

Chapter 17

Urban Green Spaces in a Post-Apartheid City: Challenges and Opportunities for Nature-based Solutions



Valentina Giombini and Jessica P. R. Thorn

Significance Statement Cities in sub-Saharan countries are simultaneously facing climate change, rapid urbanisation, and social inequalities. Nature-based Solutions harness nature's benefits to address these environmental, social, and economic challenges. In this study, we investigate how taking into account temporal dynamics and multiple values of nature helps to implement better Nature-based Solutions. Through satellite images and interviews with practitioners and residents, we look at how green spaces and dry riverbeds are distributed, managed, and perceived in the capital city of Namibia, south-western Africa. We find that apartheid spatial segregation legacies persist through the unequal distribution of urban green spaces, and that, although their current management limits their capacity to deliver benefits, riverbeds have the potential to support sustainable development and climate change adaptation.

Keywords Ecosystem services · Urban green infrastructure · Namibia · Environmental justice · River networks

V. Giombini (✉)

Institute for Alpine Environment, Eurac Research, Bolzano/Bozen, Italy
e-mail: valentina.giombini@eurac.edu

J. P. R. Thorn

School of Geography and Sustainable Development, University of St Andrews, St Andrews, UK

York Institute of Tropical Ecosystems, Department of Environment and Geography,
University of York, York, UK

African Climate and Development Initiative (ACDI), University of Cape Town, Cape Town,
South Africa

1 Introduction

Urban green spaces are widely recognised as multifunctional areas that can help address converging urban and global environmental change challenges (Ahern et al., 2014; Lindley et al., 2018). Studies and practical applications in cities have shown how green spaces improve the quality of life of urban residents and help to adapt to climate change by reducing, for example, the impact of heatwaves or slowing floodwater (Gómez-Baggethun & Barton, 2013; Andersson et al., 2019). Disadvantaged groups of people, however, often live in districts where green urban spaces are scarce or of lesser quality, and thus receive fewer socio-economic and environmental benefits stemming from natural areas. The adverse effects of climate change indeed frequently disproportionately affect the most vulnerable parts of society, which are often more exposed to risks and lack the socio-economic means (e.g., lack of insurance) to recover from shocks (Black et al., 2011). A closer understanding of the relationship between green urban spaces and social inequalities is therefore a critical step needed to identify effective, climate resilient development pathways, which also meet Sustainable Development Goals (Ernstson, 2013; United Nations, 2015; Langemeyer & Connolly, 2020). This chapter aims to show how the discourse on ecosystem (dis)services and Nature-based Solutions (NbS) is linked to historical racial and socio-economic inequalities. We approach this by using the case of the capital city of Namibia, focusing on riverbeds as they represent a diffuse network of natural green areas, critical for regulating water in one of the most arid countries in the world.

Many studies have shown how the distribution of green urban spaces and the delivery of ecosystem services is uneven in cities and regions around the world. Recently, influenced by the field of political ecology, there has been a growing interest to understand the causal dynamics and implications occurring around such patterns of unequal distribution (McConnachie & Shackleton, 2010; Ernstson, 2013; Sandberg et al., 2014). Research in the field of ecosystem service justice highlights that when distributional, procedural, and recognition justice is not considered, practical applications of ecosystem services approaches are unlikely to develop in a just manner, and risk to recreate or reinforce prior patterns (Friedman et al., 2018; Venter et al., 2020; Langemeyer & Connolly, 2020). Ecosystem service justice moreover interacts with other socio-economic dynamics, including power, historical legacies, race, and gender, which affect the way people receive benefits or disservices from the natural environment (Ernstson, 2013; Langemeyer & Connolly, 2020).

McConnachie and Shackleton (2010) showed how today poorer and formerly categorized non-white neighbourhoods have the smallest percentage of green areas in South African cities, while more affluent, former white neighbourhoods have the most. These results indicate that to ensure a fair distribution of ecosystem services temporal dynamics should also be considered, acknowledging the legacy of historic inequalities (Venter et al., 2020; Langemeyer & Connolly, 2020). During the apartheid regime, urban plans in South Africa and Namibia were indeed developed on apartheid principles which used strict land use zoning and racial segregation.

Business activities were concentrated in the centre of the city, “townships” for non-white communities were often built at the city’s periphery, and neighbourhoods for predominantly black, coloured, white, or other communities were built using different standards (McConnachie & Shackleton, 2010). Natural areas without built infrastructure, highways, railways, and industrial areas were built with the explicit intention to physically separate areas (Müller-Friedman, 2006).

Accounting for the socio-cultural dynamics occurring around urban green spaces is essential to ensure that NbS are effective in increasing the well-being of people and in giving rise to benefits, advancing recognitional justice (Langemeyer & Connolly, 2020). To determine whether residents would benefit from, endorse, and contribute to managing NbS, it is critical to understand the way nature is perceived by local people (Andersson et al., 2015; du Toit et al., 2018; Shackleton & Njwaxu, 2021). In sub-Saharan Africa, however, the body of literature on ecosystem services provision, and especially on cultural ecosystem services, remains limited. There is, therefore, the concern that an inadequate understanding of the interaction between nature and local communities hinders a fair and effective implementation of NbS in Africa (Cilliers et al., 2013; du Toit et al., 2018).

Here, we present the findings of a study conducted in the city of Windhoek, Namibia, to shed light on the perceptions and dynamics surrounding a riverbed network in a post-apartheid Southern African city. Based on the mapping of the greenness of the city and on the fieldwork conducted over 6 weeks in July–August 2019, involving residents and key informants, we aim to answer the following questions:

- (i) How is urban greenery distributed across four socioeconomically differentiated neighbourhoods?
- (ii) Which ecosystem services and disservices are delivered by riverbeds to residents, and how do these differ across neighbourhoods?
- (iii) How do access and management of riverbeds vary across the city neighbourhoods?
- (iv) How do historical legacies, people’s preferences and potential ecosystem disservices influence the implementation of Nature-based Solutions such as green infrastructure?

2 Methods

2.1 Case Study of Windhoek, Namibia: An Arid, Post-Apartheid City

Windhoek is the capital city of Namibia, a country of 2.6 million people in south-west Africa which spreads across the Namib Desert and the semi-arid savannah of the Kalahari. Historically, Namibia was a German and then a British colony, administered by South Africa from the end of the First World War until its

independence in 1990. Namibian citizens were therefore subject to apartheid laws between the 1950s and the 1990s. Since independence, the growth of informal settlements (or peri-urban areas or slums) and the rate of urbanisation has accelerated, as people from rural areas arrived in the city in search of employment and education opportunities (Weber & Mendelsohn, 2017). With predicted warming, drier conditions, and increased variability in the spring rainfall, internal rural-urban migration is likely to grow as people move away from subsistence farming and pastoral lifestyles (Niang et al., 2014). In 2019, 49% of the population lived in urban areas, 31.5% of which lived in Windhoek, the biggest city of the country which had 404,280 inhabitants in 2018 (Ritchie & Roser, 2019). Windhoek developed on a flood plain and the surrounding hills, in a plateau ranging between 1200–1700 m.a.s.l. in the central region of the country. Every summer growing water demand, coupled with recurrent nationwide droughts, puts the city under stress. Two main river systems run through the city (Gammans and Arrebusch) and collect the seasonal storm water from the surrounding hills into three city dams. Despite the ephemeral nature of the river network, riverbeds have the potential to foster NbS, supporting most of the city's greenery and hosting perennial trees, bushes and grasses adapted to arid conditions (e.g., acacia trees, trumpet thorn trees, dwarf shrub species) (Mendelsohn et al., 2002), (Fig. 17.1).

2.2 *Study Approach*

Between July and August 2019, we applied a mixed method approach, combining satellite observations of the distribution of urban greenery with interviews of practitioners and of residents living close to the city's river network, to understand how green urban spaces in the city of Windhoek are distributed, managed, and perceived. First, we computed and mapped, on the Google Earth Engine platform, the Normalised Difference Vegetation Index (NDVI) to reveal the greenness of the area of the city of Windhoek, using the greenest pixels available in the annual collection of satellite images. Second, we interviewed 12 key informants representing the City of Windhoek, NGOs, or businesses in the field of spatial planning, nature resource management, and housing, to understand how green urban spaces, including riverbeds, are managed, and what is the interaction between NbS and ongoing development. Third, we conducted 16 semi-structured interviews with residents of four neighbourhoods living close to the river network to gain an understanding of how riverbeds are used and perceived in terms of accessibility and provision of ecosystem services and disservices. Interviews were conducted in English or local dialects, translated when needed, recorded, transcribed, and manually analysed using thematic coding. The four neighbourhoods we studied represented a gradient of formal and informal land tenure arrangements and structural and socio-economic characteristics of neighbourhoods formerly racially segregated during the apartheid regime. The formal neighbourhoods included in the study were: Klein Windhoek (formerly white), Khomasdal (formerly coloured),

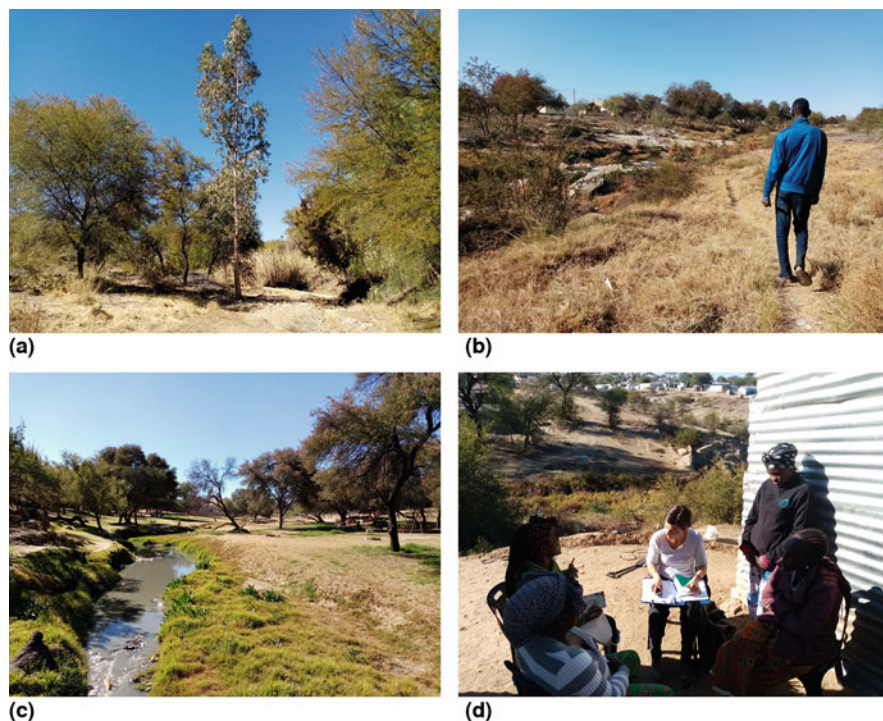


Fig. 17.1 (a) Riverbeds in Klein Windhoek, a wealthier area of the city with more green spaces along riverbeds (Van Rooy et al., 2006). (b) An interviewee of Khomasdal, the formerly coloured neighbourhood, showing us the riverbeds behind his house. (c) The “United Nations Plaza” city park in Katutura, which is a green space developed around a river section in the former black neighbourhood after independence, and frequently used for picnics, letting children play, taking photos and relaxing. (d) The first author interviewing residents of Okuryangava, an informal settlement with fewer green spaces along riverbeds. Behind interviewees, trees along the river can be seen, used for shade, as meeting areas, and for selling camelthorn pods for fodder. (Photo source: V. Giombini)

and Katutura (formerly black). Broadly speaking, progressing from formerly white to black neighbourhoods, the size of each property decreases and the distance to the central business district increases (Müller-Friedman, 2006) (Fig. 17.2). The Okuryangava neighbourhood represented an informal settlement (or peri-urban area or slum) characterised by insecure land tenure, limited access to formal services such as running water, sanitation and electricity, and makeshift corrugated iron sheet housing. To gain a deeper understanding of the context of the study, we visited on foot, with the support of a local research assistant and a community guide, the riverbeds and the four neighbourhoods where the residents were interviewed.

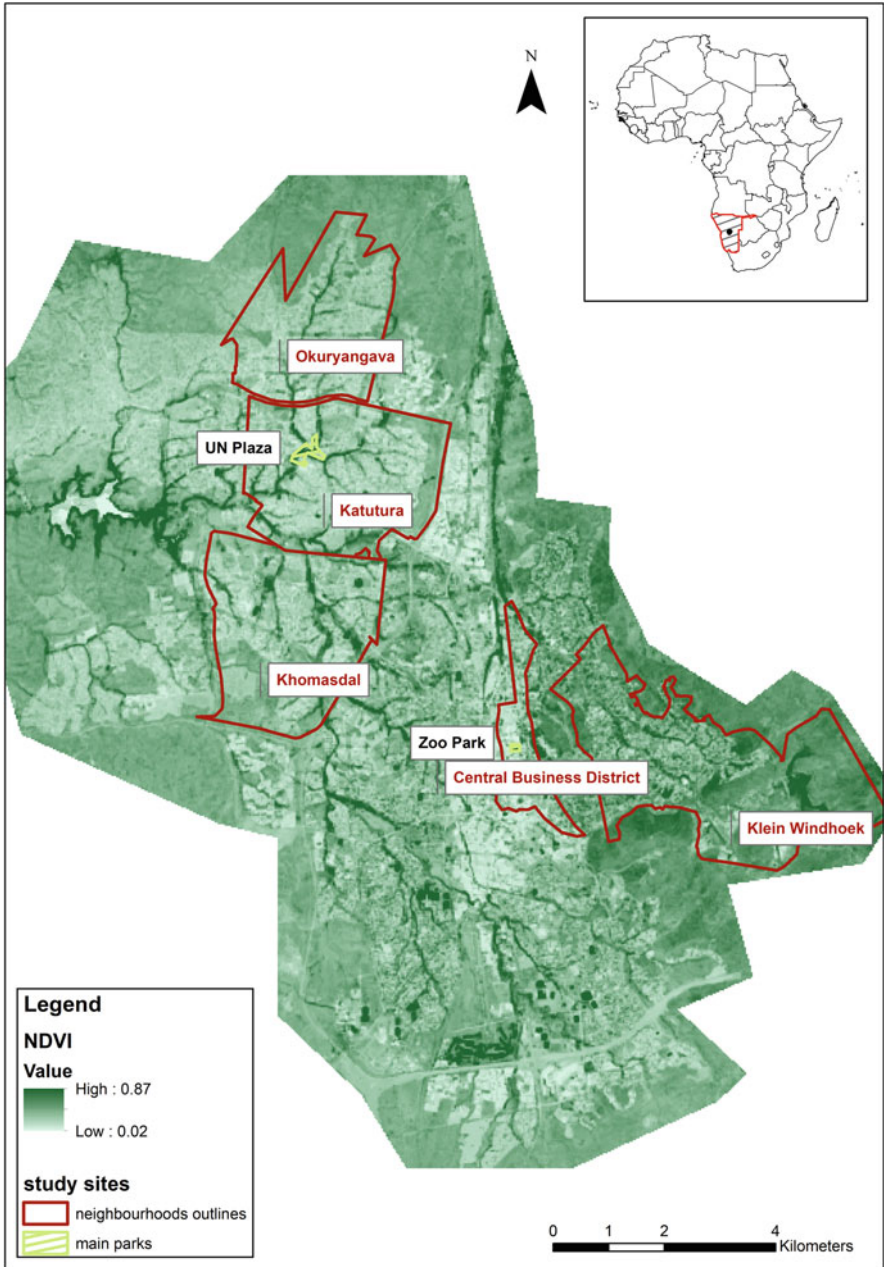


Fig. 17.2 The position of Namibia in Africa (top-right panel), and the greenness (NDVI) of the capital of Namibia. The main panel displays the NDVI values of the area of Windhoek, overlaid with the outlines of the central business district, the neighbourhoods analysed in this study, and the city parks mentioned by interviewees. The ephemeral river network (dark green) and the Goreangab dam on the top left, are clearly visible. *NDVI* = Normalized Difference Vegetation Index, representing the greenness of a pixel

3 Discussion of the Main Findings

3.1 Distribution of Urban Green Spaces Across Neighbourhoods

The analysis of the satellite images of the region showed that the area of Windhoek has overall a low degree of greenness (NDVI values between 0.020 and 0.863), consistent with the arid conditions of Namibia. Nonetheless, higher than average photosynthetic activity was evident along riverbeds, around the Goreangab dam, and in irrigated public parks or soccer fields (Fig. 17.2). Among the neighbourhoods analysed, the former white and more affluent neighbourhood of Klein Windhoek displayed the highest NDVI values (mean = 0.326), while the smallest values were found in the poorer informal settlement of Okuryangava (mean = 0.196), and in the former black neighbourhood of Katutura (mean = 0.200). The former coloured neighbourhood of Khomasdal displayed an intermediate level of greenness (mean = 0.214). As documented in several southern African cities by McConnachie and Shackleton (2010), similarly, it appears that in Windhoek formerly white, coloured, and black neighbourhoods have respectively the highest, intermediate, and the lowest values of greenery. The pattern observed in Windhoek is likely to be the combination of the fact that former black neighbourhoods were built with a higher density of houses compared to coloured areas, and that former white neighbourhoods developed on lush hilly areas and have bigger properties and gardens (Müller-Friedman, 2006). The Okuryangava informal settlement, on the other hand, unregulated by municipal planning processes, is subject predominantly to informal rental or procurement arrangements between residents. Most of the local vegetation continues to be removed to make space for corrugated iron shacks or for energy biomass. However, larger trees are left standing to provide shade, and some bushes and plants have been planted to delineate properties, grow vegetables gardens, or embellish houses. These findings on the greenness of Windhoek highlight how social inequalities shape the way people can benefit from the environment (Sandberg et al., 2014). We argue that such inequalities should be closely examined and mitigated prior to the design and implementation of any nature-based adaptation or mitigation intervention. Studies mapping NDVI and ecosystem services can help quantify the distribution of greenery and the delivery of ecosystem service. Results can be used to prioritize intervention areas and guide the development of NbS such as urban green infrastructure (Hansen & Pauleit, 2014).

3.2 Ecosystem Services and Disservices Provided by Riverbeds Across Neighbourhoods

Key informants highlighted how riverbeds and natural features, if well managed throughout the year, mitigate the risk of both summer city-wide water stress and seasonal destructive flash floods. Interviews with residents shed light on the

Table 17.1 Services and disservices deriving from riverbeds, as perceived by residents of four socio-economically and structurally differentiated neighbourhoods of Windhoek, Namibia

Neighbourhood	Context	Ecosystem services deriving from riverbeds	Disservices deriving from riverbeds
Klein Windhoek	Wealthy and former white neighbourhood	Biodiversity observation, outdoor recreation, walking dogs	Facilitation of house robberies and mugging, diseases, and smell from overflowed sewage manholes
Khomasdal	Middle class and former coloured neighbourhood	Mental well-being, biodiversity observation, space for socializing and for children to play	Facilitation of house robberies, diseases and smell from overflowed sewage manholes, mosquitoes and snakes, youth consuming alcohol and smoking
Katutura	Poorer-middle class and former black neighbourhood	Mental well-being, biodiversity observation, space for socializing	Facilitation of house robberies, diseases and smell from overflowed sewage manholes, bushes behind which criminals can hide, mosquitoes, youth consuming alcohol and smoking
Okuryangava	Informal settlements with limited access to services	Cooling, biomass for energy, camelthorn pods and grasses as fodder, home vegetable garden	Diseases and smells from overflowed sewage manholes, bushes behind which criminals can hide to rob or assault, mosquitoes

perceived benefits provided by riverbeds (Table 17.1). In the former white neighbourhood, many residents appreciate how riverbeds have the potential to support biodiversity and outdoor recreation. In the former black and coloured neighbourhoods, the majority describes how the riverbeds allow them to relax and watch the water flow. A woman from Katutura said that “[the river] feels good, it’s quite nice there, when you sit down, you try to listen, [...] you just go in the middle of the river, sit there and relax your mind”. Living close to the riverbeds in the Okuryangava informal settlement allows some households to have home gardens and to alleviate heat stress in summer, improving living conditions in corrugated iron houses with minimal ventilation. Furthermore, some residents of the informal areas sustain their livelihoods collecting and selling fodder.

Interviews with residents and key informants also outlined several ecosystem disservices (Table 17.1), intended as ecosystems’ characteristics that give rise to disadvantages for people (Lyytimäki & Sipilä, 2009). The major concern of the residents of Windhoek regarding riverbeds is the risk of being robbed and the limited security of the areas. In more affluent neighbourhoods, there is the fear that living

close to the riverbeds increases the risk of having one's home burgled, as riverbeds provide escape routes for criminals. In all the neighbourhoods studied, the overflow of poorly maintained sewage manholes running beneath the riverbeds spurs the fear of contracting waterborne diseases. This is especially felt in the former black neighbourhood and in informal settlements, where sewage maintenance is often limited and delayed. An interviewee from Khomasdal summed his feelings about the river saying: "*it made me feel a bit relaxed, you know, just admiring the nature, even though, the problem about it, the environment (and) this kind of river, is [. . .] sewage water flows there, the smell and all that makes it uncomfortable. Otherwise, I wouldn't mind sitting in the river, you know, and drinking some cool drink*". In the informal settlements, people fear being assaulted or raped when using the riverbeds for open defecation, as well as mugging when using riverbeds to commute on foot.

3.3 Perceptions of Access to and Management of Urban Green Spaces

Overall, although the riverbeds in the city of Windhoek are a diffuse network of naturally green areas, few residents perceive riverbeds as an asset or access them for pleasure other than for commuting or necessity. To enjoy natural areas, residents who can afford it drive to farms and dams on the outskirts of the city. Poorer residents, on the other hand, go to city parks like the Central Zoo Park (2 ha) or UN Plaza (3.5 ha) in Katutura (Fig. 17.1, panel (c)). Yet, such parks are generally not reachable by foot, being several kilometres away from the informal settlements. Interviews with key informants highlighted how riverbeds are not managed by the City of Windhoek to be used by the public as urban parks. The reason for this is, in part, due to issues of maintenance, financing, and clarity of mandates between municipal departments. The City of Windhoek indeed manages riverbeds by keeping them in their natural state and removing litter and invasive species. Moreover, the fact that the riverbeds and the waterways are under the jurisdiction of two separate divisions of the City of Windhoek hinders the possibility to harness synergies, such as those occurring between recreation and water management.

3.4 Challenges to the Successful Implementation of Nature-based Solutions

This study highlights how it is important for researchers and practitioners working towards implementing NbS in a given social-ecological system to also consider the historical context, the multiple values of nature in place, and the presence of underlying socio-economic and development dynamics (Ernstson, 2013; Langemeyer & Connolly, 2020). In the case of Windhoek, for example, approaches

for developing urban green infrastructure will not be fully effective if synergies and trade-offs with other development issues such as housing, sanitation, transport, and economic inequalities are not navigated and sensitively addressed at the same time. Moreover, it should not be taken for granted that natural features always hold a positive value to residents. This is because individual factors (e.g., gender, age) and socio-cultural dynamics affect how nature is perceived in specific contexts (Chan et al., 2012). Spatial planners highlighted, for example, how natural areas and vacant land of post-apartheid cities hold an explicit segregation value. Müller-Friedman (2008), reflecting on her experience as a practitioner in Namibia, suggests that architecture and spatial planning approaches in the country unintentionally fortify the apartheid-built form by adopting modernist principles, viewing planning as a technical issue, and failing to recognise how the urban form is not politically and culturally “neutral”. Building on this argument, we suggest that vacant and natural land in Windhoek should also not be considered “neutral” but connected to the historical legacy of apartheid spatial planning.

3.5 Opportunities for the Fair and Effective Implementation of Nature-based Solutions

The implementation of NbS represents an opportunity to overcome the aforementioned challenges. Strategically addressing the historical legacy of apartheid era’s spatial planning, a green infrastructure network should be developed to incorporate, for example, naturally green riverbeds and vacant land currently separating neighbourhoods, in addition to other types of green spaces such as meeting areas, parks, and drought-tolerant botanical gardens. In the context of Windhoek, NbS should also be designed to maximise synergies with sustainable development goals (United Nations, 2015) and managed to meet the needs of local people, by limiting sewage outbursts, fostering a secure environment, and supporting recreation, urban farming, and rainwater harvesting. We argue that eliciting the local perceptions of residents represents an opportunity to investigate the plurality of ecosystem (dis-)services and values, and can help ensure a fair delivery of ecosystem services and an effective implementation of NbS (Andersson et al., 2015; Chan et al., 2012). Although riverbeds and their buffer zones are currently exposed to densification and sprawl pressures in informal settlements and their current management gives rise to ecosystem disservices, they should be considered as an asset. Being naturally green areas in one of the most arid countries of the world, riverbeds have the potential to represent the backbone of a green infrastructure network which fosters synergies between the development and climate adaptation goals.

4 Conclusions

This case study shows the importance of adopting both quantitative and qualitative methods for gaining a holistic understanding of the interactions occurring within complex social ecological systems. Interviews and other participatory processes are critical for acknowledging the multiple values of nature, exploring ecosystem services and disservices, and ensuring that local needs are met. Although more research is needed across longer temporal scales, with larger sample sizes and diverse neighbourhoods, this study highlights that practical implementations of ecosystem services approaches should acknowledge that nature and natural areas do not always hold a positive value and that their distribution might be the result of prior unjust patterns. It furthermore shows that failing to acknowledge historical legacies of apartheid spatial planning carries the risk of maintaining and strengthening green space inequity. To this end, the ecosystem service concept can provide a framework for identifying and managing disservices, harnessing synergies among ecosystem services, and exploring their interaction with sustainable development goals. Moreover, research from the field of political ecology and ecosystem service justice can greatly contribute to provide the frameworks and tools necessary to approach the discourse of NbS in a critical and foresighted way.

Acknowledgments We would like to thank all interviewees for having given their time and their voice; research assistants Erikka Mokanya and Penda B. Nembwaya; Green Templeton College and the Environmental Change Institute of the University of Oxford for supporting and funding field work in Windhoek; and Climate Research 4 Development fellowship (CR4D-19-21) for funding the Urban Evolution project – implemented by the African Academy of Sciences in partnership with the UK’s Department for International Development, Weather and Climate Information Services for Africa programme and the African Climate Policy Centre of the United Economic Commission for Africa. This study has also been funded in part by the African Women in Climate Change Science Fellowship supported by the African Institute of Mathematical Sciences Next Einstein Forum and the International Development Research Centre of Canada Aid, the UK’s Research and Innovation’s Global Challenges Research Fund under the Development Corridors Partnership project (ES/P011500/1).

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