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Opening the Door for Wider Application of the Tourism Area Life Cycle Model with Application to the Rietvlei Nature Reserve, Tshwane, South Africa

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Abstract

In this paper, the Tourist Area Life Cycle (TALC) model was adapted for application to an urban green space that is not necessarily a tourist destination. Important components of the TALC model, such as carrying capacity, critical life cycle points and a variety of scenarios relevant to urban green spaces that do not primarily have a tourism focus were considered in the development of an adapted model that could be of value in the management of a variety of functions in such spaces. A case study approach was followed, in which the model was applied to the Rietvlei Nature Reserve in Tshwane (South Africa). The functions and benefits of the Rietvlei Nature Reserve include the protection of a portion of the Highland grassland biome with the associated biodiversity, recreation, opportunities for environmental education research, and water provisioning to the City of Tshwane. Qualitative and quantitative data were collected through observation, individual interviews, focus groups and questionnaires, with a total of 558 respondents. The data included primary and secondary sources, and the researchers' own observations. The management of a variety of ecosystem services provided by the conservation area and surrounding urban landscape plays an important role in the life cycle of this urban green space. The value of this study lies in demonstrating that an adaptation of the TALC model can be of value in the sustainable management of the ecological services that urban green spaces provide to urban dwellers.

Keywords: TALC, ecosystem services, urban green space, Rietvlei

Introduction

The Tourism Area Life Cycle (TALC) model developed by Butler (1980) is an important management tool and illustrates the prominence of management decisions in the life cycle of a tourist destination (Butler, 2015; Butler, 1999, 2010; Hall & Page, 2012). In this paper, we argue that the TALC model (figure 1) could have a wider application beyond tourism development. We further maintain that an adapted TALC model could be applied successfully in the context of the management of urban green spaces that may not necessarily have an associated or dedicated tourist function. This paper thus focuses on the adaptation of the TALC model to be of value in the management of a multi-purpose urban green space, specifically the Rietvlei Nature Reserve located in the City of Tshwane, Gauteng province, South Africa.

The TALC model and various adapted versions thereof have been applied and used as benchmark in the field of tourism (Butler, 2015; Butler, 1999, Liu, Butler & Zhang 2019; Milano, Novelli & Cheer 2019; Saarinen, Rogerson & Hall, 2017). Through the different

phases of the destination cycle, the characteristics that initially make a place attractive could be destroyed by over-tourism when the limits of acceptable change in terms of attractiveness of a tourist destination are exceeded. The environmental quality and carrying capacity in terms of the recreational function therefore must be monitored and managed for the purpose of a sustained recreational experience (Arnberger, 2012; Kuldna, Poltimäe & Thukanen, 2020). The relationship between environmental quality and sustained tourism is established in the literature (Danish & Wang, 2018).

According to the TALC model, an S-curved dominates the cycle (figure 1); simply put, when a destination reaches the stagnation phase in terms of visitor numbers, different future scenarios are evident ranging from rejuvenation to stabilisation or decline until the tourism function collapses. Within the tourism context, the degradation of a destination could be turned around through measures mitigating environmental degradation, rehabilitation and through reinventing the functions of the destination (Liu et al., 2019). According to this model, the critical range of elements of capacity should be considered in the implementation of management strategies. Butler (1980) recommends the development of human-generated structures, facilities and attractions or the exploration of previously untapped natural resources to rejuvenate a destination. Marketing initiatives and events are also used to promote the tourist destination image (TDI) to support the life cycle of a destination (de Jager, 2010). The tourism life cycle of a destination can be influenced by management decisions and implementation of strategies to balance the tourist resources available at the destination. The limits to acceptable change as well as the critical range of elements of capacity is therefore dynamic.

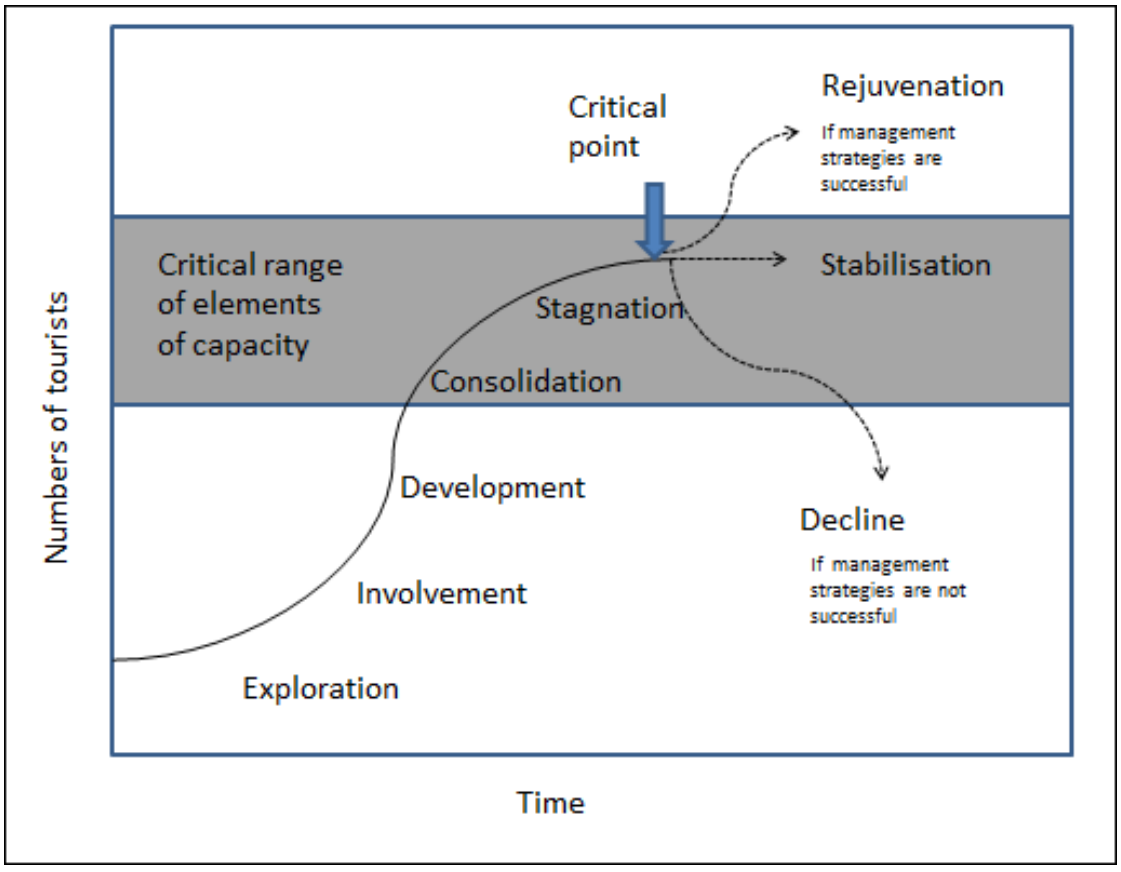

Figure 1: The TALC model
Source: Adapted from Butler (1980)

Key concepts of the TALC model were applied to the Rietvlei Nature Reserve. Stressors experienced within the reserve were identified and possible mitigation strategies recommended based on the research done.

Methods

A mixed method was applied in this case-study research (Birt, Scott, Covers, Campbel & Walter, 2016 ; Creswell & Plano Clark, 2017). Land-use changes in the catchment area of the Rietvlei Nature Reserve were detected by comparing the South African National Land Cover Database for 1990 and 2014. Secondary data sources were consulted to obtain relevant information on the history, functions, environmental benefits, risks, and stressors experienced in the study area. Fieldwork and observations by the researchers, as well as published research reports, marketing material, media reports and the internet formed the basis for identifying benefits, risks and environmental stressors in the Rietvlei Nature Reserve.

Face-to-face semi-structured interviews were conducted with key informants representing different types of stakeholders (n = 18). Face-to-face, structured on-site interviews were conducted with visitors at different areas and time intervals in the reserve (n = 181). Questions were directed to specifically evaluate visitors' sense of place response regarding the reserve and to identify possible stressors. The results of two electronic surveys that were placed on the Facebook pages of the Friends of Rietvlei and Rietvlei Photographers (n = 365) were added to the data collected from the interviews with visitors to the reserve. Dedicated group interviews with interest groups were conducted to establish the different perspectives of users of the Rietvlei Nature Reserve. Discussions were held with the Honorary Rangers (n = 5), Friends of Rietvlei (n = 5), Pretoria Sailing Club (n = 5) and birders and photographers (n = 5). A plenary focus group was then conducted with participants who were purposively selected based on their interest in dedicated aspects of urban development, conservation and sense of place regarding the Rietvlei Nature Reserve. During this focus group session, the potential benefits and risks identified in the previous phases of the research were evaluated through respondent validation (Birt et al., 2016). The participants were challenged to rank social, environmental and ecological benefits and risks according to their understanding of the relevance thereof to the Rietvlei Nature Reserve.

The re-interpretation of the TALC model in the Rietvlei Nature Reserve

The Rietvlei Nature Reserve is a multi-functional green space located in the dynamic urban fringe area between the Tshwane and Ekurhuleni Metropolitan Areas in Gauteng. It provides space for bulk electrical and water infrastructural networks, recreational spaces and healthy ecosystems that support natural processes. In the case of the Rietvlei Nature Reserve, it is therefore not visitor numbers, but rather expected ecosystem services gained from an urban green space and associated environmental indicators that can be used to delimit the life cycle of the destination. This was important because the concepts of critical range of elements of capacity, critical points of decision making or tipping points, and different scenarios in a destination life cycle are also relevant to multifunctional urban green spaces that do not primarily have a tourism focus.

Since the publication of the Millennium Ecosystem Assessment (2005), the ecosystem services provided by urban green spaces have been awarded increasing prominence in the literature. This perspective acknowledges the interdependence of ecological wellbeing and human quality of life (Bernstein, 2017; CABE, 2009; Haase & Rink 2014; Wolhitz, 2016; World Health Organisation, 2017). Urban green spaces are important for its support of ecosystem processes, the provisioning of resources, its regulatory effect in mitigating climate change, in cleaning the air, and in terms of its cultural ecosystem services, such as recreation,

cultural identity and aesthetic and spiritual values. Examples of ecosystem services provided by urban green spaces as green infrastructure include the cooling effect of the urban heat island, mitigating the effects of flooding, protection of wildlife habitat within a growing city, carbon sequestration in peatlands, and the social and health benefits of people living in the city. The green infrastructure role of wetlands, peat and grasslands for water provisioning is widely acknowledged (Cadman, de Villiers, Lechmere-Oertel & McCulloch, 2013, Dickens, Kotze, Mashigo, MacKay & Graham, 2003; McKay, Ndlopfu, & Ahmed, 2018).

The Rietvlei Nature Reserve provides a buffer between urban development and water sources: the two dams, water treatment plant, wetlands and fountains within the conservation area. The conservation area of 4 000 hectares (40 km^2) consists mainly of grasslands and wetlands (Marais, 2015). The Rietvlei Nature Reserve is one of a few conservation areas that protect the Bankenveld grassland biome.

Even though the Rietvlei Nature Reserve is a multi-functional destination, the phases of the TALC model (Butler, 1980) can be linked to the history of this urban conservation area (figure 3).

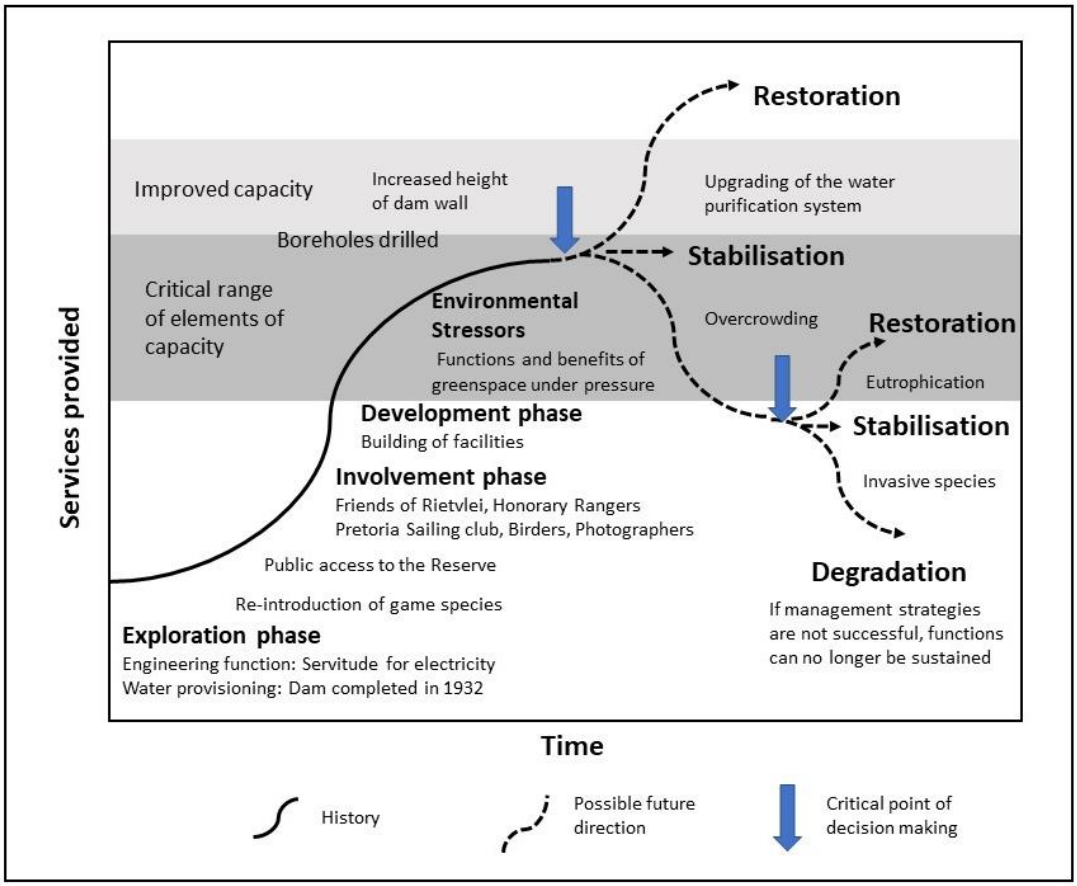

Figure 3: An adapted life cycle of ecosystem services from urban green spaces, applied to the Rietvlei Nature Reserve
Source: Adapted from Butler (1980)

The exploration phase

The exploration phase of the tourist destination life cycle (Butler, 1980) can be compared to the period when the Rietvlei Nature Reserve was established in 1929. The different phases of the model can be distinguished by critical events or blurred stages that identify the different phases of the model. When the Rietvlei Dam was built, the Rietvlei Nature Reserve was under the management of the Engineering Department of the then Pretoria Municipality (Manager

Rietvlei Nature Reserve, personal communication, 8 September 2016). The reserve was not open to the public and visitors could only enter it on a guided bus tour.

On 2 September 1929, the farm Rietvallei was bought by the local government to extend the water provisioning capacity to the growing urban population. At first, only the six natural springs were tapped. The ground dam wall was completed in 1934 (Dippenaar, 2013). Other farms were incorporated to create the nature reserve. At the time, the reserve fell outside of the then Pretoria boundary and there was still some wildlife on the farms that were incorporated. To enhance the game species in the reserve, 67 blesbuck were chased by horses from Doornkloof (the nearby farm of General Jan Smuts) to the Rietvlei Nature Reserve (City of Tshwane Metropolitan Municipality, 2012).

The involvement phase

Growing population numbers implied a greater need for a variety of municipal services as well as for ecosystem services provided by this urban green space. The involvement phase identified by Butler (1980) was re-interpreted to not only refer to increasing visitor numbers and tourism enterprises, but also to more demands on the ecosystem services expected from the urban green space. It was therefore important to identify the benefits and functions of the reserve.

In the involvement phase of the model, it is not only tourist enterprises or visitors who became involved but rather volunteers and NGOs that are involved in conservation activities, for example, the Honorary Rangers and Friends of Rietvlei. Public-private participation plays an important role in the conservation initiatives in the Rietvlei Nature Reserve and these efforts could be expanded. The NGO Friends of Rietvlei (affiliated with the Wildlife and Environmental Society of South Africa) supports the conservation goals and maintenance of the reserve and has been instrumental in obtaining sponsorships and feeding animals during periods of drought. Honorary Rangers support various conservation and environmental education initiatives in the reserve as volunteers. The Coffee Shop and Lion Tours are run as private enterprises and play an important role in the recreational and educational functions of the reserve. Public-private participation was recommended as a way forward to restore the non-operational chalets in the camping area of the reserve in order to tap into this potential source of income.

The Pretoria Sailing Club has regular events in the reserve. Nature lovers, birders and photographers are also increasingly involved in recreational activities in the reserve. The specific characteristics and functions of the Rietvlei Nature Reserve collectively contribute to the psychological benefits experienced by visitors (Wood, Harsant, Dallimer, Cronin de Chavez, McEachan & Hassall, 2018). Social connections were identified between the Friends of Rietvlei as well as between the Honorary Rangers, birders and photographers, and members of the Pretoria Sailing Club. The shared meaning they attach to the Rietvlei Nature Reserve as well as the activities and social interactions contribute to the quality of life of the participants. These groups are not mutually exclusive but have distinct functions and benefits within the reserve (Friends of Rietvlei, 2017; Pretoria Sailing Club, 2013, 2017). The birders and photographers are not a closed membership group like the Pretoria Sailing Club, but rather an informal grouping that share a common interest. There are ad hoc social gatherings at the Rietvlei Coffee Shop and Facebook groups provide platforms for social interaction. The status of a birding hotspot in Gauteng (Marais & Peacock, 2016) implies birding opportunities as well as the protection of biodiversity in the Rietvlei Nature Reserve. The conditions of wetlands have important habitat and nesting implications which influence the variety of bird species present (Callaghan, Major, Lyons, Martin & Kingsford, 2018; McKay et al., 2018).

The development phase

The development phase of the TALC model focuses on the development of facilities for the tourism product and the tourist numbers increasing (Butler, 1980). In the case of the Rietvlei Nature Reserve, development included supporting the servitude function for electricity network, improving the water provisioning capacity and the increased diversity of species in the reserve.

Environmental impacts are closely linked to infrastructure development. In dealing with potential environmental stressors, an invertebrate survey was done to inform the evaluation of alternatives for the location of Rand Water pipelines in the Rietvlei Nature Reserve and Bronberg Ridge (Hawkes, 2010). The focus of this evaluation was on the spatial distribution and habitats of significant invertebrate species, namely *Ichnestoma stobbiai*. In the report, it is emphasised that construction must be carried out in collaboration with the reserve management. At the time of the study, this construction did not yet start. Environmental damage should be mitigated by timing the proposed construction in accordance with the activity patterns and breeding of invertebrate species, limiting the duration of construction, carefully demarcating the designated work areas, and adhering to conservation practices. While these are very important aspects to consider in the development and expansion of infrastructure, the importance of the natural flow patterns of water should not be underestimated. The various natural functions of wetlands should be considered when evaluating different development alternatives. Increased flow speeds could destroy wetlands and lead to increased eutrophication and the silting of dams. Therefore, it remains important to provide mitigation measures, such as weirs and retention dams to reduce runoff speed and avoid the channelling of water running through the reserve.

The capacity for water provision from the reserve was increased at various critical points; for example, when the water treatment plant was built, when boreholes were drilled and when the height of the dam wall was increased. The wall of the Rietvlei Dam is 32 metres high and it has a capacity of 12 000 000 m^3 (City of Tshwane, 2015). The Rietvlei Water Treatment Plant was the first in South Africa to implement the dissolved air flotation and filtration process, and later the granular activated carbon filtration system (Clemens & Haarhoff, 2004). The plant provides 40 megalitres per day, Grootfontein approximately 7 megalitres per day and the boreholes approximately 6 megalitres per day into the Klapperkop and Garsfontein reservoirs (Director of Water and Sanitation City of Tshwane, personal communication, 28 November 2016). The total water needs of the Tshwane Metropolitan Municipality are estimated at 1 000 megalitres per day (Director of Water and Sanitation City of Tshwane, personal communication, 28 November 2016). Rietvlei therefore provides approximately 5% (53/1000 ×100) of the total bulk water needs.

Restoring the remaining peat wetlands in the Rietvleispruit supported the ecosystem functions and associated services of the wetlands (Gründling, 2004). In 1992, a portion of the Witkoppies farm to the South of the Rietvlei Nature Reserve, where wetlands were restored, was bought by the Tshwane Metropolitan Municipality and incorporated into the reserve (refer to figure 2) (City of Tshwane Metropolitan Municipality, 2012). This section of the reserve, however, falls within the Ekurhuleni Metropolitan Municipal area of jurisdiction.

The decision to incorporate Witkoppies to the reserve was based on the importance of the restored wetlands and the negative effect of the large pivot irrigation systems on this section of the farm on the groundwater levels (Manager Rietvlei Nature Reserve, personal communication, 8 September 2016). After the incorporation of the Witkoppies section to the Rietvlei Nature Reserve (represented on figure 2), the farming activities were stopped. Visitors to the Rietvlei Nature Reserve are not allowed into the Witkoppies section of the reserve in order to limit damage to the wetlands.

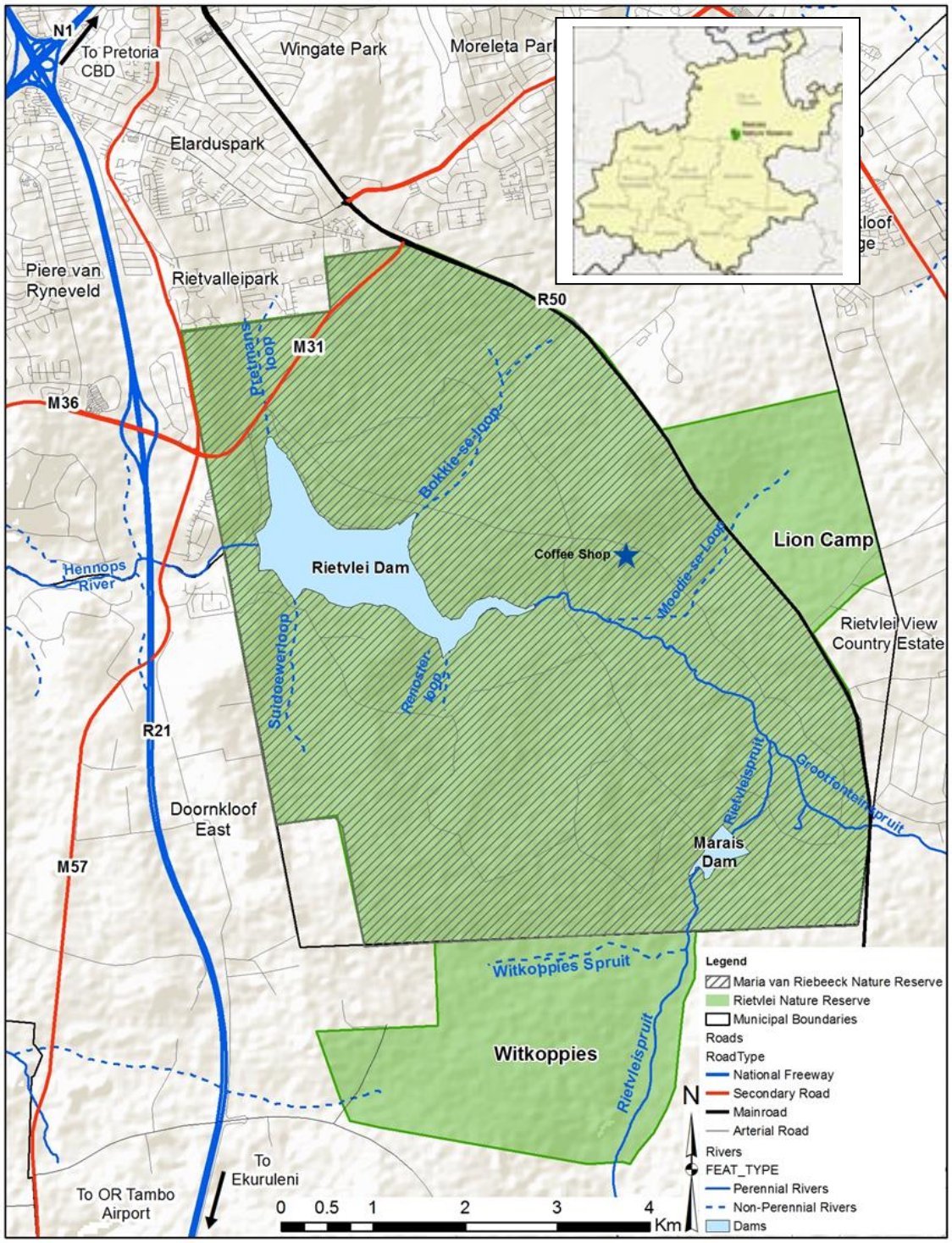

Figure 2: The location of the Rietvlei Nature Reserve
Source: S Carow Data: ESRI data in a box (2018)

The consolidation and stagnation phases

Over time, there were changes in perception of the importance of the triangular camps to the north of the Rietvlei Dam Road (M31). When the road was built, these areas no longer seemed to be a functional part of the reserve. The area, however, provides a buffer for the origin of the

Pretmansloop stream and allows for the natural purification of water flowing into the Rietvlei Dam (Andrews, 1993). At the time of the study, the camps to the north of the Rietvlei Dam Road were used for grazing of the Nooitgedacht ponies. These ponies were bred in the reserve and are descendants of the working animals that pulled the municipal waste and sewerage carts in the 1900s (Manager Rietvlei Nature Reserve, personal communication, 8 September 2016). When the reserve was originally proclaimed, the municipal working animals were housed in the reserve. Due to technological development over the last 100 years, the housing of the animals on the Rietvlei Nature Reserve has become redundant. The ponies were later primarily kept for trails through the reserve and children riding them at Marais Dam. The Triangle Camp to the north of the reserve was used as their grazing area because the Rietvlei Dam Road separated the grazing area from the game in the rest of the reserve. Due to the changing context, the specific function of the Rietvlei Nature Reserve to accommodate working animals for the city is no longer relevant. The Rietvlei Nature Reserve, however, continued to accommodate a variety of game species and remained an important urban green space.

The conservation area is legally protected from development and is acknowledged as such in spatial planning frameworks at a provincial level as well as at a local level by the Tshwane and Ekurhuleni Metropolitan Municipalities. The Rietvlei Nature Reserve was proclaimed a conservation area at the provincial level and, as such, is acknowledged in the Gauteng Conservation Plan (Gauteng Department of Agriculture and Rural Development, 2014). The conservation status of the reserve provides protection against development as it falls within a high control zone (zone 3) of the Gauteng Environmental Management Framework. Areas that fall in this zone, limit urban development, and allow human activities related to conservation, tourism, and recreation. The fauna in the reserve provide a resource for tourism and recreation and contribute to the conservation of the grassland biome and gene pools for biodiversity (Cadman et al., 2013). This is an important benefit within the Rietvlei Nature Reserve, as the area would have most probably been transformed to other land uses if it was not legally protected against urban development.

There have been various attempts by the local government to de-proclaim some of the fragmented areas for development, as these did not seem to be functionally part of the reserve. In 1942, a portion of the reserve (580 ha) to the east of Delmas Road was sold for the establishment of the Agricultural Research Station (Marais, 2015). According to the Tshwane City Planning Department, the Triangle Camp could be de-proclaimed for expanding the road network, as it was no longer a functional part of the Rietvlei Nature Reserve. In 2012, there was strong resistance from the Friends of Rietvlei (a non-government organisation – NGO), the Pretoria East branch of the South African Hunters and Game Conservation Association and local communities to a decision of the Tshwane Metropolitan Municipality to make 100 hectares of the Rietvlei Nature Reserve available to the Super Sport United Soccer Club for the development of a sport centre (Chairperson of Friends of Rietvlei, personal communication, 8 August 2016; Hlahla, 2012). The proposed development of the Triangle Camp was subsequently prevented and a decision was taken in instances where portions of the reserve in future be used for other land uses, it should first be de-proclaimed as a conservation area and a formal environmental impact assessment as well as a process of public participation would be required to evaluate the impact of developing the particular site as well as the impact on the adjacent conservation area.

The spatial form of the city and the relative location of the city to the Rietvlei Nature Reserve exacerbates development pressures in the area surrounding Reserve (Brand, Geyer, & Geyer, 2017; Gauteng Provincial Government, 2017; Hamann, Mkhize & Gotz, 2018). Due to the reserve's location on the urban fringe, and along a proclaimed development corridor (Brand et al., 2017), there are continuous development pressures on the reserve despite its critical

biodiversity status. An example of this is the proposed development of a petrol filling station in Knoppieslaagte, just outside the Rietvlei Nature Reserve (Pelser, 2019). The development pressures on the Rietvlei Nature Reserve will most likely increase in the future. There are numerous environmental stressors that originate from outside the boundaries of the reserve. Urban discharge and agricultural runoff from the catchment area within the Ekurhuleni Metropolitan Area have implications for water quality in the Rietvlei Nature Reserve (GeoTerraImage, 2016).

Water quality is a stressor for the Rietvlei Nature Reserve, as this area provides approximately 5% of the water for the City of Tshwane. This is significant because the environmental quality in the catchment area as well as pollution of the ground water sources can influence the water provisioning capacity. Most South African cities and towns are experiencing major challenges with limited water sources for the demands of a growing population (Knuppe, 2011); it is therefore becoming increasingly important to protect systems that support the provisioning of water. Not only is the quantity of water a problem, but pollution and catchment destruction contribute to the decreasing quality thereof (Oberholser, Botha & Cloete , 2008; Van Ginkel, 2011). The protection of green spaces that support water provisioning is therefore becoming increasingly important.

The Rietvlei Dam has experienced algae blooms since the early 1970s (Toerien & Walmsley, 1979). Water quality is increasingly concerning as anthropological eutrophication (Du Plessis, 2019; Harding & Hart, 2013) is evident due to conditions in the catchment area of the Rietvlei Dam (Mbiza, 2014; Oberholser et al., 2008; Van Ginkel, 2011). Human settlement development with insufficient service provision, insufficient capacity of water treatment/purification systems, runoff from industrial areas as well as agriculture runoff in the Hennops River catchment area and its principal tributaries contribute to pollution in the Rietvlei Nature Reserve (Hoffmann, 1994; Oberholser et al., 2008).

The Tshwane Metropolitan Municipality is experiencing challenges in providing an acceptable quantity and quality of water to the fast-growing population. There is pressure on existing infrastructure, not only in terms of maintenance and capacity but also security. Tshwane has three water treatment plants, which are located at Rietvlei, Temba and Roodeplaat. When the infrastructure becomes incapable of dealing with the amount of wastewater, there is normally a reduced efficiency of water treatment/purification. On 18 October 2016, water provision to parts of the City of Tshwane was interrupted when the Temba Water Treatment Plant was closed due to severe contamination (City of Tshwane, 2016). Cable theft at the Rooiwal Wastewater Treatment Plant and leakages of raw sewage into the system led to the contamination of water sources (City of Tshwane, 2016). The interconnectedness of the different municipal services of electricity, water and sanitation clearly manifested in the incident of cable theft at Rooiwal. Interconnectedness of different components remains an important factor to consider in the sustainable provision of essential municipal services to a growing urban population.

Table 1: Links between identified stressors in the Rietvlei Nature Reserve and the TALC model of Butler (1980)

Stressors identified in the Rietvlei Nature Reserve	**TALC model**
Lack of spatial co-variation between the boundaries of the reserve and municipal boundaries and natural boundaries such as watersheds.	This stressor is not specifically included. The model was developed for site level evaluation of tourist destinations.
Development pressures due to relative location. The proximity to spatial economic development corridors and major transport routes between two growing metropolitan areas (Tshwane and Ekurhuleni) lead to increasing development pressures to the Rietvlei Nature Reserve.	Butler (1980) focused on the life cycle of a destination and how over-tourism changed the characteristics of a destination. In the Green Space Stress Model of Urban Impact, other stressors are also identified within the urban green space. Stressors occur within the destination and from the surrounding context of the urban green space.

Increasing demands for water and electricity to a growing urban population.	Increased use changes the characteristics of the destination. Different scenarios are possible based on the way in which ecosystem services are managed within a changing context.
Anthropological eutrophication due to conditions in the catchment area of the Rietvlei Dam resulting in a negative impact on water quality.	This is not specifically relevant, as the focus of the model is mainly within a particular destination and not necessarily on the surrounding context. Water quality would be a stressor for the model when it influences the tourist product.
Invasive species provide stressors on veld management and carrying capacity for grazing game.	Environmental quality can influence the characteristics of a tourism product. This will only be relevant if the experience of the tourism product is influenced.
Challenges regarding the maintenance and management of facilities and infrastructure.	Maintenance of the tourist destination is important to sustain the tourism product.
Safety and security for both biodiversity and humans (crime, poaching of animals and illegal harvesting of plants).	The safety of visitors influences the tourist experience and number of tourists to a destination.
Ineffective environmental management increases the risks of veld fires, the balance of different species in the reserve and environmental degradation.	Environmental management is important for sustainable tourism. The tourism product is influenced by environmental management.

When the balance between urban development in the area surrounding the reserve, conservation and sense of place is disturbed, stressors develop for which relevant local response plans should be implemented. In the case of the Rietvlei Nature Reserve, the following stressors were identified: rapid urban development in the area surrounding the reserve; anthropological eutrophication due to conditions in the catchment area; invasive species causing decreased quality of the veld and environmental degradation; crime, security issues and poaching; and management challenges due to lack of spatial co-variation between areas of responsibility.

Environmental stressors could lead to a situation where the reserve is no longer well suited for its designated role and functions (fit for purpose), with negative implications for the sustainability thereof. This could negatively impact the ecosystem services, biodiversity and carbon sequestration in the peat wetlands of the reserve. Suitable mitigation strategies should therefore be developed for each of the identified stressors. Local response plans have been implemented in the Rietvlei Nature Reserve for water quality (Clemens & Haarhoff, 2004), ecological management (Marais, 2015), wetland restoration (Gründling, 2004; Venter, Bredenkamp & Gründling, 2003), eradication of invasive species (Mbiza, 2014; McConnachie, Retief, Henderson & McKay, 2011; Strobach, 2018; Van der Westhuizen, 2019), infrastructure management (Moromo, 2019), safety and security, and cultural heritage (Van Vollenhoven, 2010). The catchment management plan for the Rietvlei Dam is a positive initiative towards improved coordination between the Tshwane and Ekurhuleni Metropolitan Municipalities (Ekurhuleni Metropolitan Municipality, 2019).

Stabilisation, restoration and rejuvenation or degradation

In line with the TALC model (Butler, 1980), various scenarios are possible when a tourist destination is under stress, based on the evaluation of stressors and the success of the implementation of mitigation strategies. The S-curve of the life cycle of a destination can follow a curve of stabilisation, restoration and rejuvenation, or degradation (figure 3). When a destination reaches the stagnation phase in terms of visitor numbers, it can either decline until it collapses, or rejuvenation can take place. Applied outside the tourist destination context, the rejuvenation of an urban green space requires environmental management decisions and the implementation of relevant strategies that could influence the provision of sustainable ecosystem services by urban green spaces (Rapport, Clay-Williams, Churruca, Shih, Hodgen & Braithwaite, 2018). It could be possible that different functions of the reserve follow different life cycle curves.

The dynamic context of the green space influences the functions as well as the scenarios of the life cycle thereof. In line with the national Department of Water and Sanitation's initiative to reduce the dependency on the Vaal System, the Tshwane Metropolitan Municipality has developed a water management plan to increase the capacity of water provision from their own sources (Van Rooyen, Cerenio, Mouton, Talanda & Loubser, 2015). It is envisaged that over the next 40 years, the capacity of the Rietvlei Water Treatment Plant will be increased to provide an additional 200 megalitres of water per day (Mouton, Loubser, Talanda, Van Rooyen & Cerenio, 2015; Van Rooyen et al., 2015). According to the Director of Water and Sanitation in Tshwane (Mouton, personal communication, 2016), the height of the dam wall will not be increased but the planned extensions to the water treatment plant will require a new inflow structure from the dam. More structures will also be required downstream from the dam wall, where the Rietvlei Water Treatment Plant is located. It was indicated that the current boreholes will not be affected by the increased capacity of the purification system. This, however, does not mean that there will be no implications for the Rietvlei Nature Reserve. In order to provide for the growing water needs of the urban population, the capacity of the Rietvlei Water Treatment Plant will have to be further increased to meet expectations (Van Rooyen et al., 2015).

Should the capacity of the treatment plant be increased to the planned level, the status of the dam could change from a storage dam to a balancing dam. Even though the dam wall will remain the same height and the area covered by the dam will not be increased, it is anticipated that more water will be extracted from the dam. The average summer rainfall of the Rietvlei Wetlands Complex is 600 to 750 millimetres per annum (Gründling, 2004). The volume of water flowing into the Rietvlei Dam is influenced by precipitation, groundwater and inflow from the catchment area. This is not only from natural processes, but includes storm water, runoff from hard surfaces and sewerage from upstream areas.

The increased capacity of the water treatment plant can only be achieved by pumping the water via an extended pipe network into the plant (Rietvlei Water Treatment Plant, personal communication, 2017). This would be a significant achievement, as water will not be channelled through the wetlands system and dams in the Rietvlei Nature Reserve. The variety and type of grass and reeds, and animals and birds are influenced by the water level and speed of flow (Sieben, Collins & Kotze, 2017). It is thus important to manage the Rietvlei wetlands in a suitable way, while supporting water provision for the growing urban population.

Sound environmental management practices such as the restoration of wetlands are important to improve the adaptive capacity of the green space to overcome stressors (Sieben et al., 2017). The rehabilitation of various wetlands in the Rietvlei Nature Reserve included changes in water flow as well as in the type of biodiversity (Gründling, 2004; Sieben et al., 2017; Venter et al., 2003). The catchment management plan for the Rietvlei Dam is a more recent example of a local response plan for improved water quality that stretches outside the boundaries of the reserve (Ekurhuleni Metropolitan Municipality, 2019).

There needs to be continuous monitoring and evaluation of the success of local response plans and the implementation thereof. Should the implementation of mitigation strategies for the identified stressors be successful, the balance can be restored. This implies that the green space is fit for purpose and the objectives of water provision, protection of biodiversity in a healthy environment and social benefits from the Rietvlei Nature Reserve can be achieved. Ecological processes and biodiversity are protected and opportunities for environmental education are expanded. However, should mitigation strategies to stressors in the reserve not be successful, this could lead to environmental degradation and further loss of ecosystem services.

The life cycle of the destination can also be interpreted in terms of the diversity of species in the reserve. Various initiatives to improve the diversity of species have been evident in the history of the Rietvlei Nature Reserve. The partnership agreement concluded between the Rietvlei Nature Reserve and the Carnivore Conservation Project of the Endangered Wildlife Trust (EWT), which led to the re-introduction of cheetahs into the reserve (Buk, van der Merwe, Marnewick & Funston, 2018). As such, this project protects the cheetah gene pool on an international level. This project enhanced opportunities for environmental education, research and monitoring and supported tourism and recreation in the reserve. In 2019, nine cheetahs were relocated from the reserve after the declining number of mature blesbuck on which they prey became noticeable. This strategy protected the carrying capacity of the reserve.

Discussion and recommendations

Tourist destinations requires management practices that specifically address the goals and the phase in the life cycle of the destination. Multi-functional urban green spaces, however, require strategic environmental management as there should be a balance between promoting recreational experiences, tourism activities and conservation (Hudson & Miller, 2005). The ecological management plan (Marais, 2015) should therefore include a communication plan for improved awareness of the functions of the urban green space and the vulnerability of the conservation functions and sense of place of the reserve. The relationships between different stakeholders need to be nurtured to enable the successful execution of projects in the reserve.
Environmental awareness and sense of place of various stakeholders can play an important role in management decisions at particular critical points and the life cycle of a specific urban green space. Should the City of Tshwane decide to promote and increase the tourist function of the Rietvlei Nature Reserve, there is a risk that the sense of place and other environmental ecosystem services could be negatively impacted. The social carrying capacity and environmental health, as well as the natural water purification capacity of the wetlands and grasslands should be considered in the management of this sensitive area.

The ecosystem functions of a green space should be evaluated within the broader context of the relative location. Water provisioning is challenging on different scales form global, national and local level (Department of Water and Sanitation, 2019; Du Plessis, 2019). According to the Gauteng State of the Environment Report 2011, most of the water resources in Gauteng are over-utilised and degraded (Gauteng Department of Agriculture and Rural Development, 2011). This is attributed to "extensive urbanisation, encroachment into riparian areas, mining and industrial development, as well as poor management of water resources" (Gauteng Department of Agriculture and Rural Development, 2011: 11). The global South is characterised by critical levels of socioeconomic vulnerability, which is often associated with limited awareness of the importance of green space or nature conservation (Ferreira, 2011; Mthembu, 2009; Nkambule, Buthelezi & Munien, 2016). Should the value of the urban green space be measured only in terms of recreational use, the balance between development, conservation and sense of place would be disturbed. Improved understanding of the link between ecosystem health and the physical and psychological benefits of interaction with nature for human health (Tzoulas, Korpela, Venn, Yli-Pelkonen, Kazmierczak, Niemela & James, 2007) would influence local response strategies to stressors within green infrastructure. Ecosystem-based management is becoming increasingly important in high-density urban developments (Heymans, Breadsell, Morrison, Byrne & Eon, 2019), since the effective maintenance and management of green spaces contribute to resilient ecosystems (Chishaleshale, Shackleton, Gambiza & Gumbo, 2015; Marais, 2015; Venter et al., 2003; Wolhitz, 2016).

As South African cities and towns are experiencing major challenges with limited water resources to satisfy the demands of a growing population (Chauke, 2017; Du Plessis, 2019; Knuppe, 2011; Tleane, 2011), it is becoming increasingly important to protect systems that support the provisioning of water. The destruction and pollution of the catchment area contribute to a decline in the quality of water (Oberholser et al., 2008; Van Ginkel, 2011). Thus, it is vital to protect green spaces, since it supports the provisioning of water.

Managers should identify critical points in the life cycles of various functions of the urban green space and implement relevant mitigation strategies to deal with environmental stressors. Wetland ecosystems may, for example, have thresholds beyond which negative impacts can become stressors that have detrimental consequences for the functioning thereof. Natural processes should therefore be protected through effective wetland management (Mitch & Gosselink, 2011). Structures such as weirs and retention dams can be used to mitigate the risks associated with heightened water flows related to urban development. Buffer areas thus need to be considered in the design of developments adjacent to the Rietvlei Nature Reserve, to protect and support the ecological functions of the green space itself (Wolhitz, 2016). The natural flow patterns, as well as flood lines, also need to be considered in developments so that green infrastructure benefits can be sustained. Removal of vegetation when land is cleared for development in the catchment areas can increase the risk of flooding and of volumes of sediment being transported into the wetlands of the Reserve. There remains a risk that the design of development projects and infrastructure surrounding the green space, as well as the upgrading of infrastructure inside the conservation area, could negatively impact biodiversity in the reserve.

Conclusion

The Rietvlei Nature Reserve is a multi-functional urban green space and the stressors to the reserve need to be managed in such a way that the functions remain sustainable. Adapted to the specific case study of the Rietvlei Nature Reserve, the Butler (1980) model can be applied in the sense that as theorised by Butler (1980) in the TALC model, the very characteristics of a place that made it attractive in the first place can be destroyed by over-tourism when the limits of acceptable change are exceeded and the carrying capacity can no longer provide the tourism benefits of the destination. In the same way, a multi-functional urban green space such as the Rietvlei Nature Reserve can be jeopardised if demands on and usage of the reserve changes the characteristics of the geographical area. In line with the TALC model (Butler, 1980), various scenarios for the future sustainability of urban green spaces are possible, based on the evaluation of stressors and the success of the implementation of mitigation strategies. It is essential that managers understand the spatial dynamics and functions of a particular geographical area. This could be in terms of the expectations of the tourists in the case of a tourist destination or the ecosystem services provided to the local population by a multifunctional urban green space site.

South Africa, like many other countries in the global South, experience challenges in providing services for a growing urban population, and this is often characterised by the conflicting interplay between human needs and development associated with urban growth. The location of the Rietvlei Nature Reserve within the dynamic urban fringe between the Tshwane and Ekurhuleni Metropolitan Municipalities necessitates greater collaboration between the local governments to deal with the environmental stressors experienced in the reserve. The model presented in this paper can be used by the managers of the reserve to help mitigate the negative consequences of increasing, and sometimes conflicting, demands on this urban green space. If further adapted to accommodate the geographically specific interplay of

functions, the Green Space Area Life Cycle model can be applied to a variety of other urban green spaces in the global South.

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