially in the catchment met this criterion.



What was the potential access (proximity) to vegetated open space of at least 900 m² in the Lourens River quaternary catchment in 2005?

All but two houses in the Lourens River Quaternary Catchment met the most stringent suggestion for proximity to space found in the literature – that of English Nature of 300 m (Barbosa et al. 2007). All the schools within the catchment had open space of at least 900 m² within 300 m. Public transport in the form of busses, minibus taxis and trains provided access to open spaces of at least 900 m² within 300 m of their stopping points and routes.

What spaces within the urban edge in the Lourens River quaternary catchment can be said to have some protection from development?

Most of the open space in the Lourens River Quaternary Catchment was not formally designated as open space and may be lost to development. Thus the positive picture provided by the number of open spaces and the proximity to open space is partially an illusion. There has been considerable development in the area since 2005. Action is

needed from both residents and the municipality to ensure that proximity to open space remains a positive feature of living in the Lourens River Quaternary Catchment.

Within the urban matrix, only 124 spaces have some form of protection. Only one of these is a nature reserve. The other spaces that may be said to have some protection were cemeteries (two), community parks (111) and school grounds (10). It is important to use existing open space to promote conservation both through education and through management of the space. The challenge for those concerned about the environment is to act at a local level as concerned citizens.

Future Research

Expanding the present research could provide baseline data for change detection research. Promoting more change detection research projects may be a way to stimulate action to protect open space.

The quality of open space is highlighted in the literature (e.g. Crawford et al. 2008 and Giles-Corti et al. 2005) as an important determinant of the use of open space. The quality of open space is dependent on its facilities and maintenance which are largely determined by its management. In Cape Town, the municipality has everything possible mowed flat apparently in the belief that it is more aesthetically pleasing because it is 'tidy' (Maneveldt 2011, Pitt & Boulle 2010, Marais & Maneveldt 2006). This has a negative impact on biodiversity retention (Maneveldt 2011, Marais & Maneveldt 2006) – a fact of which City Parks is aware and are working towards rectifying (pers. comm. Mr George Frost and Mr Gregory Benskin 3.07.2013). Research is needed to demonstrate the impacts of mowing on biodiversity. Research could also be done to identify the determinants of park quality in a South African context.

Keurboom Avenue Park, the open space in Westridge between Keurboom Avenue and Nerina Avenue, had many indigenous species in the 1990s when some pupils from Parel Vallei High School surveyed the flora (Pers Comm. Dr R.R. Raitt 28.05.2013). Unfortunately, this area is subjected to regular municipal mowing so it is unlikely to have retained all the species that were then present. Personal

observation suggests that the surviving native species are mostly geophytes. Research could be done to determine which indigenous species persist on open spaces.

Expanding the present research to cover a larger area would provide additional baseline data. There is a lack of research looking at the changes in open space over time. Research on the management of open space and its impacts would provide useful information.

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Personal Communications

Mr Gregory Benskin, Principal GIS Technician, City Parks North, Community Services, City of Cape Town at his office in Millpark Office Block, Ixia Road, Milnerton on 3 July 2013.

Mr George Frost, Head of Administrative Support, City Parks North, Community Services, City of Cape Town at his office in Millpark Office Block, Ixia Road, Milnerton on 3 July 2013.

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Appendix 1 Online Programme Sources

Shp2kml is available from <http://www.zonums.com/shp2kml.html>.

DNR Garmin Application 5.4.1 (Minnesota Department of Natural Resources) is available at

<http://www.dnr.state.mn.us/mis/gis/tools/arcview/extensions/DNRGarmin/DNRGarmin.html>).

