



Local Governments
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AFRICA



Urban Resilience and Local Governance

GREENING FOR URBAN RESILIENCE: THE CASE OF DODOMA, TANZANIA

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AfriFOODLinks





Urban Resilience and Local Governance in Tanzania

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Contents

| | |
|---|-----------|
| 1. Introduction | 01 |
| 2. Innovative planning towards greening for urban resilience | 03 |
| 2.1. The role of local governments in urban greening | 06 |
| 2.2. Green infrastructure in cities | 07 |
| 2.2.1 Green roofs | 07 |
| 2.2.2 Green walls and vertical gardens | 07 |
| 2.2.3 Sustainable Drainage Systems (SuDS) | 08 |
| 2.2.4 Permeable paving | 08 |
| 3. Growth and greening in Dodoma | 09 |
| 3.1 Challenges and opportunities related to Dodoma’s greening initiatives | 18 |
| 3.1.1 Challenges | 18 |
| 3.1.2 Opportunities | 20 |
| 4. Conclusion: The future of greening investments and developments | 22 |
| 4.1 Start early in schools | 22 |
| 4.2 Tying greening initiatives to livelihoods | 22 |
| 4.3 Amplifying incentives | 22 |
| 4.4 By-law enforcement | 23 |
| 4.5 Expanding the definition of greening | 23 |
| References | 24 |





1. Introduction

Climate change, biodiversity loss and rapid urbanisation are global challenges articulated by the 17 Sustainable Development Goals ([SDGs](#)) of Agenda 2030 and the Kunming-Montreal Global Biodiversity Framework ([GBF](#)). Climatic and biodiversity threats, including floods, droughts, water stress, sea level rise, heat waves, and storms, are also highest on the list of economic and social risks in cities (Senadeera, 2023; WEF, 2024; IPBES, 2019;). Climate change and biodiversity loss are compounding the unprecedented rapid urbanisation experienced in Africa, and contributing to the rapid degradation of natural assets, increasing the vulnerability of urban communities. In response, many African governments have adopted a greening agenda to enhance urban resilience, and reduce the impacts rapid urbanisation and environmental threats. If prioritised and effectively implemented, greening programmes have the potential to create a harmonious relationship between the natural and built environments in cities.

While the process of greening cities worldwide spans nearly all governance levels, local governments remain among the key actors championing the green urban development strategy. Local governments are crucial in addressing vulnerabilities through green infrastructure and public services, land use planning, green building regulations and protecting natural public space or

wilderness. In practice, however, we must be aware of opportunities and challenges regarding greening initiatives.

In the case of Dodoma City, it is essential to take stock of what has been done towards green infrastructure planning. We need to capitalise on opportunities to build clean and efficient cities that are resilient to natural disasters without sacrificing sustainable development. The challenges of green infrastructure planning (e.g. institutional barriers and competing priorities) will help identify the issues that need to be addressed as we seek to enhance the ability to address increasing environmental threats. Against this background, this piece seeks to examine the opportunities and challenges related to green infrastructure planning for urban resilience that Dodoma has to offer, discerning lessons on green infrastructural planning that could be relevant to other cities in Tanzania and across Africa.



Defining “green infrastructure”

According to the United Nations Environment Programme ([UNEP](#)), green infrastructure is “a network providing the ‘ingredients’ for solving urban and climatic challenges by building with nature (including stormwater management, climate adaptation, less heat stress, more biodiversity, food



production, better air quality, sustainable energy production, clean water and healthy soils, [...] increased quality of life through recreation and providing shade and shelter in and around towns and cities. Green infrastructure also serves to provide an ecological framework for the social, economic and environmental health of the surroundings.” (UNEP, n.d.)

2. Innovative planning towards greening for urban resilience

The contribution of cities in addressing global environmental challenges has long been recognised (Bulkeley & Betsill, 2003). SDG 11, which aims to make cities and human settlements inclusive, safe, resilient and sustainable, recognises that cities are places where economic and technological interventions for climate change adaptation and mitigation have the best potential to be implemented and scaled up. To do this, however, adequate solutions, resources and policies are required.

African cities are undergoing rapid and unplanned land use changes, predominantly due to unprecedented urban expansion. Unplanned growth of cities poses an increasing threat to biodiversity, particularly in peri-urban, rural and conservation areas on urban fringes. African cities often cannot adapt at a rate that enables them to reap positive socioeconomic outcomes from urbanisation, like elsewhere in the world (Dorosh and Thurlow, 2012 cited in Sakketa, 2023; Page et al., 2020). This is primarily due to (i) a sectoral approach to urban planning and development instead of an integrated spatial planning and management approach, and (ii) underinvestment in fundamental physical and social infrastructure for sustainable growth

(African Development Bank Group, 2023). Further, inner-city green open spaces are often not maintained or are encroached on by unplanned expansion. Yet, these green open spaces serve as green lungs in the cities, providing ecosystem services (Figure 1) to urban residents. Green infrastructure provides various socioeconomic and cultural benefits to help cities build resilience (Pamukcu-Albers et al., 2021). These benefits include, but are not limited to: cleaner air and water; recreation spaces; flood protection; diverse habitats; and beautiful green spaces (EPA, 2024). Furthermore, green infrastructure creates diverse green spaces in cities that promote urban biodiversity by providing habitats for an array of species (Kattwinnkel et al., 2011; Jim and Chen, 2008). From a health perspective, green infrastructure can encourage a healthy lifestyle through physical activity or relaxation for urban residents.

Urban greening and green infrastructure should be at the centre of urban planning, and should be understood as a vital means of attaining urban resilience (Ramyar, Ackerman and Johnston, 2021). With rapidly growing concerns about climate change and natural degradation in urbanised areas, urban planners urgently need to adopt



more integrated, adaptive approaches and utilise more innovative tools and methods to enhance urban sustainability and resilience. Urban green infrastructure planning has valuable potential for planners to direct development in ways to buffer cities in the face of adverse impacts through the diverse delivery of ecosystem services.

“Green infrastructure is a game-changer for our cities and communities. It is all about using nature to make our urban areas better for everyone” (Karnik Aswani, 2023).

THE VALUE OF NATURE IN URBAN LIFE

Nature provides diverse life-supporting and life-enhancing contributions to people in cities and towns. These gifts from nature make human life both possible and worth living. All cities critically depend on healthy interconnected ecosystems within and around them, so it is essential that nature is fully integrated into urban planning and development. There is a growing urgency for collective and large-scale action to protect the biodiversity in and around cities to prevent irreversible loss and damage to the natural systems we depend on.



KEY:
 ● TANGIBLE THINGS FROM NATURE THAT MEET HUMAN NEEDS
 ● BENEFITS OBTAINED FROM THE PROCESSES THAT REGULATE THE NATURAL ENVIRONMENT
 ● NATURE'S GIFTS THAT ENRICH OUR LIVES
 ● SUPPORTING THE LONG-TERM HEALTH OF THE PLANET

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Figure 1: Ecosystem services derived from urban nature (Source: CBC ICLEI)

Greening in Tanzania

Tanzania offers good case studies where investments in green infrastructure result in substantial benefits to cities. For example, the European Union-funded project “Green and Smart Cities” aims to raise the quality of life in cities through green infrastructure investments, local economic growth, circular economy, and e-governance, as part of efforts to improve urban resilience and economic sustainability in Mwanza, Tanga, and Pemba (Amir, 2023).

In addition, Arusha and Moshi are actively developing green cities through various initiatives that promote environmental sustainability, energy efficiency, and green infrastructure projects to create more livable and resilient urban environments in Tanzania. Arusha and Moshi have been recognised as the greenest cities and municipalities in Tanzania respectively. Arusha, located in the northern zone of Tanzania, was awarded the title of the greenest city on Environment Day in 2015. This recognition highlights their efforts towards environmental sustainability and green initiatives. Moshi has frequently won the title of the cleanest municipality in Tanzania. In 2015, it participated in the Earth Hour City Challenge with other Tanzanian towns, such as Dar es Salaam and Mwanza. Moshi outperformed other regions and became the number one cleanest town/municipality in Tanzania (Tunza Eco-generation, 2022).

2.1. The role of local governments in urban greening

Local governments are key actors in their role as planners for sustainable urban development and are at the forefront of responding to climate and biodiversity challenges by providing resources and protecting urban green spaces (WHO, 2016). Local governments can improve urban nature through the development of greening plans, strategies and policies. Green infrastructure planning enhances the ability to deal with climate change on an urban scale, by producing a variety of ecosystem services and having a proactive multi-function and multi-discipline approach. Furthermore, creating an enabling environment which integrates greening will positively influence local governments’ abilities to help urban communities become more resilient and achieve environmental, social, and economic benefits.

In addition to developing greening strategies and policies, local governments need to ensure that there is adequate knowledge and capacity to manage and maintain the various forms of greening that are integrated into urban spatial planning. Working with key stakeholders such as local communities can ensure that various aspects of a green infrastructure network (green spaces, food systems, walking and cycling zones, and urban heat island management) are developed and maintained, making urban environments more resilient.

Local governance in Tanzania

In Tanzania, the local government authorities are mandated to maintain good governance; to promote the economic and social welfare of the people in their jurisdiction; and to ensure effectiveness and equitability of quality services delivery. In addition, however, the National Environment Policy (2021) clearly states that local government authorities shall be responsible for implementing all environmental issues in their respective areas of jurisdiction. This would include mainstreaming environmental issues in their development strategies, plans, programmes and projects; promoting protection and conservation of the environment; and raising awareness of environmental management issues in their geographical jurisdiction. Local governments therefore become among the key actors in championing a green urban development strategy for developing a win-win solution that creates a harmonious relationship between the natural and built environments of the cities.

2.2. Green infrastructure in cities

The loss of natural ecosystems in cities makes it more challenging to solve urban problems such as air pollution, the urban heat island effect, water scarcity, local flooding, loss of nature, and lack of social cohesion. Some of these problems can be addressed using conventional engineering, such as

stormwater systems or dams; however increased hard surfaces in cities has been shown to increase water runoff speeds and flooding, reducing infiltration and recapture of water sources, and exacerbating heat-island effect. The increasingly attractive alternative is to use green infrastructure. This is challenging where cities are already built up, such as inner-city areas with concrete paving and dense, high-rise buildings. In these instances, cities can be retrofitted with green infrastructure or natural areas to access the associated benefits through man-made ecosystems. Some examples of green infrastructures that should be included in urban development are:

Green roofs are spaces on top of buildings covered in vegetation, planted in a growing substrate. They are an increasingly popular measure to introduce more greenery in densely built-up areas, without placing demands on additional space. Green roofs have various benefits such as reducing energy consumption, improving air quality, reducing air and noise pollution and the urban heat island effect, and attenuating stormwater runoff (Iwaszuk et al., 2019). They also provide aesthetic improvements, environmental protection, contribute to more urban biodiversity and green spaces in cities, and can improve urban quality of life and human well-being.

Green walls or vertical gardens refer to vegetated vertical surfaces, which are

partially or completely covered by greenery. They are often created by growing plants vertically across a wall or a building facade (Iwaszuk et al., 2019). Given the amount of available wall space, it is considered a sensible strategy for greening dense cities. As with green roofs, vertical gardens are expected to reduce the urban heat island, energy consumption and stormwater runoff. Green walls can also support biodiversity in cities by acting as a “corridor” or “stepping-stone” to facilitate the movement and dispersal of species.

Sustainable Urban Drainage Systems (SUDS) involves the strategic design and use of green infrastructure in urban areas for stormwater management. Often, green infrastructure and built systems are combined to create a hybrid drainage system. The adaptability and flexibility of SuDS mean that it can be incorporated into any environment. Flooding and urban stormwater management are becoming increasingly prevalent in cities, in the face of the changing climate and biodiversity loss. SuDS reduce, slow and retain stormwater runoff, particularly during high rainfall events. Examples of SuDS in urban areas can include constructed wetlands and rainwater harvesting.

Constructed wetlands consist of saturated soils with varying shallow water levels and abundant vegetation. Rainwater harvesting involves capturing and storing stormwater runoff from a

roof or other surfaces. This can then be used as a source of water supply for mostly non-potable needs and can also be stored for future use. It has the potential to contribute to improved water supply (particularly in arid regions) and can also be a solution to food security by increasing water supply for urban agriculture and enabling homestead gardening.

Permeable paving allows surface water runoff to infiltrate through the surface, into the ground, by having open parts or using porous materials in its design. It offers several benefits, such as the elimination of surface water runoff, recharging of groundwater, trapping of suspended solids and pollutants, reduction of surface temperatures and reducing the need for retention basins and water collection areas (Iwaszuk et al., 2019).

The integration of greening and green infrastructure has the potential to create a harmonious relationship between the natural and built environments of cities. Many governments across the world, and in Africa, have started to adopt a greening agenda which includes green infrastructure, to enhance urban resilience. While the process of greening cities worldwide spans nearly all governance levels, it is recognised that local governments are crucial in addressing risks and vulnerabilities, by providing green infrastructure and public services, land use planning, and policies and regulations.

3. Growth and greening in Dodoma

Throughout its rich history, the City of Dodoma has recognised the need for greening. Dodoma is in a semi-arid or dry-land environment, therefore the most notable environmental challenge there is drought. This is accompanied by changing rainfall patterns and a destabilisation of cropping and harvesting seasons. In addition, severe land degradation due to overexploitation of natural resources and deforestation, resulting in reduced fuel wood, flooding, and soil erosion are also noted challenges (Currie, 2021). However, greening has long been a part of the Dodoma City Master Plan which was first approved in 1976. The initial plan outlined the need for tree planting and greening initiatives, which have since been undertaken in several ways to address deforestation and land degradation across the city.

From an urban planning perspective, the Dodoma City structure plans are outlined in the Dodoma National Capital City Master Plan (2019-2039) prepared by the Capital Development Authority (CDA), providing a framework for developing Dodoma as the national capital over a twenty-year horizon (refer to Box 5 below). The plans focus on various aspects of urban development, including land use, transportation systems, connectivity to neighbouring regions, and providing services to residents.

History of Dodoma

The Dodoma region is located in the heartland of Tanzania at 6°10'23"S; 35°44'31"E. It is approximately 455 km west of the former capital, Dar es Salaam, and 441 km south of Arusha. Dodoma, officially Dodoma City, is the national capital of the United Republic of Tanzania (Capital Development Authority, 2010). The region is administratively divided into seven districts: Bahi, Chamwino, Chemba, Dodoma, Kondoa, Kongwa, and Mpwapwa.

DODOMA NATIONAL CAPITAL CITY MASTER PLAN
LOCATION OF DODOMA CAPITAL CITY DISTRICT (CCD)

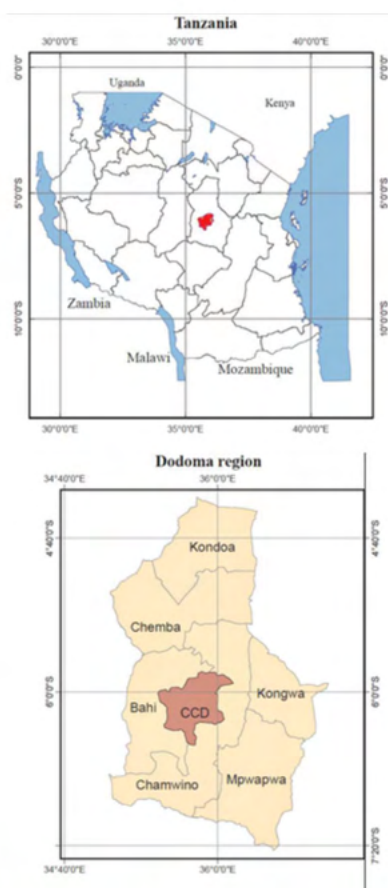


Figure 2: Dodoma City location map (Source: DNCCMP)

Originally a small market town known as Idodomya, the modern Dodoma was initially founded by German colonists in 1907, during the construction of the Tanzanian central railway (Huang et al., 2017). In 1961, Tanzania became an independent republic. Later, in 1973, the Tanzanian government announced the decision to move its capital city from Dar es Salaam to Dodoma. The decision to move the capital was reached democratically following a national referendum, with the main reasons being to create significant social and economic improvements for the central region, establish a regional administrative centre for building states, and capitalise on the centrality and accessibility of Dodoma in the national context.

A state agency (Capital Development Authority) and ministry were established to oversee the transfer and were mandated to prepare plans for the development of Dodoma as the national capital of Tanzania. Due to various reasons, however, the transfer took almost 50 years to complete. The city needs to meet the rapidly rising demand for utilities and community infrastructure and address challenges around infrastructure, transport systems, water supply, and housing, to accommodate government workers and residents alike, amidst the climate and biodiversity crises.

Since the initial Dodoma City Master Plan in 1976, various tree planting and greening initiatives have been undertaken to address deforestation and land degradation. For example, the government, in collaboration with external organisations, made efforts to work on environmental conservation through the Hifadhi Ardhi Dodoma (HADO) project. The project engaged in soil conservation in the Kondoa district and some parts of the former Dodoma Rural District. In addition, to implement Julius Nyerere's vision of transforming Dodoma into a green city, environmental restoration was implemented through tree-planting campaigns. This included the propagation of 335,000 plants and trees, maintenance of natural vegetation, reforestation of 150 hectares, establishment of two horticulture nurseries, and development of controls against tree felling. However, these projects were designed with minimum involvement of the people in the local areas. Furthermore, they were not sustainable, as there were missing links in planning, decision-making, and project implementation (Xinhua, 2017).

The Dodoma Master Plan

Developing plans enable areas of the natural environment to avoid fragmentation and allow land uses to be demarcated to preserve and conserve green areas to prevent encroachment by urban development and to mainstream

urban resilience (Dodoma National Capital City Master Plan, 2019). Aspects of the urban edge and urban-rural linkages are important to consider as they guide the interrelationship between urban and rural land and the complexities surrounding them.

In 1976 a Master Plan was developed for Dodoma. The lack of progress in implementing this plan led to a review and revised plan, which considered the new economic realities in Tanzania (CDA, 1983) providing insights into the shifting urban development strategies. The 1988 structure plan was prepared by Cameron McNamara of Brisbane, Australia, who used the strengths of the 1976 plan to produce a better plan providing an alternative urban concept which could fit better with local culture, the economics of development and the physical terrain surrounding Dodoma. New towns were created of between 90,000 - 120,000 people instead of the organic growth concept of the 1976 plan (CDA, 1988). The concept had the advantages of (i) reducing infrastructure and development costs; (ii) a much larger population that can support a more diversified and larger employment, commercial and services base; (iii) a major centre which forms a central place; (iv) creating a choice of settlement areas in Dodoma; (v) avoiding a monotonous linear expansion of communities; and (vi) recognised a high proportion of people that can only afford to walk or cycle to work.

This plan has since been updated, the most recent version being the Dodoma National Capital City Master Plan (2019 - 2039). This plan includes a landscape improvement plan, which looks at making Dodoma a "biophilic city" through the concept of "greening and bluing the semi-arid Capital City of Dodoma". The concept underscores the fact that while greening evokes all notions of green structures and elements (trees, shrubs, grasses, etc.), bluing refers to creating and utilising water bodies to enhance the landscape quality of the city. As a result, a total of 6,573,292 trees are to be planted across Dodoma Capital City, an average of 1,643,323 trees planted every five years in addition to creating and expanding more water bodies where topography allows. The recommended comprehensive tree planting is consistent with the programme of greening the capital city of Dodoma (Dodoma National Capital City Master Plan, 2019).

In 1988, when the master plan was first revised, more than 20,000 hectares were already developed into forest zones, providing greenery in the areas directly surrounding the city of Dodoma (Lupala & Lupala, 2003). Additionally, a city open space system has been developed, and efforts have been made to monitor the growth and health of young plants.



Despite these efforts, deforestation continues to be an issue, particularly in areas surrounding Dodoma. Vegetation has been cleared for agricultural activities and this trend has aggravated deforestation to devastating scales by causing soil erosion. In addition, the problem of domestic fuel deficiency drives firewood harvesting, exacerbating deforestation through tree cutting (NBS, 2003). Kayombo et al., (2020) and Gayo (2021) also note that many forest patches of native species in the urban areas of the city have been cleared for infrastructure development and fuel wood consumption.

To remediate this, tree planting campaigns in and around Dodoma City have intensified. For example, with financial assistance from Chadwick Textiles, more than 30,000 trees were planted alongside other stakeholders in Dodoma from 2021 to 2022, through the KeshoTutachelewa (Tomorrow is Too Late) campaign. Almost half of these trees were planted during an activity coordinated by the Dodoma City Council and Tanzania Forest Services Agency (TFS), which involved the Human Dignity and Environment Care Foundation (HUDEFO) and Local Government Authorities (LGA). In addition, from 2018 to date, the Greening Dodoma campaigns have been spearheaded by the country's Vice President's office but with a wider scope to cover the whole of the Dodoma region. The campaign is to re-green the country and mitigate against climate change. In schools, a campaign named "Study with a Tree" aims to encourage students to cultivate

a culture of protecting the environment. In recent decades, a call for greening the drylands in the country has been prompted by the need to mitigate the effects of climate change and biodiversity loss.

While there has been a strong focus on tree planting in Dodoma and the surrounding regions, there are several other greening initiatives that should be recognised. For example, the Dodoma region is the only place in Tanzania where grapes are grown, but these farms are more concentrated in Dodoma Urban, Bahi, and Chamwino districts. Peri-urban settlements around Dodoma City, such as Mpunguzi, Nkulabi, Hombolo Bwawani, Veyula, Makutupora, and Chahwa, are also famous for vineyards. These farms encourage and promote green open spaces in Dodoma whilst supporting the livelihoods of peri-urban farmers.

Partnerships have also played a pivotal role in greening efforts around Dodoma, such as the greening campaign being implemented in the Medeli Investment area, the University of Dodoma, Magufuli Government City in Mtumba, the Mzakwe catchment basin, and areas surrounding Makutupora National Service camp. Other areas include Njedengwa, Ipagala, the stretch of road from St. Peter Cleaver School (Ihumwa) to the University of Dodoma, and nearly all school compounds in the city. In addition, the Tanzania Urban Resilience Program (TURP) (July 2016 - January 2023) was established to support the government's efforts to increase

resilience to climate and disaster risk. The programme has involved various activities, including flood risk mapping and developing use cases for the data collected to support resilience-building efforts (Tanzania Urban Resilience Program, 2019). Lastly, the Tanzania Green Solutions for Sustainable Urban Development in Dodoma City project, supported by the African Development Bank, has been pivotal in bolstering urban governance, upgrading infrastructure, and enhancing essential services within the city (Green Solutions for Sustainable Urban Development in Dodoma City, 2023). A significant milestone in this endeavour has been the development of a robust policy framework for climate change adaptation and sustainable land management. This framework has been instrumental in reducing pressures on critical infrastructure, safeguarding environmental resources, and fortifying the city's resilience to climate-related risks (Policy Framework in Dodoma, 2022).

Collaboration with international organisations and partners such as the World Wide Fund for Nature, UN-Habitat, and the United Nations Development Programme (UNDP) offers an important opportunity worth developing. A case in point is the partnership between the Institute of Rural Development Planning of Dodoma, the UNDP, UN-Habitat, and the office of the Dodoma Regional Commissioner, which together implemented a robust project for making the capital city green.

This project, known as the Ilazo-Swasa Stormwater Project, is part of the Dodoma National Capital City Master Plan (2019 - 2039). This will involve creating a recreational park on the site surrounded by greenery.

CASE STUDY

Greening Dodoma Project

The Greening Dodoma Project is an example of the role private sector firms play in greening initiatives. The Vodacom Tanzania Foundation (VTF) signed a grant agreement with the World Wide Fund for Nature (WWF) to provide USD 131,700 to plant over 71,000 trees across 116.1 hectares in support of the 'Greening Dodoma Project' which is championed by the Vice President's Office (Langen and Savinus, [Vodacom Tanzania Foundation and WWF Tanzania, 2019](#)). The project's objective is to support the government's efforts in implementing eco-friendly programmes for tree planting initiatives, solid waste management, control of plastic bags usage, and diversification of livelihoods. Furthermore, it promoted the government's national tree planting initiative and women and youth economic empowerment, through the Plastic Bag Control Program and Solid Waste Management in Dodoma (Langen and Savinus, n.d.). Other key project implementing partners are the City Council of Dodoma (CCD), Tanzania Forest Services Agency (TFS), academic institutions, and local community youth and women groups.





Figure 3: The project's progress (Source: Story Maps Arcgis)

CASE STUDY:

Msalato Community Farm in Dodoma

The Msalato Community Farm in Dodoma was implemented through the INTERACT-Bio project which is funded by the German Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection through the International Climate Initiative (IKI). This specific project, coordinated by ICLEI Africa and ICLEI Cities Biodiversity Center, together with BORDA Africa and Inhabit Earth, represented a holistic approach to sustainable urban development, integrating components to create a regenerative and productive landscape which mimics natural ecosystems to

cultivate diverse, closed-loop systems without waste. This approach promotes sustainable food production and enhances soil health and ecosystem resilience.

Central to the success of the project was the community, who were equipped with the skills and knowledge necessary to cultivate regenerative livelihoods, who contributed to the broader initiative. The residents also actively engaged in the design and implementation process. By empowering the community, the project fosters a sense of ownership and responsibility, ensuring long-term sustainability and success.

The Msalato Community Farm ultimately forms part of a larger vision to establish foodways across Dodoma, which are corridors of productive landscapes that regenerate human communities and natural systems. Furthermore, the project's emphasis on food security and sovereignty resonates with global efforts to build more resilient food systems in the face of environmental challenges and climate change. Through the establishment of productive landscapes and the promotion of regenerative agriculture, the Msalato Community Farm showcases how sustainable food production can be integrated into urban environments, ensuring access to nutritious food for all residents. Furthermore, it exemplifies an innovative and integrated approach to urban development, demonstrating how

regenerative agriculture, community engagement, and sustainable resource management can create vibrant and resilient urban landscapes. Serving as a model for other communities paves the way for a greener and more sustainable future for Dodoma and beyond (ICLEI CBC, 2017).



Figure 4: The site of Msalato Community Farm (Source: ICLEI CBC)



Figure 5: The community getting involved in discussions on the community farm in June 2021 (Source: ICLEI CBC)

CASE STUDY: **Greening of Nyerere Square**

In collaboration with the INTERACT-Bio project, the City Council of Dodoma and environmental stakeholders initiated the greening of Nyerere Square to enhance urban resilience and promote nature-based solutions. Nyerere Square was chosen due to its public accessibility, proximity to amenities, and suitability for revitalisation. Implemented in 2019, by ICLEI Africa, BORDA Africa and city officials, the project design incorporated sustainable irrigation, native flora integration, and community engagement.

One of the project's innovative aspects was implementing subsurface irrigation systems and green roof structures. Greywater collected from nearby handwashing facilities was integrated into the irrigation system as a solution to conserve potable water. This sustainable approach minimises water consumption and contributes to the overall resilience of the green space by providing additional ecosystem services, such as rainwater retention and temperature regulation. In addition, an array of native trees, shrubs, and grasses were planted to enhance biodiversity by attracting pollinators and improving ecological resilience.

Community engagement was paramount throughout the greening process. Stakeholders, including local residents and authorities, were involved in decision making and implementation.

This fostered a sense of ownership and ensured sustained maintenance and stewardship of the green space. The launch event, attended by the Lord Mayor of Dodoma and local representatives, underscored the importance of public participation in urban greening initiatives.

In addition to community engagement, the project focused on education and awareness. Information and education materials such as signage and posters were strategically placed to raise awareness about environmental benefits and foster appreciation for nature in urban settings. The greening of Nyerere Square has yielded significant benefits for urban resilience. Ecologically, it has enhanced biodiversity, mitigated urban heat island effects, and improved air quality in Dodoma. Socially, the revitalised square has become a communal gathering space, fostering social interaction and community cohesion. Economically, its enhanced aesthetics and functionality have attracted tourism and stimulated economic activity, promoting sustainable urban development.

The greening of Nyerere Square exemplifies the transformative potential of nature-based solutions in building urban resilience and fostering sustainable development in Dodoma and beyond (INTERACT-Bio, 2021).



Figure 6: Press conference at the Nyerere Square with the Lord Mayor of Dodoma and the project team (Source: [INTERACT-Bio webpage](#))



Figure 7: The site during the construction and greening work (Source: INTERACT-Bio team)



Figure 8: The site after construction while in use by residents (Source: INTERACT-Bio team)

Green open spaces in Dodoma exist in many forms. These initiatives, however, have not been without their challenges, due to limited livelihood opportunities for residents, issues such as livestock grazing, tree felling for fuelwood, demand for land for urban farming, and limited surface water and rainfall (Dodoma City, 2021). What is evident, though, is that by harnessing the power of nature, cities such as Dodoma can create vibrant, resilient, and liveable environments. It is becoming increasingly recognised that further efforts are required specifically to integrate green infrastructure into development priorities and to create green spaces within existing areas of the region and city. The successes of the many greening initiatives position Dodoma as a model city for similar initiatives across Tanzania.

3.1. Challenges and opportunities related to Dodoma's greening initiatives

Reflecting on the implementation of various greening initiatives, some valuable insights for policymakers and urban planners can be discerned. Significant challenges need to be addressed continuously. At the same time, there exist many opportunities to ensure that greening efforts are not futile and are sustained over the long term. Some of these challenges and opportunities are highlighted below.

3.1.1 Challenges

Financial and institutional capacity constraints: Establishing and maintaining green infrastructure requires adequate and sustainable sources of finance. However, with long lists of priorities for local government authorities in most African countries, financial limitation is the most significant challenge affecting the implementation of green initiatives in cities. For example, the Environmental Unit of the City Council of Dodoma receives a minimal budget for greening campaigns. Given the problem of limited funds from the local government authorities, monitoring greening activities suffers the most, as it becomes difficult to conduct follow-ups on initiatives once implementation has concluded.

Lack of integration of greening in urban planning: Drawing from experiences in other parts of Africa, [Wijesinghe](#) and [Thorn](#) (2021) argue that integrating urban green infrastructure into local government mandates, spatial planning, and targeted action plans remain limited, and Dodoma is no exception. Greening and green infrastructure are not often integrated into spatial and urban planning and are an afterthought, once plans are already in place. This lack of strategic planning has rendered greening campaigns unsustainable. The success of greening cities should benefit from having a medium-term to long-term strategic plan to guide action, which is part of the spatial development

plan and frameworks. This is also partly the reason for the limited budgetary allocation to environmental protection.

Policies and governance: local government authorities have an important role in their respective cities' greening agendas. This role is best realised through different policy development, which earmarks land for greenery and protects it from invasion for other urban land uses. Having a substantial amount of land for green spaces is one thing, but instituting governance measures to protect these spaces is another. It is in the latter that we note some challenges. The governance approach still needs to be revised despite the collaboration between the government and non-governmental actors in the greening of Dodoma. The government still plays a dominant role in developing and managing green urban infrastructure. The collaboration has not gone deep enough to include members of the local communities – the key beneficiaries of the greening initiatives. Empowering local communities to lead and maintain green open spaces could help the city council with management of these areas.

Public awareness: Social constraints on urban greening include the need for more interest from the general public. This is more evident given the relatively dry land conditions in Dodoma. A lack of public awareness of the benefits of urban green spaces may limit public support and funding for green

infrastructure projects. The City Council of Dodoma must do more to create awareness among the city's residents. Sometimes, local knowledge and expertise gained from lived experiences are overlooked. Members of the local communities should be asked to host special events, rather than just being invited. The current top-down approach to engaging the local communities is not sustainable and does not empower the communities to appreciate and maintain their open spaces.

Spatial constraints: Tree planting in Dodoma is also hindered by the compactness of the residential plots. Citing experiences from other parts of the developing world, Burton (2002) and Jenks et al. (1996) argue that compact cities have the challenge of limited space to integrate greenery. This could also be evident in some parts of Dodoma where buildings and roads occupy a high proportion of the land surface. This presents constraints for greening, which is further compounded by infrastructural layouts such as electricity cables and water pipes.

Open space management: Sustainable management of green urban spaces poses a significant challenge as cities expand due to population increase. Peri-urban green spaces particularly are threatened due to urban sprawl and densification processes such as infill development (Byomkesh et al., 2012). In addition to the lack of financial resources and capacity, management of green open spaces becomes difficult,



leading to the degradation and encroachment of many such areas.

3.1.2 Opportunities

Newness of the city Dodoma is a relatively new capital city with more land to be planned. This brings the opportunity to allocate more land for green urban spaces and protect it from transformation and invasion. Even with the infrastructural developments currently undertaken in the city, there are opportunities to insist on solutions, such as rainwater harvesting, that would contribute to greening initiatives. Indeed, this is an opportunity that the City Council of Dodoma needs to utilise.

Effective urban planning: The Dodoma City Master Plan for 2019-2039 provides for open spaces for urban and peri-urban agriculture. This is an opportunity that, if correctly harnessed, can contribute to the city's greening efforts. Urban and peri-urban farming have been allocated land in various locations in the city and grape farming is of great significance. This crop not only contributes to greening the city, but it is also an essential source of income for the city's farmers and wine processing industries. Hombolo, Matumbulu, Msalato, Mbabala, Vikonje, and Mapinduzi are all famous for grape farming and are noted for their green environment and contribution in bringing nature into the city. Dodoma's wine industry contributes to the region's cultural identity: the Dodoma Wine Festival is an annual event that

promotes the local wine culture and environment. Besides grape farming, areas such as Zinje, Msalato, Mapinduzi, Vikonje, and Hombolo are also crucial for urban and peri-urban agriculture, producing vegetables, fruits, poultry, and dairy products. The City Council of Dodoma needs to ensure that as the city expands outwards, more land is allocated to urban and peri-urban agriculture to bring nature into cities.

Government support and political will:

The national government is giving its full support to the greening agenda, and this is noted through the launching of tree planting campaigns, not only in Dodoma but countrywide. In addition to this, the government has occasionally issued policy directives to local government authorities that require them to plant trees to combat the effects of climate change. Tanzania Forest Services (TFS), is a semi-autonomous executive agency tasked with conserving, developing, and utilising national forest and bee resources to meet present and future social, economic, ecological, and cultural needs. In addition, the ruling party, Chama cha Mapinduzi (CCM), has urged the government to take measures to protect the environment and address climate change and its environmental impacts. With a shared political will and continuing support, the City Council of Dodoma can tap into this opportunity to develop green infrastructure strategies and ultimately build urban resilience.

Municipal by-laws: A suitable regulatory environment in the form of by-laws is necessary to support the greening agenda. Despite weak enforcement of by-laws by the City Council of Dodoma, there are still opportunities to strengthen their enforcement. The city council has instituted a requirement for building permits in which one must plant five trees within a residential compound.

Private sector involvement: The private sector's involvement in managing green urban spaces helps to overcome budget constraints and allows better risk-sharing across a long-term investment. The National Microfinance Bank (NMB) stands out in terms of the private sector's contribution to greening initiatives in Dodoma city. The bank's environment conservation initiatives have also added significant value to national and worldwide efforts to preserve the natural world and reverse the impacts of climate change in Dodoma City. NMB is partnering with the Tanzania Forest Service Agency (TFS) and several ministries, including the Ministry of Regional Administration and Local Governments (PO-RALG), to plant at least 1.5 million trees in every local government authority throughout the country.



4. Closing Reflection: The future of greening investments and developments

It is imperative to take a holistic and collaborative approach in envisioning the future of Dodoma's green investments and developments. Such an approach must acknowledge the manifold benefits of green spaces and actively engage the community while leveraging innovative financing mechanisms.

Start early in schools: It all starts within educational institutions. School grounds can be considered as sites that can be cultivated for ecological, pedagogical, and social transformation. Focusing on greening efforts within and around school campuses, rather than solely in students' residential areas, offers distinct advantages. School administrators wield greater control over these spaces, facilitating decision making regarding greening initiatives. Moreover, greening school grounds necessitates minimal financial investment, making it an accessible avenue for initiating change.

Tying greening initiatives to livelihoods: Recognise the symbiotic relationship between green infrastructure and local livelihoods. In Dodoma, as in many developing regions, green structures can serve as catalysts for poverty alleviation and sustainable livelihood provision.

Urban agriculture, prevalent in African cities, particularly in peri-urban areas and among low-income households, has the potential for integrating green initiatives into livelihood strategies. An example of linking greening initiatives to local people's livelihoods is the Re-greening Dodoma programme which involves championing farmers who share knowledge with rural communities, reaching over 200,000 households and restoring millions of trees through methods like Kisi Hai (Kihupi, 2020). Additionally, the partnership between LEAD Foundation and Justdigg in Dodoma aims to restore soils, re-green the area, and improve land productivity by training local farmers in techniques like farmer managed natural regeneration (FMNR) and rainwater harvesting, resulting in the regeneration of millions of trees and increased drought resilience, food production, and household income.

Amplifying incentives: Incentive mechanisms serve as indispensable complements to regulatory frameworks. Beyond driving positive change, incentives bolster public acceptance of regulatory interventions. This approach is especially pertinent in developing contexts like Dodoma, where familiarity with green infrastructure may be limited.

Beginning with incentives before transitioning to regulatory measures not only encourages early adopters but also fosters a foundational knowledge base. Some examples of socioeconomic incentives for greening in Dodoma include the provision of tree seedlings, fertilizer, improved seeds, beekeeping inputs, and education programmes as identified in a study focusing on sustainable environmental conservation in the Kondoa Rehabilitated Areas (KRA) of Dodoma. The Hifadhi Ardhi Dodoma (HADO) project, which commenced in 1973 across various areas of the Dodoma region, aimed to mitigate land degradation through physical soil conservation measures. These measures included afforestation, adoption of appropriate cultivation methods, construction of contour bands to control runoff, and vegetation planting in riverbeds. Notably, as part of the project's interventions, all human activities and livestock were evicted from the 1,256 km² of Kondoa Eroded Areas in 1979. This proactive step led to swift land rehabilitation, resulting in significant improvements in soil fertility and vegetation growth in the most severely affected regions, later recognised as the Kondoa Rehabilitated Areas (Chami, 2016).

By-law enforcement: Transitioning towards inclusive governance models necessitates robust enforcement of existing by-laws and regulations governing urban green spaces. Empowering non-state actors to actively participate in enforcement mechanisms marks a shift towards collaborative

governance. Mechanisms ensuring compliance with city regulations play a pivotal role in sustaining green infrastructure initiatives.

Expanding the definition of greening: Moving beyond conventional literature, the scope of greening initiatives must encompass not only tree planting within urban spaces but also the preservation of existing natural flora in peri-urban areas, riverbanks, and other ecologically significant zones. This inclusive approach can foster broader community engagement and contribute to biodiversity preservation.

It is undeniable that greening Dodoma and other African cities is not only an environmental imperative but also a moral imperative. Concerted efforts are underway in Dodoma to transform the city into a biophilic oasis through the ambitious greening and blueing initiative outlined in the Dodoma National Capital City Master Plan. By planting millions of trees and expanding water bodies, Dodoma aims to harmonise the natural and built environments, setting a precedent for other cities to follow. It is vital to recognise that local governments play a pivotal role in integrating green infrastructure into urban planning frameworks. They have the mandate to enact environmental policies and manage local resources, so they foster partnerships with stakeholders and leverage innovative approaches to drive meaningful change and usher in a new era of sustainable urban development.



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