# 2nd African Forum On Urban Forests

*Green Horizons:*
*Shaping the Future Resilience of African Cities through Urban Forests*

**18 March 2025 - 21 March 2025**

*The Forum, The Campus, Bryanston, Johannesburg, South Africa*

## ABSTRACTS

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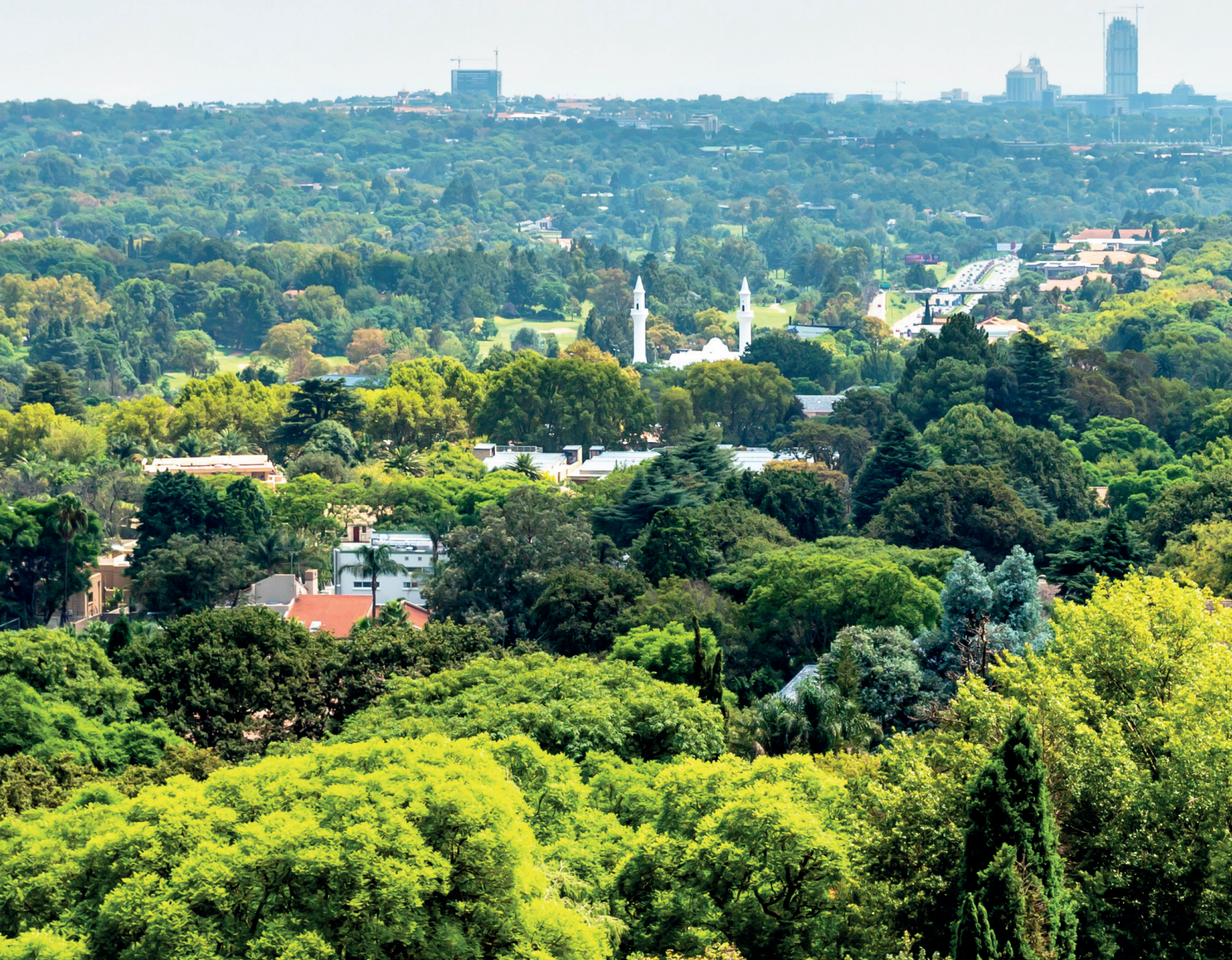

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Dr Jessica Thorn

## Welcome message by Chair of the Scientific Committee

On behalf of Scientific Committee of 2nd African Forum on Urban Forests, I take immense pleasure in welcoming you to the vibrant city of Johannesburg, South Africa, from the 18th to the 21st of March 2025.

This year's theme, "Green Horizons: Shaping the Future Resilience of African Cities through Urban Forests," reflects a bold and forward-looking vision for sustainable urban development. This theme emphasises a proactive and strategic stance in shaping the future of urban forestry across the continent, with a focus on innovation, comprehensive planning, and action-oriented solutions that will transform African urban landscapes for generations to come.

The forum and scientific conference will feature a dynamic programme, including keynote addresses, round table panel discussions, parallel sessions, poster sessions, field trips and side events. Many talks will cover cutting-edge research, practical insights and explore lessons learnt in helping achieve the holistic outcomes while balancing trade-offs. Speakers will share diverse experiences in designing, implementing, monitoring and evaluating the effectiveness of urban forest initiatives across Africa.

Over the next three days, we will explore key themes shaping the future of urban forestry in Africa:

- Day 1 focuses on climate-proofing cities, highlighting nature-based solutions for flood mitigation, carbon sequestration, and heat stress reduction, alongside biodiversity conservation, ecosystem (dis)services, pests and diseases, biodiversity inventories and indigenous restoration.
- Day 2 delves into equitable access, health, and well-being, examining how urban forests support food security, environmental justice, public health, traditional and ecological knowledge, gender and youth, education, and social cohesion, particularly in informal settlements.
- Finally, Day 3 makes the business case for urban forests, emphasising sustainable finance, local economic development, inclusive governance, and monitoring strategies essential for long-term impact.

Beyond rich discussions, this forum is a unique opportunity to connect with like-minded creative minds, exchange ideas, and build lasting collaborations and alliances for the future. All of us in scientific committee take pleasure in meeting you and acquiring new skills from your work. I encourage you to make the most of your time here—engage, challenge perspectives, and take inspiration. While in South Africa, I also hope you find a moment to take advantage of some of the breathtaking landscapes and historic sites. As we navigate the challenges of urbanisation, growing inequality, environmental degradation, and climate change, we must step up as leaders and advocates for inclusive and resilient green cities. This is your chance to participate in redefining the future of urban forests in Africa!

Wishing you a productive, abundant, and joyful conference.

***Dr Jessica Thorn***
***Chair, Scientific Committee, African Forum on Urban Forests***
***ARISE research fellow, Department of Environmental Sciences, University of Namibia***
***Lecturer, Centre for Environmental Policy, Imperial College London***

# Parallel session overview

**Day 1 - Climate-proofing cities:**

*This sub-theme prioritises climate change mitigation and adaptation strategies, positioning urban forests as essential tools for enhancing the climate resilience of African cities.*

1.1. The deluge strikes back: Fighting floods with nature

1.2. Lord of the trees: The carbon sequestration quest

1.3. Too hot to handle: Urban forests to mitigate heat stress

2.1. Guardians of the canopy: Indigenous restoration for adaptation

2.2. Living labs: Experimenting with alternative urban futures

2.3. Gaia's return: Biodiversity inventories of urban greening

2.4. The good, the bad and the ugly: Ecosystem disservices, pests, and diseases

**Day 2 - Equitable access, health, and well-being:**

*Urban forests play a pivotal role in enhancing public health and well-being by providing accessible green spaces that encourage physical activity, promote mental health, and foster social cohesion.*

3.1. Nourishing cities: Urban forests for food security

3.2. Environmental justice and legacy effects of colonial and apartheid eras

3.3. Growing knowledge: Urban forests as classrooms

3.4. Contagion: Transmitting healthy practices for public health and wellbeing

4.1. Greening the margins: Urban forests in informal settlements

4.2. Guardians of the canopy: The role of traditional and ecological knowledge, gender, and youth

4.3 Pamoja: Participation, collective action and citizen science Guardians of the canopy: The role of traditional and ecological knowledge, gender and youth

4.4 Con air: Prospects for enhancing air quality

**Day 3 - Making the business case for urban forests:**

A thriving urban forestry sector necessitates sustainable financing and investment to unlock its full potential.

5.1. Lion's share: Equitable finance and local economic development for African prosperity

5.2. Ubuntu and the urban forest: Governance of nature-based solutions

5.3. The green mile: Monitoring and mapping changes in the urban canopy

# Sincere thanks to...

## 2nd AFUF Organising Committee

- Ayanda Roji, City of Johannesburg
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- Joy Mutai, UN-Habitat
- Jessica Thorn (Chairperson of the Scientific Committee)

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# The Concept Note

## Forum Background

As of 2023, approximately 57.3% of the global population resides in urban areas, and this trend is projected to intensify. According to United Nations estimates, by 2030, the urban population will grow by nearly 600 million, reaching 5.2 billion people. By 2050, almost 70% of the world's population is expected to live in cities, more than doubling current figures. This rapid urban expansion, combined with escalating climate change impacts, is placing significant pressure on natural ecosystems within urban environments.

Africa, renowned for its rich natural heritage, supports a quarter of the world's species and holds a sixth of the planet's remaining forests, making it a vital reservoir of global biodiversity. However, this biodiversity is under growing threat from a range of pressures, including deforestation, habitat fragmentation, illegal wildlife trade, and the accelerating impacts of climate change. These forces are contributing to a significant reduction in key ecosystem services such as clean water, fertile soils, and pollination, which are critical to the well-being of millions of people across the continent.

As forests shrink and habitats degrade, the ability of ecosystems to provide these services is compromised, directly affecting agriculture, food security, and access to clean water. This not only disrupts local economies but also heightens vulnerability to natural disasters, such as floods and droughts. The deterioration of Africa's ecosystems, if left unchecked, threatens to unravel the delicate balance between nature and human well-being, endangering the continent's iconic wildlife and jeopardizing the livelihoods of communities that depend heavily on natural resources for their survival. The loss of biodiversity also poses broader risks, undermining Africa's potential to address global challenges such as climate change mitigation and sustainable development. Urgent and coordinated conservation efforts are needed to safeguard Africa's ecosystems, ensuring both the preservation of its natural treasures and the resilience of its people in the face of growing environmental challenges.

In response to these urgent challenges, there is a growing recognition of the critical role that urban forests play in fostering sustainable, resilient cities. Urban forests, which include street trees, foliage in private developments, forest parks, and public green spaces, provide numerous environmental, social, and economic benefits. They mitigate the effects of climate change by absorbing carbon dioxide, reducing the urban heat island effect, improving air quality, and supporting biodiversity within densely populated areas. Furthermore, these green spaces offer residents opportunities for recreation, improved mental health, and enhanced community well-being.

Local governments, urban planners, city managers, and civil society organizations are increasingly acknowledging the importance of urban forests as essential components of sustainable urban development. These stakeholders are actively engaging in initiatives to expand and protect green spaces, recognizing that urban forests not only enhance the quality of life but also contribute to the resilience of cities in the face of growing environmental pressures.

Globally, more than 250 cities have committed to expanding their tree cover through initiatives such as the FAO's Tree Cities of the World Programme and the UNECE's Trees in Cities Challenge. These initiatives mobilize local efforts to plant and maintain trees, with the aim of creating greener, healthier urban environments. By participating in these global campaigns, cities are demonstrating leadership in climate action and urban sustainability, while setting a precedent for future urban development that prioritizes nature-based solutions. The momentum behind these efforts underscores the increasing recognition that urban forests are not just aesthetic amenities but crucial infrastructure for a sustainable and liveable future. Notably, several African countries, including Kenya, South Africa, Cameroon, Sierra Leone, Nigeria, and Burundi, have committed to expanding their urban green canopy. Urban forests are increasingly recognized for their critical role in advancing sustainable development goals and enhancing cities' resilience to climate change, population growth, and future pandemics. Beyond their environmental benefits, these green spaces provide a range of essential economic, social, and cultural ecosystem services that are vital for urban communities. By integrating urban forests into city planning, municipalities can future-proof cities against various challenges while improving overall quality of life for residents.

Economically, urban forests contribute to local economies by boosting property values, reducing energy costs through natural cooling, and supporting tourism and recreation industries. Socially, these green spaces strengthen community bonds by fostering social networks and providing inclusive spaces where people from diverse backgrounds can interact. They also enhance public health by promoting physical activity, reducing stress, and improving mental well-being, all of which contribute to lower healthcare costs in the long run.

Urban forests play a crucial role in food security, providing urban agriculture opportunities that help ensure access to nutritious food, especially in marginalized communities. Additionally, they contribute to environmental justice by increasing social and environmental equity, ensuring that all residents regardless of income or background have access to the benefits of green spaces.

From an ecological perspective, urban forests regulate local climates by mitigating the urban heat island effect, improving air quality, and supporting biodiversity. They enhance soil formation, prevent erosion, and contribute to water management by reducing stormwater runoff. Furthermore, these spaces offer aesthetic and recreational opportunities, fostering a sense of place and cultural identity for urban residents. In sum, urban forests are indispensable in creating sustainable, equitable, and liveable cities for present and future generations.

Despite numerous initiatives aimed at urban forestry and greening, many African cities continue to fall significantly short of their long-term goals, facing multiple barriers to achieving sustainable impact. Key challenges include conducting cost-benefit analyses that adequately account for the long-term costs of maintaining urban forests, navigating complex land tenure systems, and limited enforcement of environmental regulations. Many cities also operate under outdated legal frameworks, which hinder the development of comprehensive urban forestry policies. Furthermore, insufficient monitoring mechanisms, the absence of long-term management plans, and poor implementation of existing policies all contribute to the persistent underperformance of urban greening initiatives.

Integrating forestry into broader urban planning remains a major challenge, as the sector is often viewed as separate from mainstream urban development. Historical legacies of colonialism exacerbate these difficulties, perpetuating inequities in the distribution of green spaces. Poor and marginalized communities, including residents of informal settlements, typically have far less access to green spaces than their affluent counterparts. These inequities are further reinforced by environmental decision-making processes that often exclude disadvantaged groups, concentrating power among elites and technocrats. Another critical issue is the limited involvement of local communities in the management of urban green spaces. Top-down planning processes, dominated by experts and decision-makers, frequently overlook the value of indigenous knowledge in conserving and managing these areas. This lack of community participation leads to disconnection and poor stewardship of green spaces, exacerbating the depletion and mismanagement of these vital urban resources. Addressing these challenges requires not only stronger legal and policy frameworks but also inclusive governance approaches that integrate urban forestry into broader city planning efforts. Engaging communities, particularly those in disadvantaged areas, and valuing indigenous knowledge are essential steps to ensuring the long-term success and equitable distribution of green spaces in African cities.

Amidst these challenges, the ongoing global COVID-19 pandemic has underscored the critical intersection of urban health and the role of urban forests. The pandemic has emphasized the importance of resilient and healthy urban environments in safeguarding public well-being. Learning from the experiences of COVID-19, it becomes evident that urban forests play a crucial role in enhancing urban health by providing spaces for physical activity, reducing stress, and contributing to overall well-being.

Contributing to the complexities are three factors: a lack of knowledge sharing collaboration, and prioritization of equity.

A key challenge in advancing urban forestry across Africa is the lack of localized knowledge regarding the specific dynamics of urban forests, such as their spatial extent and unique characteristics. Given the continent's vast size spanning 52 countries with diverse ecosystems ranging from forests to deserts—it is difficult to generalize urban forestry practices across the region. Africa's economic diversity, with GDP per capita ranging from USD 220 in Burundi to USD 8,600 in Gabon, further complicates the uniform application of urban forestry policies. This diversity results in varying needs, financing structures, expertise, coverage, and drivers for urban forestry initiatives.

The benefits derived from urban forests are significantly shaped by local factors, including species diversity (both indigenous and exotic), community composition, and regional environmental characteristics such as vegetation greenness, temperature, and the degree of urbanization. These localized differences underscore the need for tailored, context-specific conservation and sustainable use strategies, as well as governance frameworks that address the unique environmental and socio-economic conditions in different African Cities.

Another major barrier is the limited opportunities for urban forestry practitioners to convene in forums where they can exchange knowledge, share experiences, and disseminate best practices. More forums are needed to foster trans parent dialogue and collaboration among stakeholders, cities, and countries across Africa. These platforms would enable the development of effective governance, management, and policy models that respond to the distinct challenges and opportunities presented by urban forestry in African cities.

Equity must also be prioritized in urban forest use and management, particularly as a means of enhancing biodiversity. A decolonized approach to urban forestry requires re-examining existing power structures, acknowledging indigenous knowledge systems, and integrating Africa's rich cultural diversity into the planning and management of urban forests. This inclusive approach promotes social justice, sustainability, and the equitable distribution of green spaces across all communities.

Overall, addressing these challenges requires joint efforts to unpack underlying issues and identify opportunities for long-term collaboration and knowledge sharing. By fostering collective action, African cities can implement effective urban forestry and green space programs that support sustainability, social equity, and biodiversity.

## The 2nd African Forum on Urban Forests

The 2nd African Forum on Urban Forests, organized by the Food and Agriculture Organization of the United Nations (FAO), the City of Johannesburg Metropolitan, United Nations Human Settlements Programme (UN-Habitat), and the Centre on African Public Spaces (CAPS), in collaboration with other partners. This year's theme, "Green Horizons: Shaping the Future Resilience of African Cities through Urban Forests," is critical for the future of urban forests in Africa. Reflected in the three sub-themes, namely Climate-proofing African cities; Equitable access, health, and well-being; and, Making the business case for urban forest, the aim of the event is to focus on the role of urban forests and green public spaces in creating just and liveable cities in Africa.

The event seeks to convene key stakeholders, including representatives of local and national governments, the private sector, non-govern mental organizations, research and academic institutions, community groups, and urban professionals across different sectors in in-depth conversations that stimulate innovative ideas, and inspire concrete actions to integrate urban forests and green spaces at the core of urban planning and development.

The in-person event provides an invaluable platform for city practitioners and professionals to exchange their valuable experiences on this subject, utilizing various means such as presentations and roundtables. Building upon the success of the 1st African Forum on Urban Forests (2021) and the outcomes of the 2nd World Forum on Urban Forests (2023), this forum is envisioned as an opportunity to take stock and assess the progress of urban forestry initiatives across the continent, while charting the path for future advancements.

Moreover, the forum provides an opportunity to examine Africa's contribution to global discussions, frameworks, and commitments. These include the New Urban Agenda, Sustainable Development Goals, the FAO Green Cities Initiative, the UN-Habitat's Biodiverse and Resilient Cities Resolution, national commitments to climate action, and the Kunming-Montreal Global Biodiversity Framework (GBF). Central to these discussions is the exploration of how African Cities can effectively integrate, manage, and maintain urban forests and green spaces for improved health and well-being of their urban communities.

During the forum, the creation of an African Nature-Based Solutions Network with a dedicated Community of Practice on Urban Forests will also be discussed with the aim of fostering collaboration and knowledge exchange among policymakers, researchers, and other relevant stakeholders to follow up on the outcomes/recommendations from the event and to inspire joint efforts that can result in the development of more effective strategies for urban forest management.

## Forum Theme

The theme for the Second African Urban Forestry Forum (AFUF), "Green Horizons: Shaping the Future Resilience of African Cities through Urban Forests," encapsulates a bold vision for sustainable development and growth in Africa's urban areas. It promotes an environmentally conscious, forward-looking approach that aims to build cities resilient to the challenges of climate change, rapid urbanization, and socio-economic inequality. This theme emphasizes a proactive and strategic stance in shaping the future of urban forestry across the continent, with a focus on innovation, comprehensive planning, and targeted actions that will transform urban landscapes for generations to come.

The sub-themes of the Forum focus on three critical areas of urban forestry:

1. Climate-proofing African Cities: This sub theme prioritizes climate change mitigation and adaptation strategies, positioning urban forests as essential tools for enhancing the climate resilience of African cities. Contributions under this sub-theme will highlight innovative strategies for climate-proofing urban areas through the integration of urban forests and green spaces. Sessions will showcase the critical role these spaces play in mitigating the impacts of extreme weather events, reducing the urban heat island effect, improving air quality, and managing stormwater. Discussions will also focus on the integration and management of resilient infrastructure through adaptive urban planning, emphasizing the use of nature-based solutions and policy frameworks that prioritize the preservation and expansion of green spaces. Furthermore, the sessions will address disaster risk reduction strategies to safeguard cities against the growing challenges posed by climate change, ensuring sustainable and resilient urban development across Africa.

2. Equitable Access, Health, and Well-being: Urban forests play a pivotal role in enhancing public health and well-being by providing accessible green spaces that encourage physical activity, promote mental health, and foster social cohesion. This sub-theme emphasizes the importance of ensuring that all urban residents, particularly marginalized communities, have equitable access to the myriad benefits these green spaces offer. By leveraging urban forests and green spaces, we can promote public health and well-being in African cities while ensuring that these advantages are distributed fairly across all communities. Urban forests not only improve air quality but also offer opportunities for recreation, physical activity, stress reduction, and mental health enhancement. However, the benefits of these spaces are often unequally distributed, disproportionately disadvantageous to vulnerable populations. This Forum will explore evidence-based strategies, indigenous knowledge systems, and inspiring practices to design, distribute, and manage urban forests in ways that maximize their benefits and rectify existing disparities. By targeting underserved areas, the discussions will highlight how urban forestry can contribute to poverty alleviation through job creation, improved living conditions, and enhanced food security. Through collaborative efforts, we aim to create more equitable and healthier urban environments that empower all communities.

3. Making the Business Case for Urban Forests: A thriving urban forestry sector necessitates sustainable financing and investment to unlock its full potential. This sub-theme emphasizes the economic opportunities that urban forests offer, promoting collaboration between the public and private sectors to drive investment in green infrastructure. By showcasing the long-term financial returns associated with urban greening initiatives, this sub-theme highlights the significant economic impact of urban forests in African cities, particularly concerning local development. Discussions will focus on the role of urban forests in income generation and enhancing eco-tourism, thereby stimulating local businesses, and creating job opportunities. Furthermore, urban forests are known to elevate property values and attract real estate investments, contributing to a vibrant economic landscape. Their economic advantages extend beyond direct financial gains; they also play a crucial role in climate change mitigation, reduce energy costs, and enhance public health, all of which lead to cost savings and long-term economic stability. By presenting successful cases of public-private partnerships, innovative financing mechanisms, and supportive policy frameworks, this sub-theme advocates for urban forests as sustainable investments that can foster inclusive economic growth across African cities. Through these collaborative efforts, we can ensure that urban forestry becomes a key driver of economic vitality and resilience in urban areas.

In addition to these core sub-themes, the Forum will incorporate cross-cutting themes of gender, youth, governance, and peace, recognizing their essential roles in achieving sustainable urban forestry. Gender equality and youth engagement are critical to fostering inclusive growth, while good governance and peace are necessary to ensure that urban forestry initiatives are well-managed, equitable, and contribute to social stability. These nexus areas are of critical importance on the African continent and are integral to building resilient, inclusive, and sustainable cities.

The Second AFUF aims to not only advance dialogue but also inspire action by bringing together diverse stakeholders to shape policies, share best practices, and explore innovative solutions that will secure a greener, more resilient future for Africa's urban landscapes.

## Forum Objectives

The Second AFUF provides a diverse multi-stakeholder platform to:

- Bring together a wider spectrum of actors to foster open discussions on urban forestry, to promote knowledge sharing for actionable results.
- Evaluate the advancements made by various stakeholders since the inaugural African Forum on Urban Forests in July 2021.
- Formulate practical strategies for achieving sustainable urban forestry across the continent.
- Showcase inspiring examples of best practices to encourage widespread adoption of urban greening initiatives across the continent.
- Build capacity among the participants, through workshops, covering topics such as conducting tree inventories, mapping alien invasive species, and developing advocacy campaigns for stewardship of urban forests.
- Explore how cities integrate urban forestry in urban planning and wider policy processes.
- Facilitate collaboration between different spheres of governments, civil society organizations, academia, the private sector, and local communities to ensure equitable access to urban green spaces in Africa.
- Facilitate a roundtable discussion on resource mobilization to garner investment commitments and partnerships from development finance institutions, private sector entities, philanthropic organizations, and other funding sources.

## Intended Outcomes

The intended outputs of the Forum are as follows:

- Establish an African Nature-Based Solutions Network as part of the Centre on Africa Public Spaces, with a dedicated Community of Practice on Urban Forests to foster collaboration and knowledge exchange and inspire joint efforts to develop more effective, resilient strategies for urban forest management that address the impacts of climate change.
- Formulate actionable strategies and policy recommendations that can be implemented across various levels, from local communities to national governments, thus contributing to the protection, expansion, and enhancement of Africa's urban forests.
- Foster commitment in terms of investments and partnerships from domestic and international finance institutions, private sector entities, philanthropic organizations, and other funding sources to catalyse innovation and mobilize resources that empower African cities to reverse urban forest depletion and green space loss.

## Forum Format

The Forum will be structured into a comprehensive program that includes traditional formats such as plenaries, parallel sessions, roundtables, panels, training sessions, exhibitions, pre-conference webinars, a poster session, and side events. Additionally, it will incorporate innovative and engaging elements, including a reception dinner, a tribute to Wangari Maathai and Amos Masondo, tree planting activities, a green careers expo, and field visits. These elements are designed to inspire creativity, foster networking, and enhance overall engagement among participants.

## Celebrating Prof Wangari Maathai and Honourable Amos Masondo: A Tribute Dinner

## Green Careers Expo

On the final day of the event, March 21, 2025, the Green Careers Expo will take place at Diepsloot Memorial Park. This date is particularly significant as it coincides with both South Africa's Human Rights Day and the International Day of Forests, which this year is themed "Forests and Foods''. This alignment underscores the importance of social equity and environmental stewardship, highlighting how sustainable practices can enhance both community rights and ecological health.

The Green Careers Expo is designed to connect communities with the Second African Forum on Urban Forestry (AFUF), facilitating interaction and promoting awareness of green careers, job opportunities, and sustainable practices. This event will serve as a platform for residents, especially students and young people, to learn about potential career paths in environmental management, urban planning, and related fields. Various exhibitors will showcase successful initiatives, organizations, and businesses dedicated to promoting sustainability and environmental conservation.

## Tree Planting and Fruit Tree Distribution

Following the Green Careers Expo, delegates and attendees will engage in a tree planting event where they will distribute fruit trees to community members and schools within Diepsloot Memorial Park. This initiative not only emphasises the importance of enhancing urban green spaces but also actively involves local residents in efforts to improve their environment. By providing fruit trees, the programme aims to foster a sense of ownership and responsibility towards nature while promoting sustainable practices within the community.

## Site Tours

To conclude the conference, delegates will participate in guided site tours throughout Johannesburg, offering a unique opportunity to explore the city's various greening initiatives and appreciate its strides in environmental progress. These immersive tours will showcase key projects and programs aimed at enhancing urban forestry and promoting sustainability within the community.

Participants will visit notable green spaces, community gardens, and innovative urban forestry projects that illustrate the city's commitment to increasing tree cover and enhancing biodiversity.

# Parallel Session 1.1

*The deluge strikes back: Fighting floods with nature*

## Evaluating the role of vegetated areas in flood mitigation: A study of green infrastructure in peri-urban Antananarivo, Madagascar

***Daulphin Razafipahatelo[1,2]; Solofoarisoa Rakotoniaina[2], Bruno Ramamonjisoa1, Jessica Thorn[3,4]***

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Green infrastructure is essential for urban flood management by mimicking natural hydrological processes to reduce surface runoff and enhance water infiltration, especially in rapidly urbanizing areas like the peri-urban zones surrounding Antananarivo, Madagascar. Intensifying climate change events and expanding impermeable surfaces are overwhelming outdated grey infrastructure, leading to frequent canal blockages, water contamination and recurrent flooding. This study evaluates the effectiveness of vegetated areas, such as urban forests and urban green spaces, in mitigating floods, especially in regions with limited spatial data. In Madagascar, where less than 30% of urban areas have access to up-to-date geospatial data, this lack of information hinders sustainable flood management. Using hydrological modelling of the Rational Method, the research assesses the impact of vegetation on flood reduction. The Rational Method calculates peak discharge based on rainfall intensity, watershed characteristics, and runoff coefficients, which are adjusted for different vegetation cover scenarios. The study simulates both current conditions and projected scenarios for 2030 and 2063, aligning with the Sustainable Development Goals 2030 and the Africa Union's Agenda 2063, to evaluate potential changes in peak discharge and runoff volume under different urbanization and climate conditions. Findings will demonstrate the role of vegetation in reducing pluvial flood risks and highlight the practical benefits of green infrastructure in underrepresented contexts with unique urban and environmental challenges. This work contributes valuable insights to sustainable urban drainage planning in Madagascar, where green infrastructure solutions remain underexplored yet are crucial for effective localised flood defence schemes and biodiversity habitat creation.

*Keywords: green infrastructure, hydrological modelling, runoff reduction, sustainable urban drainage, urban flood management, vegetation cover.*

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## Assessing community-based approaches for nature-based climate solutions in flood-prone areas of Dar es Salaam, Tanzania

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Dar es Salaam, the biggest city in Tanzania, in 2035 will be home to 13.4 million people and be one of the fastest-growing cities in Africa. The city is already experiencing heavy flooding, a condition that is compounded by informal settlements, urbanization, and climate change. The nature-based approaches of the Dar es Salaam Metropolitan Development Project, such as green areas and eco-friendly drainage systems in cities, are used to mitigate flooding effects that lead to environmental pollution. In spite of evidence of introduction of these approaches, their efficacy in the local setup is not well-documented. The qualitative case study design was used to investigate how community development programs build resilience in cities that face flooding, in Jangwani ward of Ilala District. The data was gathered using semi-structured interviews of 36 neighbourhood leaders, local government, and district government actors. Thematic analysis of interviews highlighted three dominant themes: participatory planning (36.3% of coded segments), capacity building (33.3%), and benefit sharing (30.4%). Although a high extent of engagement was observed (40.5% of segments), there was also a report of large-scale disempowerment of women and youth in decision-making (32.4%). In addition, there was a report of funding constraints (26.5% of segments) and poor institutional support. Improved employment prospects appeared in 41.9% of instances; yet there was a concern over inadequate compensation (25.8%) and skewed distribution of economic gains (32.3%) that is a hindrance. The analysis highlights that there is a need to give high priority to land rights of women and youth, creating a hub of climate capacity at a community level, and incorporating public-private partnership coupled with mechanisms of financing in a community to facilitate sustainability.

*Keywords: benefit sharing; capacity building; climate change adaptation; informal settlement; participatory planning; urban resilience.*

## Turning the tide: Revolutionising Yaoundé, Cameroon with sponge city and eco-street innovations

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African sub-Saharan cities face escalating challenges from climate change and rapid urbanisation, exacerbated by frequent flooding and inadequate stormwater management. Yaoundé, Cameroon's capital, epitomises these issues, with major floods in 2020 and 2022 submerging streets, disrupting economies, and damaging infrastructure. Dense urbanisation, limited green spaces, and poor drainage intensify flooding and urban heat islands, disproportionately affecting vulnerable groups such as women and low-income communities. Despite the urgency, there's no projects applying the 'Sponge City' concept (pioneered by Kongjian Yu in China) and Pakistan's 'Climate-Smart Eco-Street' model (developed by Yasmeen Lari), which prioritise nature-based solutions and community-led resilience. Funded by the German Corporation for International Cooperation (GIZ) under the Green Mobility *(MoVe Yaoundé)* project, this study adapts these models to Yaoundé's context in the aim of developing a greening concept. The Sponge City approach uses permeable materials, green roofs, and rain gardens to enhance water absorption, reduce runoff, and recharge groundwater. The climate-smart eco-street emphasises low-cost, locally sourced materials and community engagement. The methodology includes a baseline diagnostic of vegetation, air quality, and urban climate, followed by co-designing greening strategies for selected streets with the inhabitant. Challenges include securing funding and navigating regulatory barriers. By fostering partnerships with local stakeholders, the project aims to create a replicable model for African cities, integrating nature-based solutions into climate adaptation policies. Crucially, the initiative generates employment in implementation and maintenance phases, targeting the informal sector. It will enhance livability through flood-resilient, green spaces that prioritise marginalised groups, fostering equitable urban transformation and advancing climate-adaptive, sustainable cities.

*Keywords: community-led design, flood resilience, green infrastructure, informal sector employment, nature-based solutions, urban heat mitigation.*

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## Planning for optimal ecosystem services in urban areas, Nairobi, Kenya

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As Nairobi's urban population grows, densification has led to declining urban ecology and reduced ecosystem services. High-density residential areas, such as Zimmerman Ward, are characterized by closely packed buildings and inadequate green infrastructure. While urban planning policies mandate green spaces, they lack specific guidelines on optimal species composition for ecosystem services. Additionally, street and road greenery remain underutilized for green infrastructure development. This study aimed to inform urban planning policy changes to promote strategic urban forestry for sustainable outcomes. It examined Zimmerman Ward's spatial development over 18 years (2003–2019) within its 175-hectare area and a population of 49,531. A mixed-methods approach was used: qualitative data was collected from 100 residents and six key informants, including policymakers and investors, while quantitative methods analyzed green infrastructure coverage over time. Findings show that existing open spaces and roads are mostly covered with grass, limiting their ecosystem benefits. Flooding emerged as the most pressing environmental challenge. The study proposes an optimal mix of urban greenery—trees, shrubs, and ground covers—with ideal spatial coverage and foliage density to enhance flood control and other ecosystem services. Suitable tree species for urban spaces were identified. Findings have contributed to an ongoing initiative by the Landscape Architects Chapter of the Architectural Association of Kenya to develop an urban tree guideline. Once completed, this guideline will be shared with county governments, road planning agencies, and the public to inform urban greening efforts as Kenya aims to plant 15 billion trees by 2032.

*Key Words: densification, ecology, green, infrastructure, spatial, trees.*

## Evaluating the effectiveness of nature-based solutions for flood mitigation, heat reduction, and erosion control in informal settlements of North and Central Namibia

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African cities are faced with growing climate-related challenges such as heat stress, erosion, and flooding, challenges that are further intensified by rapid urbanisation. Informal settlements are especially susceptible to these hazards due to unregulated expansion, inadequate infrastructure, and environmental degradation. In Namibia's informal settlements, the situation is particularly acute, as intense summer rains lead to pluvial and flash flooding, which in turn accelerate erosion, while the loss of vegetation exacerbates heat stress. Despite the recognized potential of nature-based solutions to address these challenges, there is limited empirical evidence on their application and effectiveness in informal settlements. Additionally, the interconnectedness of multiple hazards remains underexplored in the context of informal settlements. This study investigates the effectiveness of nature-based solutions in mitigating flooding, extreme heat, and erosion in informal settlements across Northern and Central Namibia. By integrating high-resolution satellite imagery with vegetation indices, and field observations, the study evaluates the role of vegetation in reducing these hazards over Namibia's census years (1991, 2001, 2011, and 2023). The findings highlight the potential of nature-based solutions such as community gardening, agroforestry with Acacia trees within the vegetation buffers, and sustainable land-use practices such as avoiding settlements in drainage pathways. Vegetation reduces runoff, stabilizes soils, and provides shade, thereby mitigating flooding, erosion, and heat stress simultaneously. The study provides spatially explicit maps and evidence-based recommendations to inform Namibia's Climate Change Strategy and Action Plans, as well as urban upgrading initiatives by the Shack Dwellers Federation Namibia and local authorities. These findings contribute to advancing nature-based solutions as a scalable and transformative approach for enhancing resilience in Namibia and other arid and semi-arid regions of Africa.

*Keywords: climate hazards, community adaptation, multi-hazard assessment, urban resilience.*

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## Analyse critique du cadre juridique d'urbanisme au Burundi et de son efficacité dans la promotion de la reforestation urbaine

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Dans un contexte de changement climatique avec la croissance démographique non maitrisée, la quête de logements décents et différents risques de catastrophes naturelles font que le Burundi a besoin de se doter d'outils et d'instruments d'aménagement territorial impliquant une planification urbaine écologique d'où la nécessité d'intégrer les forêts dans les plans d'aménagement urbain comme le prévoit son Code d'urbanisme. Concrètement, la recherche vise à savoir, dans la situation actuelle, la pertinence et l'adéquation de la règlementation en vigueur dans la promotion de la reforestation urbaine. La méthodologie utilisée s'est basée sur une approche documentaire nécessitant une lecture critique des politiques et codes d'urbanisme. Cette étude essentiellement qualitative a cherché à comprendre les défis et opportunités relatifs à reforestation urbaine au Burundi d'une part et les manquements du cadre juridique actuel. L'objectif est donc d'offrir une analyse critique de l'arsenal juridique burundais de gestion urbaine et son effectivité dans la réalisation de la reforestation urbaine en soulignant ses atouts et lacunes et de proposer les pistes d'amélioration de son efficacité en vue de la promotion des villes durables au Burundi. Comme résultats, l'étude devrait ainsi permettre d'évaluer l'étape franchie et les actions concrètes envisageables dans la promotion des forêts urbaines et comment faire face aux défis actuels sans « laisser personne derrière ».

*Mots-clés: boisements urbains, droit, durabilité, espaces verts, urbanisation, utilisation rationnelle.*

*Translation*

## Critical analysis of the legal framework for urban planning in Burundi and its effectiveness in promoting urban reforestation

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In the context of climate change and uncontrolled population growth, the demand for decent housing and various natural disaster risks makes it imperative for Burundi to develop territorial planning tools and instruments that incorporate ecological urban planning. This highlights the need to integrate forests into urban planning strategies, as outlined in the country's Urban Planning Code. This research aims to assess the relevance and adequacy of the current regulations in promoting urban reforestation. The methodology employed a documentary approach, involving a critical review of urban planning policies and codes. This qualitative study seeks to understand both the challenges and opportunities related to urban reforestation in Burundi, as well as the shortcomings of the existing legal framework. The objective is to provide a critical analysis of Burundi's urban management legal framework and its effectiveness in implementing urban reforestation. The study highlights its strengths and weaknesses while proposing ways to enhance its efficiency in fostering sustainable cities in Burundi. As an outcome, the research is expected to assess the progress made and identify concrete actions to promote urban forests, addressing current challenges while ensuring that no one is left behind.

*Keywords: green spaces, law, rational land use, sustainability, urban forests, urbanization.*

# Parallel Session 1.2

*Lord of the trees: The carbon sequestration quest*

## Urban tree diversity, carbon stocks and sequestration potential in five Grand Nokoué, Benin

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Urban sprawl represents a critical development issue in African cities, compromising the function of natural carbon sinks and threatening urban sustainability. However, the role of urban trees in biodiversity conservation and climate change mitigation remains underexplored in Benin. Therefore, this study assessed trees' composition, diversity, and carbon stock potential in five cities of Benin. Field data were collected (March to May 2021) using a stratified random sampling method. A total of 137 transects (20 m x 500 m) and 56 plots (30 m x 30 m) were established along the main roads, and all tree species with a diameter above 10 cm were measured. The diameter, height and species name were recorded and allometric equations were used to estimate the carbon stocks. A total of 3057 stems belonged to 44 species and 23 families, with 63% of them being exotic species. The Shannon diversity index varies from 1.44 (Cotonou) to 2.27 (Abomey-Calavi) while evenness differs between cities. In addition, significant differences were observed in dendrometric parameters across cities. The diameter distribution in each city adjusted to Weibull distribution showed a bell-shaped curve with left dissymmetry, characteristic of a young stand (shape coefficient between 1 and 3.6). The total carbon stock of the study area was estimated at 1162.9 tons, with low carbon density per city varying from (5 -13 tons/hectares). Thus, urban forestry policies and initiatives are needed to enhance biodiversity and ecosystem services, improve tree cover and maximise carbon sequestration in rapidly urbanising cities of Benin.

*Keywords: Benin, biodiversity, climate mitigation, ecosystem services, urban forestry, urban planning.*

## Can home gardens mitigate household greenhouse gas emissions? Evidence from Obuasi municipality, Ghana

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Urban home gardens are an essential sanctuary for plant diversity and climate change mitigation. Yet studies on household greenhouse gas (GHG) emissions and mitigation utilising home gardening, in the Majority World are rare. This study examined the household GHG emissions and the potential of home gardens to mitigate household GHG emissions within Obuasi municipality, Ghana. About 200 home gardens were inventoried and 240 households, classified into three socioeconomic levels, interviewed between March 2022 and February 2023. The mean annual household CO2 emissions were 1584 kg CO2e. High income neighbourhoods emitted more CO2 compared to the middle income and low-income neighbourhoods (p=0.000). Within the three neighbourhood classes, 237 plant species; partitioned into 97 woody species, 77 palms, and 63 herbs were identified. Home garden vegetation carbon stocks were not statistically different (p=0.943) among neighbourhoods. The average total CO2e per household was 489.05 kg CO2e m-2. Furthermore, household annual income (p=0.000), neighbourhood class (p=0.001), and dwelling type (p=0.002) statistically influenced household CO2 emissions and explained more than 60% of the total variation in the CO2 emissions. Sociodemographic factors had no statistical impact on the carbon stocks of home gardens (p=0.062). Overall, the home gardens in Obuasi can offset about 20% of the mean household GHGs emitted. Thus, home gardens have a great potential to offset household GHG emissions and mitigate local climate change. It is imperative to prioritize home gardens as an essential green infrastructure in overall city development. We recommend that residential spaces incorporate at least 30% green cover made predominantly of alimentary woody species in African cities as a local climate change adaptation and mitigation strategy.

*Keywords: emissions, carbon stocks, climate change, neighbourhoods, species, diversity.*

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## Spatial analysis of the relationship between urban forest and residential areas in Osogbo, Nigeria

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Rapid urbanization has contributed significantly to loss of urban forest and green spaces due to land fragmentation over time. Despite these impacts, there is limited research on the relationship between urban forests and residents in Nigeria. This study addresses this gap by examining urban forest dynamics in Osogbo, Nigeria, using semi-structured questionnaires and analyzing vegetation changes through the Normalized Difference Vegetation Index and Land Use Land Cover from Landsat images of 1987, 1997, 2007 and 2017. Osogbo was chosen as the study area due to its rapid urban expansion and strategic importance as the capital of Osun State, a growing urban center in southwestern Nigeria. The LULC analysis revealed that 2017 had the highest amount of built-up area (1925.19 ha) compared to 1987 when built up area was 442.08 ha. Dense vegetation was highest in 1987 (1972.8 ha) when compared to 2017 (555.75 ha). NDVI value for 1987 was highest (-0.50 – 0.03) due to presence of dense vegetation while the value for 2017 (-0.07 – 0.02) indicated loss of vegetation. There was rapid deforestation and fragmentation of the urban forest between 1987 and 2017. There is an urgent need for the forestry extension services to educate more urban residents on the benefits of urban forest to the environment and incorporate re-afforestation programs in the city.

*Keywords: city, deforestation, educate, environment, fragmentation, forest.*

# Parallel Session 1.3

*Too hot to handle: Urban forests to mitigate heat stress*

## Urban land surface cover dynamics and its impacts on land surface temperature between 2011-2021 in Hawass City, Ethiopia

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The rapid urbanization in Africa leads to significant land cover changes and exacerbates climate change impacts. However, this land surface cover change dynamics and extent of green coverage required to mitigate rising temperatures in Ethiopia's urban centers remain poorly understood. This study examines heat island effect mitigation roles of green spaces in Hawassa City, Ethiopia, by detecting ground cover change and its impact on temperature dynamics between 2011 and 2021. Landsat 5 Thermal Band 6 and Landsat 8 Thermal Band 10 satellite images were used to detect changes in urban greening and temperature in ArcGIS, while land surface cover was assessed using i-Tree Canopy software. Results show that Hawassa is predominantly covered by grey (40.6%), followed by green (36%) and exposed soil (23.4%). Temporally, tree canopy cover increased by 9.8%, while bare soil and herbaceous decreased by 34.6% and 2.8%, respectively. This resulted in an increasing Normalized Difference Vegetation Index from 0.17 in 2011 to 0.23 in 2021. Correspondingly, average temperatures dropped by 1.7°C, with maximum temperatures decreasing by 2.2°C. This study highlights the crucial role of integrating urban green spaces into built-up areas to mitigate urban heat waves, with tree cover expansion contributing to significant temperature reductions. This study provides empirical evidence on how increasing tree cover amid rapid urbanization can support climate-resilient urban planning. This study emphasizes the need to inform planners about revisiting structural plans to create spaces for greenery and establish tree cover targets within urban planning frameworks, thereby enhancing climate resilience in Ethiopia.

*Keywords: Land surface cover change; i-Tree canopy; land surface temperature; urbanization; urban tree canopy; urban greening.*

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## Relief from urban heat: Insights from Johannesburg's ecosystem goods and services assessment in Johannesburg, South Africa

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Urbanisation is one of the world's most profound contemporary trends. It is estimated that by 2050, 60% of the African population will be urban. The value of nature must be recognized and managed strategically to meet the growing needs of urban communities. It is critical that urban planners and policymakers account for urban ecosystem goods and services in decision-making processes and funding streams. The Johannesburg Assessment is an effort to present persuasive evidence of the value of nature to the city and inspire decision-makers to allocate resources for ecosystem maintenance, restoration, and expansion. Commissioned by the City of Johannesburg's Environment and Infrastructure Services Department, the Assessment presents information for major ecosystems in the city: Trees, green open spaces, urban agriculture, aquatic ecosystems, grasslands and bushveld, and man-made ecosystems. Each chapter offers scientific evidence of ecosystem benefits and economic value to people. The Assessment was developed using an ecosystem services framework, an in-depth literature review of the value of ecosystems, supplemented with economic valuation of selected ecosystem services and enriched by local and international case studies. Each chapter outlines the ecosystem services provided, their intrinsic and economic value and local and global management challenges and options. We use the chapter on Johannesburg's trees to highlight the provision of ecosystem services such as carbon sequestration, reduced air pollution, mitigation of urban heat, and habitat for biodiversity; and discuss related policy and management implications.

*Key words: decision-making, evidence-based, funding, policy, trees, value.*

## Assessing the impact of land cover land use changes on urban heat islands in Bulawayo metropolitan city, Zimbabwe

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The Urban Heat Island effect, exacerbated by climate change, has severe consequences for human health and environmental sustainability. Urban and rural areas in Africa have a temperature difference of between 0.17 and 2.21 degrees Celsius. In Zimbabwe, Harare's urban heat island intensity was found to be 1.5Oc by 2015. Therefore, understanding the spatio-temporal dynamics of Land Use/Land Cover changes and their influence on land surface temperature and urban heat island is crucial for sustainable urban planning. . This study employed thermal remote sensing and GIS technology to investigate the relationship between land use/land cover changes and UHI in Bulawayo Metropolitan City. Landsat TM and Landsat 8 OLI imagery were used for LULC classification in 1990 and 2020, respectively. The spatio-temporal pattern of LST was computed from the thermal band of Landsat imagery and correlated with land use type and indices. The results showed a significant decrease in vegetation and barren lands (from 39% to 15.9%) and an increase in built-up areas (from 20% to 53.6%) due to rapid urbanization. The Normalized Difference Vegetation Index values also declined, indicating a loss of vegetation. There was a strong negative correlation between NDVI and LST, with correlation values of -0.95 and -0.98 for 1990 and 2020, respectively, showing that green infrastructure mitigates the UHI effect, while increased built-up areas exacerbate it. The study recommends urban forestry as a strategy to improve the urban resilience to environmental changes. The findings of this study are essential for informed sustainable urban planning and management decisions.

*Keywords: green infrastructure, land surface temperatures, microclimates, remote sensing, urban heat island.*

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## Future scenarios of urban green infrastructure for temperature regulation in Antananarivo, Madagascar

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Participatory scenario planning is an effective approach for optimizing land use, expanding urban forests, and promoting sustainable urban development. Despite an increasing number of participation scenarios literature undertaken in Sub-Saharan Africa, a little investigation is made into urban green infrastructure for temperature regulation in Madagascar. Antananarivo, the capital, faces rapid urbanisation, with impervious surface increasing by 50% since 2003 along with widespread poverty that 70% of its urban settlements in informal settlements, heightening climate vulnerability. To anticipate the future of urban development under uncertain socio-economic context, we engaged participants (n=90) from the municipalities of Bemasoandro, Ambohitrimanjaka and Ambohimanambola to co-create four normative land use scenarios in 2063 aligned with the African Union Agenda 2063: (1) a loveable future, where the city thrives with intensified agriculture and equitable green infrastructure; (2) development priority world, characterized by profit-driven urban expansion, green infrastructure loss, and agricultural land fragmentation, (3) a worst tomorrow, depicting urban degradation due to unplanned development and lack of conservation; and (4) a run-away scenario, where large-scale reforestation and conservation convert agricultural and unused land at the expense of economic growth. Participants perceived ecosystem services and temperature regulation at most beneficial in a loveable future and a run-away scenario, followed by development priority and a worse tomorrow. These scenarios and temperature narratives provide strategic insights for fastening a cooler, greener, and more equitable Antananarivo.

*Keywords: African Union Agenda 2063, knowledge co-creation; land cover modelling; participatory scenarios planning; sustainable development; urban and peri-urban system.*

## Biophysical effects of land cover changes in West Africa: a systematic review

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Anthropogenic land use and land cover change is a key driver of global and regional climate change, with significant impacts on biophysical processes. Despite the ability of climate and land surface models to simulate land use and land cover change impacts, considerable uncertainties remain, particularly in simulations of precipitation and temperature responses. This study provides the first multidisciplinary systematic review of land use and land cover change impacts in West Africa, following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses protocol. Data from 25 selected publications were eventually synthesized from an initial pool of nearly 6,000 studies. Results indicate that deforestation generally contributes to regional warming, with significant historical temperature increases of +0.26 ± 0.12 °C and projected increases of +0.88 ± 0.25 °C under the future scenarios. Conversely, afforestation could have significantly cooled the climate, lowering temperatures by –0.24 ± 0.14 °C historically and –0.22 ± 0.14 °C in future scenarios, without even accounting for carbon sequestration. Deforestation decreases regional precipitation by –47.45 ± 29.2 mm/year historically and –55 ± 102.2 mm/year in future scenarios, while large-scale afforestation could substantially reduce droughts with increased precipitation, averaging 200 ± 124 mm/year historically and +635 ± 521 mm/year in future scenarios. These results emphasize the need to integrate land use and land cover change-induced climate effects into land-based mitigation strategies, climate policy, and assessment frameworks.

*Keywords: land use and land cover change, deforestation, afforestation, climate modelling, PRISMA, West Africa.*

# Parallel Session 2.1

*Guardians of the canopy: Indigenous restoration for adaptation*

## Impact of monoculture on urban forests and the use of indigenous trees to mitigate climate change in Johannesburg, South Africa

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The City of Johannesburg has claimed to be one of the largest man-made urban forests in the world, and it estimated that 3 million trees are in open public space. Due to increasing temperatures, pests and diseases have increased and threaten the urban forest. One of the objectives of the study was to map tree species affected by PSHB and this led to identification of monoculture practices. The study was conducted in Johannesburg in Region B, E and F. Data was collected on streets and parks, and stratified sampling method was used. Greening of Soweto, tree withdrawals receipts were analysed, and a random sampling method was used. Approximately 5793 trees were counted and mapped in old suburbs of Johannesburg, and it was found that there is limited species diversity planted on open public spaces and exotic species make up to 98% of the tree species. Platanus spp was (52.4%), Jacaranda mimosifoila (30.2%), Quercus spp (8.7%), Acer negundo (4.6%) and Other (4,1%), respectively. In greening of Soweto, 200 000 trees were planted, and it was noted that 93% of the trees planted were four (4) main species, which is Combretum erythrophyllum (31%), Celtis africana (30%), Olea africana (16%) and Searsia lancea (16%) and 7% was other species. This presented a risk of urban forest being wiped out in case of severe pest outbreak such as PSHB. Platanus spp, Quercus spp, Combretum spp and Acer spp are reproductive hosts of PSHB, and most of these species are dead and some severely dying back.

*Keywords: City of Johannesburg, diseases, diversity, monoculture, polyphagus shothole borer, urban forest.*

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## Analyzing tree planting projects, resource strategies, and environmental benefits in urban Africa from 2009-2021

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This paper aims to analyze tree-planting projects in African cities from 2009 to 2021, focusing on their benefits, and challenges. Africa faces rapid urbanization and environmental changes, making green infrastructure crucial for sustainable development. The study collects data through literature review and document analysis from media, and national and international documents. It examines 60 urban-focused projects out of 181 identified across 54 African countries, highlighting the socio-environmental impacts and the role of green spaces in urban planning. The research highlights successful examples, such as Ethiopia's Green Legacy initiative, which planted over 350 million trees in one day, and South Africa's comprehensive urban tree projects in cities like Johannesburg and Cape Town. These projects demonstrate significant benefits in carbon sequestration, air pollution mitigation, and urban health improvement. The study highlights resource mobilization strategies for these projects, including government funding like the Abidjan project costing EUR 939 million and Tshwane's costing USD 3 million—as well as collaboration with international donors and NGOs. However, the study identifies several limitations, including insufficient data availability, inadequate tracking policies, and funding challenges. It also emphasizes the need for gender and inclusion in planning and executing these projects, ensuring community involvement and equitable benefits. The paper calls for better planning, monitoring, and integrating green infrastructure into national development plans, considering local conditions and indigenous species. The findings suggest that while tree-planting projects are promising for combating climate change and promoting urban sustainability, they require robust governance and long-term commitment to achieve their full potential.

*Keywords: Africa, climate change, urban trees, socio-environmental benefits, urban planning, sustainability.*

## Transforming urban landscape through indigenous tree planting in Bulawayo's CBD, Zimbabwe

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Project Guquka, a youth-led Bulawayo initiative under Green Hut Trust, is funded by Bloomberg Philanthropies through the Bulawayo City Council Youth Climate Action Fund. It examines the feasibility and impact of gradually replacing exotic ornamental trees, planted during the colonial era, with indigenous fruit-bearing species to enhance urban biodiversity, mitigate ecological risks, and improve public health. The study explores three key research questions: community perceptions on replacing exotic trees with indigenous species, the impact of exotic trees on urban health and environmental sustainability, and the potential benefits of integrating indigenous trees into Bulawayo's urban landscape. Using a combination of physical surveys and mapping techniques, a structured questionnaire was administered to 200 respondents to assess community attitudes, and tree geolocation and optical condition assessments were conducted, revealing that 75% of the trees were Jacaranda, 10% Azadirachta indica, 5% pine, and 10% other exotic species. Data analysis involved thematic coding for qualitative responses and statistical evaluation of tree conditions. The study found that 75% of participants supported replacing exotic trees due to health risks and ecosystem degradation, while 25% were against it. Termite infestations had weakened 25% of exotic trees, posing safety hazards, and 75% of Jacaranda trees contributed to seasonal allergic reactions. Gender and inclusivity considerations highlighted that women and children, as primary users of public spaces, faced heightened risks from falling trees and seasonal allergies. Policy recommendations include integrating indigenous forestry into urban planning and establishing awareness campaigns. Economic analysis suggests that long-term cost savings in healthcare and infrastructure maintenance outweigh reforestation expenses, making this transition both an ecological and economic imperative.

*Keywords: Indigenous tree planting, sustainable, tree mapping, urban biodiversity, urban renewable energy.*

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## Potential of controlled natural tree regeneration for urban forest management in Kampala, Uganda

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Urban areas are highly controlled environments where trees and other vegetation are critically selected and positioned to grow in designated places. Seeds and propagative material from mother trees when adequately collected and utilized can contribute to reduce city tree planting budgets, stabilize tree diversity and deter loss of endangered tree species. Kampala city is constrained by limited financing and budgets, there has not been studies investigating the potential of using free propagative materials to enhance the urban forest cover. This research extracted nursery activity data from the city office, covering a period of three years from July 2021 to June 2024. The controlled natural regeneration process considered for data collection started with tree seeds / wildings collection to production of field ready saplings in pots. Data was analyzed to quantify tree species' regenerative potential and assessed the species' environmental and economic impact. A total of 39 tree species were recorded. Out of these, 30 are exotic species while 9 are indigenous species to Uganda. Aleurites moluccanus (2,122 individuals) demonstrated the highest regenerative potential followed by Grevillea robusta (1,469 individuals), Khaya anthotheca (1,011 individuals) and Bombax buonopozense (995 individuals). The total annual estimated worth of all regenerated saplings at field ready stage was calculated to the tune of 260,122,800/= Uganda shillings, the total worth for three years is 780,368,400/= Uganda shillings. Controlled natural regeneration contributes to more exotic species establishment than indigenous species, therefore, cities across Africa should employ it with control measures like the Frank Santamour species diversity index method.

*Keywords: Controlled natural regeneration, environmental impact, economic impact, exotic species, indigenous species, regenerative capacity.*

## The urban forest's structure, composition and tree-related microhabitats in Greater Kumasi, Ghana

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Urban trees offer significant benefits to city residents and support tree-related microhabitats, which enhance structural complexity, sustain ecosystem services, and bolster resilience against climate change and environmental stressors. Despite their importance, tree-related microhabitats are under-researched in rapidly growing African cities, which are facing numerous climate change impacts and biodiversity loss. This study examines the size structure, composition, and functional traits of the urban forest in Greater Kumasi, Ghana, a densely populated and rapidly expanding city, and discusses their influence on the abundance and type richness of tree-related microhabitats. Between August and December 2022, we surveyed 644 trees across 236 plots, identifying 93 species from 31 families. We analyzed tree species composition, functional traits, tree-related abundance, and type richness across different land cover classes, and identified key drivers of tree-related microhabitat diversity. Our findings indicate a scarcity of large-diameter trees and a prevalence of non-native species, while highlighting the importance of native and large-diameter trees in supporting numerous tree-related microhabitat, including ecologically valuable types such as epiphytic structures. We further identified a decrease in tree vitality supporting the abundance of tree-related microhabitats which may cause trade-offs with the economic benefits of urban trees. The results underscore the need to strengthen urban forestry research and management in Sub-Saharan African cities to enhance their multiple benefits. We provide recommendations for future policy and research and advocate for strategies that integrate socio-economic perspectives, prioritize the protection of mature trees, and monitor the spread of non-native species to enhance the biodiversity and resilience of tropical urban forests in Africa.

*Keywords: biodiversity, ecosystem services, urban forestry, west African Cities.*

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## Urban forest regeneration as a catalyst to combatting landslides in ecological fragile zones of Cameroon. The case of the Bamenda escarpment

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Urban Forest depletion is partly due to urbanisation and energy needs. Records show that in the last five years, major landslides within the volcanic zone of Cameroon have led to disasters; most of them occurring close to informal settlements where harvesting of wood for fuel, urban agriculture, and clearing portions for settlements have caused weak zones that eventually promote landslides. Bamenda City has an Ecologically fragile zone of 84km2, with 25% gradient which has been invaded by squatters. Their activities have led to 4 landslides and loss of 6 lives and properties within the past 10 years. The city actions to combat these hazards have seen 2000 trees planted yearly for the past 3 years, planned expropriation of 850 households from the escarpment where area will be used for forest densification and planned resettlement for those to be displaced. Partnership funds under UN Habitat, FEICOM (council support fund) and the council, to the tune of 547USD have been raised for implementation of a resilience building programme which targets water catchment protection, potable water supply, forest densification with water yielding plans and development of 02 tree nurseries which will be community- managed by a 50-man Sisia Supervisory Committee formalised by a Municipal Decision. On the other part of this ecologically fragile zone, the City Council in partnership with UN Habitat is developing a City Green Park which will not only serve recreational purposes and protect the area from landslides but also help build the carbon capture capacity of the city.

*Keywords: densification, expropriation, resettlement, resilience, squatters.*

# Parallel Session 2.2

*Living labs: Experimenting with alternative urban future*

## Reclaiming urban landscapes for climate resilience and social healing: the Miyawaki method as a path to sustainable peace in Cape Town, South Africa

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Urban forests are increasingly recognised as vital tools for addressing climate change, biodiversity loss, and social inequality in African cities. This study explores the application of the Miyawaki method, a high-density afforestation technique, in Cape Town, South Africa—a city marked by apartheid-era spatial segregation and environmental degradation. Between 2021 and 2024, five Miyawaki forests were established in historically marginalised communities, including Langa, Mitchells Plain, Bo-Kaap, District Six, and Philippi, in collaboration with SUGi, a global leader in urban reforestation. The method involved planting 3–5 indigenous tree and shrub species per square metre, creating dense, multi-layered forests that mature up to 10 times faster than conventional plantations. Data collection included annual monitoring of tree height, girth, survival rates, surface temperatures, and biodiversity resurgence. The Khoi First Nations Forest, a 200m² site planted with 600 trees from 22 native species, exemplifies the method's success. Within three years, the forest achieved a closed canopy, reduced local temperatures by up to 11°C, and attracted diverse wildlife, including Cape Dwarf Chameleons and numerous bird species. Beyond ecological benefits, the project fostered social healing by involving youth and women in planting and maintenance, creating local employment, and reclaiming Indigenous ecological knowledge. Challenges included securing long-term funding and community buy-in, highlighting the need for multi-stakeholder partnerships with governments, NGOs, and private entities. This study advocates for urban forests as essential infrastructure, offering scalable solutions for climate resilience, social equity, and cultural restoration across African cities.

*Keywords: biodiversity, climate resilience, community engagement, miyawaki method, urban forestry, youth empowerment.*

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## Cooling effects of agricultural vs. non-agricultural urban green infrastructure in diverse neighbourhoods in Antananarivo, Madagascar

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Urban heat in Sub-Saharan Africa has increased considerably due to urbanisation and climate change, disproportionately affecting vulnerable populations. While green infrastructure is recognised as an effective cooling strategy, its uneven distribution and varying cooling effects across neighbourhoods remains understudied. This Antananarivo case study employs Gini coefficient in 2017 and 2022 to map the population-weighted degree of green infrastructure inequality and combines with a calculation of land surface temperature using Multi-Task Gaussian Process modelling, to evaluate how vulnerable neighbourhoods mitigate surface temperature, and how their cooling thresholds compare to other areas. In 2017, 74% of neighbourhoods with a Gini coefficient of <0.38 had relatively equal green infrastructure exposure, while 26% of proportion were vulnerable to heat due to relatively unequal GI exposure (Gini>0.38). By 2022, the vulnerable neighbourhoods with Gini>0.38 decreased to 23%. Vulnerable neighbourhoods were found primarily in temperature hotspots in densely populated urban centres and southern districts with part in the northern periphery. These vulnerable neighbourhoods observed a greater cooling effect during the day, reliant on agricultural green infrastructure (0.02–0.03°C per 1% increase). While equal neighbourhoods (Gini<0.38) dominating the eastern periphery saw a greater cooling effect at night, relying on non-agricultural green infrastructure. Every 1% increase in non-agricultural green infrastructure led to a 0.01-0.02°C temperature reduction, with a 62% in 2022 non-agricultural green infrastructure being able to maintain comfortable temperatures. The findings emphasise the importance of equitable green infrastructure to mitigate heat stress, and our methodology can help design strategies to benefit marginalized urban communities in Antananarivo and other cities.

*Keywords: Cooling threshold; Gini coefficient; greenspace inequality; land surface temperature; MODIS images; vulnerable neighbourhoods.*

# Parallel Session 2.3

*Gaia's return: Biodiversity inventories of urban greening*

## Assessment of biodiversity and carbon sequestration potential of urban green spaces in Rama Town, Tigray, Ethiopia: Implications for nature-based solutions and urban resilience to climate change impacts

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Urban green spaces are essential for climate change adaptation and mitigation, yet their carbon sequestration potential in growing towns remains largely unassessed. This study aimed to evaluate the carbon sequestration potential of urban green spaces in Rama Town, Northern Ethiopia. Rama Town, a rapidly expanding urban centre in Tigray, was selected for its rich biodiversity and extensive vegetation cover, making it an ideal case for studying urban green spaces and their ecological benefits. Using a stratified random sampling approach, 38 sample plots of varying sizes were established across selected urban green spaces to record plant species and measure key vegetation parameters. A one-way analysis of variance was conducted to determine significant differences in carbon sequestration potential among urban green spaces, while Pearson correlation analysis explored relationships between diversity indices and biomass. Thirteen woody species, representing nine families, were recorded. Species diversity and richness were similar across urban green spaces. The highest mean biomass carbon values (Mg C $ha^{-1}$) were recorded in roadside green spaces (41.24 ± 14.91), followed by educational sites (12.90 ± 3.92) and churches (10.77 ± 2.61), while parks had the lowest value (7.12 ± 2.86 Mg C $ha^{-1}$). Correlation analysis revealed positive relationships between evenness and both above-ground and below-ground carbon ($p<0.05$). These findings highlight the role of urban green spaces in biodiversity conservation and climate change mitigation. Expanding and sustainably managing these spaces in urban planning is crucial. Indigenous plants should be prioritised to enhance ecosystem resilience and serve as in-situ conservation sites for local species.

*Keywords: Above-ground carbon, below-ground carbon, climate change mitigation, diversity indices, woody species.*

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## A tree inventory management system as a key tool for urban forest management in South Africa

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Urban forestry enhances urban environments by improving air quality, mitigating climate change, and promoting social well-being. Effective management requires accurate data and strategic planning, which a tree inventory management system facilitates. This digital platform collects and analyses data on urban trees, including species, health, distribution, and maintenance needs. This study examines its role in optimising urban forestry through systematic data collection, real-time updates, and geographic information system integration. Data was gathered using mobile devices and mapping tools, ensuring accessibility and accuracy. The system enables managers to monitor tree distributions, track changes, and prioritise maintenance efficiently. Findings indicate that a structured, data-driven approach enhances resource allocation, ecosystem services, and informed decision-making. A centralised database ensures continuity across teams and administrative transitions, supporting long-term sustainability. Transparency is promoted by providing stakeholders and the public with reliable forestry data. Additionally, the system fosters community engagement by raising awareness and encouraging participation in tree planting and maintenance initiatives. The data support scientific research on urban forestry trends and climate adaptation. By quantifying ecosystem services, such as carbon sequestration and energy savings, the system attracts investment from green funds and partnerships. Furthermore, integrating artificial intelligence and machine learning could enhance predictive capabilities, allowing for proactive maintenance and risk assessment. Implementation further supports employment in data collection, tree care, software development, and urban planning, aligning with national development goals. Ultimately, a well-maintained urban forest contributes to improved public health, reduced urban heat islands, and enhanced biodiversity, creating more resilient and liveable cities.

*Keywords: biodiversity, data management, environmental planning, sustainability, urban greening, vegetation mapping.*

## Impacts de la diversité ligneuse urbaine sur l'avifaune dans la ville de Maradi, Centre Sud du Niger

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Les essences urbaines jouent un rôle très important dans la conservation de la biodiversité animale urbaine. Cependant, il y a peu d'études qui ont déterminé les rôles des ligneux urbains dans la conservation des oiseaux en milieu urbain en Afrique de l'ouest. D'où l'intérêt de la présente étude qui a déterminé les effets de la diversité des espèces ligneuses urbaines sur la diversité des oiseaux dans la ville de Maradi. Inventaire forestier et de la faune aviaire des enquêtes et des observations de terrain ont été fait sur la base d'un échantillonnage ciblé dans xx maisons pendant le mois de Juillet-Aout et septembre 2023. Au total 13 espèces ligneuses ont été recensées dont Azadirachta indica est l'arbre dominant. Quant à la faune aviaire, sept espèces ont été identifiées dont les espèces Icterus nigrogularis (X%) et Lagonosticta rufopicta (% y) sont les plus dominantes. Ainsi, les arbres sur lesquels les oiseaux ont été les plus observés sont Azadirachta indica (59,27%) et Terminalia mantaly (6,33%). De plus, la totalité des personnes enquêtées affirment que Azadirachta indica est l'espèce la plus attirante pour les oiseaux. Cependant, dans les quartiers Bagalam, Bourja et Makoyo ces arbres sont confrontés à une phytopathologie liée aux vers selon 50% des personnes enquêtées. Les résultats cette étude complètent l'effort mondial de la conservation des oiseaux dans un contexte du changement climatique en milieu urbain. En plus cette étude présente des opportunités pour une éducation de la botanique et de l'ornithologie aux enfants de la ville de Maradi. Cette étude recommande la prise en compte des essences qui attirent la diversité avifaune dans les politiques, projets et programmes de conservation durable de la biodiversité urbaine au Niger.

*Mots clés: Impacts, espèces ligneuses, avifaune urbaine, foresterie urbaine, Maradi.*

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## Espèces ligneuses des maisons du quartier Zaria II de la ville de Maradi : Importance, Diversité et Facteurs de mortalité, Maradi, Niger

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Les maisons jouent un rôle dans la conservation de la biodiversité ligneuse. Cependant il n y'a pas assez d'étude qui ont déterminé la diversité ligneuse dans les maisons, ainsi que les services rendus et les causes de leur mortalité. C'est ainsi que l'étude menée dans la région de Maradi (Niger) a déterminé le nombre d'espèces ligneuses, leurs valeurs et les causes de leurs disparitions. Une enquête socioéconomique et botanique a été réalisées dans 73 maisons selon un échantillonnage ciblé. Nous avions recensé 34 essences appartenant à 21 familles et 30 genres. Fabaceae (11%) est la famille dominante. Ces espèces procurent quatre (04) catégories de services, dont un seul service culturel qui est la beauté (8,82%), les services de régulation : lutte contre l'érosion (5,88%), lutte contre le vent (10,29%), captage du $CO_2$ (5,88%). Les services d'approvisionnement cités sont : la pharmacopée (16,17 %), l'alimentation humaine (14,70 %), bois de chauffe (4,41%), ombrage (17,64%) et en fin le service de support : confort (13,23%). Les indices de diversité floristique montrent que le quartier Zaria est riche avec un indice de Shannon de (2,94) et d'équitabilité de Piélou de (0,83). Le test d'égalité des espérances porté sur le nombre d'espèces et les caractéristiques socio démographiques révèlent qu'il existe une relation significative entre le nombre d'espèce et ces caractéristiques ($P<\acute{\alpha}$). Cette étude recommande la prise en compte de ces essences locales dans la planification urbaine ainsi que la sensibilisation des populations pour la plantation des plantes locales et exotiques à intérêts alimentaires dans leurs maisons.

*Mots clés : les maisons vertes, services écosystémiques, Ville de Maradi.*

Translation

## Woody species of houses in the Zaria II district of the city of Maradi: Importance, diversity and mortality factors, Maradi, Niger

Houses play a role in the conservation of woody biodiversity. However, there are not enough studies that have determined the woody diversity within households, as well as the services provided and the causes of their mortality. This study conducted in the Maradi region (Niger) aimed to determine the number of woody species, their value, and the causes of their decline. A socio-economic and botanical survey was carried out in 73 households using targeted sampling. We recorded 34 species belonging to 21 families and 30 genera. Fabaceae (11%) was the dominant family. These species provide four (04) categories of services, including a single cultural service: aesthetics (8.82%); regulatory services: erosion control (5.88%), wind protection (10.29%), and $CO_2$ capture (5.88%); provisioning services: medicinal uses (16.17%), human food (14.70%), firewood (4.41%), and shade (17.64%); and finally, support services: comfort (13.23%). The floristic diversity indices show that the Zaria district is the richest, with a Shannon index of (2.94) and a Pielou's evenness index of (0.83). The equality test on species count and socio-demographic characteristics reveals a significant relationship between the number of species and these characteristics (P<ά). This study recommends considering these local species in urban planning and raising awareness among populations about planting local and exotic plants with food benefits in their homes.

*Keywords: green homes, ecosystem services, City of Maradi.*

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## The forest of freedom: Greening democracy and cultivating heritage of Tswane, South Africa

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As South Africa commemorates 30 years of democracy, the Forest of Freedom initiative at Freedom Park, Tshwane, merges environmental restoration with cultural heritage. This project transforms a previously disturbed landscape into a living monument that embodies resilience, unity, and sustainability. By planting 30 diverse indigenous tree species, including a symbolic tree representing freedom, and dedicating segments for tree planting by heads of state, embassies, and dignitaries, the initiative fosters international solidarity and climate action. Aligned with national tree-planting commitments, the Forest of Freedom contributes to South Africa's broader environmental goals, enhancing urban forestry, biodiversity, and community engagement. The project integrates the A RE JWALENG concept, encouraging public participation in tree planting to promote stewardship and sustainable urban greening. The launch event will align with the presidential pledge to plant 10 million trees, leveraging government and private-sector partnerships to maximize impact. This paper explores the Forest of Freedom as a model for urban reforestation that interweaves ecological rehabilitation with socio-political commemoration. It highlights the role of urban forests in climate resilience, cultural remembrance, and diplomatic engagement. By merging environmental stewardship with historical consciousness, the Forest of Freedom stands as a testament to South Africa's journey toward democracy while advocating for sustainable and inclusive urban landscapes.

*Keywords: Urban forestry, democracy, heritage conservation, climate resilience, community engagement, reforestation.*

# Parallel Session 2.4

*The good, the bad and the bugly:*
*Ecosystem disservices, pests and diseases*

## Protecting Africa's urban forests from insect pests and diseases the case of the polyphagous shot hole borer in South Africa

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Insect pests and diseases pose a substantial threat to the sustainability and health of natural and managed forests, including urban forests. Urban forests in Africa are particularly vulnerable to insect pests and diseases because most countries have little capacity or resources assigned to manage this threat. Urban forests, with diverse hosts that are often stressed and in proximity to trade and travel routes between countries, are ideal bridgeheads for invasive pests and pathogens, from where they can spread more broadly. Such introductions can result in significant damage in urban areas and beyond, as recently demonstrated by the introduction of the polyphagous shot hole borer, Euwallacea fornicatus, in South Africa. This invasive ambrosia beetle has infested hundreds of tree species across the country, many of these in established urban forests, but also spreading to native and agricultural trees. The landscapes in the infested areas have been changed considerably with the broader impact of this beetle in the country estimated to be 0.66% of the country's GDP. Management strategies to mitigate the threat posed by pests and diseases to the current and future urban forests on the continent are thus urgently needed. These include the development of relevant policies, investment in research, including urban forests in biosecurity initiatives, and networks to facilitate knowledge sharing within and between countries.

*Keywords: invasive species, biological control, Euwallacea, research.*

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## The influence of environmental factors and socio-economic status on urban residents' experiences of and vulnerability to ecosystem disservices in South Africa

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Peoples' experiences of ecosystem disservices (EDS) are influenced by socio-economic and environmental characteristics, and this needs better understanding for informed planning and management of urban green infrastructure. This is investigated in four towns in South Africa. Employing a questionnaire survey, in 303 randomly selected households in three neighbourhoods of different economic standing, alongside statistical analysis provided quantitative data on experiences and vulnerability to EDS. A list of reported EDS was compiled and the number of EDS/respondents was compared between towns, neighbourhoods and places of experience, using Kruskal-Wallis test and nested ANOVAs. Respondents' vulnerability to EDS was assessed by analysing the magnitudes of experience and coping abilities. The influences of socio-economic and environmental characteristics on experiences of and vulnerability to EDS were assessed using PCAs. Twenty-three EDS were reported in total, with the highest numbers recorded in affluent areas and the lowest in the poorest areas. Irrespective of town and neighbourhood, the reported EDS were mainly experienced in domestic gardens and surrounding streets. Consequently, only one EDS seems of high concern, while the others are of lower concern or well manageable by the respondents. Significant influences of socio-economic (education and income levels, source of income, upbringing, frequency of visits to green spaces (GS), length of residence in neighbourhoods) and environmental (environmental worldview, garden ownership, membership to environmental NGO) characteristics were observed on the experiences and vulnerability to EDS. Therefore, such variations in and influences on peoples' experiences and vulnerability to EDS should be considered for sustainable management of urban GS. Furthermore, the creation of GS should be accompanied by actions to improve people's relationships to nature as well as to ensure their maintenance and security, particularly public GS and commonages.

*Keywords: environmental worldview; nature nuisances; perception; socio-economic status; risk; urban greening.*

## Detecting and mapping a polyphagous shot hole borer infestation on urban trees in Johannesburg, South Africa using Sentinel-2 data

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The outbreak of polyphagous shot hole borer (Euwallacea fornicatus) is causing damage to iconic street trees, such as Platanus trees, in the City of Johannesburg. E. fornicatus creates obvious stains on the trunk and branches of these trees; however, the use of remote sensing could aid in detecting E. fornicatus-induced changes in spectral vegetation indices. Additionally, detecting E. fornicatus infestation signs typically rely on observing entrance holes on the trunk and dried or dead falling branches, which indicate a severe level of damage. This study investigated the potential of Sentinel-2 images and different classification models to detect and map E. fornicatus infestations on trees in Johannesburg. Six machine learning models; random forest, Gradient Boosting, AdaBoost, linear support vector machine, support vector machine-radial basis function and neural network were employed to analyse Sentinel-2 images and validated using field ground truthing data. The results of the study showed that vegetation indices in non-infested and infested trees have significant differences and random forest performed well (overall accuracy = 70%) compared to five other classifiers. This proved that freely available multispectral Sentinel-2 images can successfully detect and map E. fornicatus-Fusarium dieback infestations in an urban forest. These results can help urban forest managers in assessing the spread of E. fornicatus, thereby improving management strategies of this invasive pest in South Africa.

*Keywords: Euwallacea fornicatus; Platanus; random forest; urban forest.*

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## Restoring green spaces in low-income high-density suburbs: lessons from the greening Kuwadzana project

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Urbanization and population growth have led to the degradation of green spaces in the historically disadvantaged low-income high-density suburbs, exacerbating environmental and income-related health inequalities. The stark difference in the micro-climatic conditions between high density and low-density suburbs is alarming, effectively creating a form of environmental inequality that reflects the continuation of the social and economic segregation of the past. In response, Community-Based Organisations (CBOs) have stepped in to address this worsening crisis and to advocate for clean, healthy and sustainable low-income communities. The Greening Kuwadzana Project, launched in 2020, aims to restore green spaces and to campaign for environmental justice in Kuwadzana, a densely populated low-income suburb of Harare, Zimbabwe. This presentation shares the initiative's experiences, achievements, and lessons learned. It highlights the project's innovative approaches, including community-led tree planting activities, community environmental justice education, and art-based awareness campaigns. The presentation will also discuss the project's impact on community engagement, social cohesion, and environmental sustainability. Despite facing numerous challenges, including limited resources, competition for land use, and community skepticism, the project has made significant strides. Key lessons learned include the importance of community ownership, partnerships with local stakeholders, and adaptive management. This presentation contributes to the growing body of research on urban green spaces, highlighting the potential for community-led initiatives to drive environmental sustainability and social transformation in low-income high-density suburbs. The overall goal is to inspire similar initiatives in other urban settings to fight for the right to clean, healthy and sustainable communities.

*Keywords: Community-Based Organisations; Deforestation; Environmental Justice; Green Spaces; Health Inequalities; High-Density Suburbs.*

## Monitoring a polyphagous shot hole borer infestation in Johannesburg's urban forest using Google Street View

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The Polyphagous shot hole borer (PSHB) (Euwallacea fornicatus) is attacking native and exotic street trees in the city of Johannesburg (CoJ). The date of its first introduction into the city is uncertain. This study investigated the efficacy of using Google Street View (GSV) imagery to map and monitor the spread of PSHB infestation on the CoJ trees and discover the date of its arrival. A total of 1137 PSHB infested and non-infested trees were recorded using GPS for ground-truthing data in 2022. The same tree coordinates were also located on each of the available Google Street View images, for each year spanning from 2010 to 2022 and assessed for the presence and absence of PSHB infestations. Both the field survey and GSV image assessments were in agreement, when classifying the PSHB infestation status of Platanus tree species. However, the GSV utility was species specific and only applicable for selective species, amongst which were Platanus x acerifolia, Platanus racemosa and Acer buergerianum, in which the PSHB infestation symptoms were conspicuous in the GSV images. The GSV findings showed that the PSHB infestation was present in the urban forest of the CoJ from 2017, effectively tracing back the year of the first infestation in the city. The GSV assessment proved that it could be a viable alternative method to field surveys on selected species. The findings also affirmed that the PSHB has already established, and the Johannesburg city authorities need to act fast to contain any further proliferation and damage on trees.

*Keywords: Acer buergerianum; Euwallacea fornicates; Invasive pest; Ground-truthing; Platanus x acerifolia; Platanus racemosa.*

# Parallel Session 3.1

*Nourishing cities: Urban forests for food security*

## Increasing the breadbasket of the city through youth-led urban agricultural programme

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Bamenda being the third ranked city in Cameroon is where the average city dueller does not depend only on wages earned from secondary and tertiary sectors of the urban economy but also practice some micro urban agriculture. With a population of over 650,000 inhabitants, the city is an attraction to all categories of migrants. The Socio- political crises presently in its seventh year has only increased the pressure on city space. The city, though with strong urban –rural linkage, faces food challenges, youth unemployment and pressure on urban space. The present farm area served as hide out for gunmen when it was a bush. The city Mayor developed this programme which enables the improvement of food security of the city. The Council provides the land, and the youths learn from each other on practical farming techniques and can use the same to replicate. With this youth led programme, the city council has progressively produced and supplied to the urban market in 2022, 50 tons of tomatoes, 20 tons of tuber yams, 5 tons of Irish potatoes, 2 tons of grains and other horticultural produce. Organic waste from the city space has become a resource as it is the main input into these pilot farms which are diversified today. This has equally led to the engagement of more than 100 youths where some have developed passion for agriculture. The long-term goal is to see that this project contributes to food security, City economy and sustainable development goals.

*Keywords: employment horticulture, land, markets. migrants, organic.*

## Urban agriculture as a strategy for enhancing climate resilience and food security in Dar es Salaam, Tanzania

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Despite the growth in agricultural production and recognition of localized food systems' importance, millions in Africa still face food insecurity. Rapid urbanization, loss of urban forests, and decreasing productive land push (peri-)urban households to find alternative means to supplement diets and income. Urban agriculture is a key strategy to meet these challenges, supply local produce, and enhance city livability. However, empirical evidence on urban agriculture's benefits, adoption challenges, and effective food system transformation solutions is scarce. This study examines how urban agriculture can build community and enhance city resilience in Dar es Salaam, one of the fastest-growing cities in sub-Saharan Africa. A mixed-methods approach was used. A household survey (n = 233), four focus groups, and 25 key informant interviews revealed local perceptions of challenges and opportunities. Results show urban agriculture's vital role in formal and informal economies, providing employment, enhancing social capital, ensuring food security, and contributing to urban green infrastructures. However, Dar es Salaam faces institutional, economic, and environmental challenges, such as limited access to land, insufficient extension services, lack of legal protection for urban farmers, and inadequate health information. From 2002 to 2022, urban agriculture area decreased by 33.3% from 6,951.02 hectares to 4,639.21 hectares. The built area increased by 505.05%, urban forest decreased by 15.03%, and NDVI significantly ($p < 0.05$) decreased by 11.0%, indicating poor vegetation cover. Integrating urban agriculture into urban forest policies, fostering public-private partnerships, and adopting climate-smart technologies is essential for biodiversity enhancement, mitigate vegetation loss and addressing food insecurity.

*Keywords: food insecurity, urban green infrastructure, urban forest systems, urban farmers, social capital.*

## Socio-spatial dynamics in wild plant foraging practices in two medium-sized South African towns: How do foragers adapt and respond to change?

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There is growing interest in urban foraging of wild plants worldwide. But rapid urban transformation potentially poses a threat to foraging sites and practices. Yet, little is known about how urban transformation shapes foraging practices over time. This study assessed the perceived socio-spatial dynamics influencing wild plant foraging practices in two medium-sized South African towns and how foragers adapt and respond to transformation. Eighty-one semi-structured interviews were conducted with regular foragers, complemented by 20 unstructured in-depth interviews. Descriptive and inferential statistics were used for analysing quantitative data and thematic analysis for qualitative data. The results showed that the practice of foraging wild plants is constantly changing over time, with respect to spaces, foragers and regulations. Foragers attested to a gradual decline in the number and size of foraging spaces over the past ten years. Moreover, urban development's engulfing green spaces brought along various regulations which often prohibited or restricted access and activities outside the purview of such developments. Besides, change was also noted among foragers' themselves. There was a decreasing trend in the number of people participating in foraging, coupled with changes in foragers' profiles. The aforementioned changes, particularly on the spaces and land-use management, prompted foragers to devise adaptation strategies. The principal adaptation strategies were locating new foraging sites, foraging in more distant areas, and negotiating access. Overall, the results demonstrated that urban transformation continually reconfigures foraging practices.

*Keywords: Access; Foraging; Green spaces; Urbanisation; Urban transformation; Wild plants.*

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## Integrating fruit-bearing trees into Kigali's urban forests: A review of opportunities, challenges, and policy gaps

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Urban forests provide critical ecosystem services that enhance climate resilience, public health, and food security, particularly in rapidly urbanizing regions. Fruit-bearing trees offer additional socio-economic benefits, yet their integration into urban planning remains limited and poorly documented. This review examines the current state of fruit tree incorporation into Kigali's urban landscape, synthesizing existing research on their environmental and socio-economic contributions while identifying policy and implementation gaps that hinder their effective integration. A systematic review of academic literature, policy documents, and case studies was conducted to evaluate the extent of fruit tree adoption in urban forestry programs. Findings reveal that fruit-bearing trees contribute significantly to urban sustainability, with reported benefits including a 15% reduction in particulate matter, a 20% decrease in stormwater runoff, and a 1–2°C mitigation of urban heat effects. Additionally, fruit trees enhance food security, with reported yields of up to 2,500 kg per hectare annually, while fostering community engagement, social cohesion, and economic opportunities through local fruit markets. Despite these advantages, the review identifies several barriers to large-scale fruit tree integration in Kigali's urban forestry framework, including limited institutional coordination, weak policy enforcement, insufficient public awareness, and lack of spatial data on tree distribution. Current urban greening strategies often prioritize ornamental species over productive trees, missing an opportunity to leverage fruit-bearing species for both environmental and socio-economic benefits. To address these gaps, this paper recommends a policy-driven, multi-sectoral approach that enhances institutional collaboration, strengthens community participation in tree maintenance, and prioritizes fruit trees within Kigali's reforestation programs. Lessons from this review offer insights for urban forestry planning across African cities, advocating for policies that integrate fruit-bearing trees into climate adaptation strategies while promoting equitable access to green infrastructure for urban populations.

*Keywords: fruit-bearing trees, food security, policy integration, urban forestry.*

## Foresetrie urbaine pour un context de changement climatique au Togo

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L'arbre en milieu urbain procure de nombreux bienfaits malgré des conditions difficiles. La foresterie urbaine suscite un intérêt croissant et a fait l'objet de nombreuses recherches. Ce projet a recensé les publications scientifiques sur la foresterie urbaine, évalué la situation des villes togolaises et identifié les besoins de recherche des municipalités. Les informations ont été collectées à partir de bases de données scientifiques (Science Direct, PubMed, Scopus, etc.) et de documents ministériels sur une période de six mois (décembre 2023 - mai 2024). L'étude a couvert les publications de 2000 à 2024 et inclus des enquêtes semi-structurées auprès de responsables environnementaux et gestionnaires de forêts communautaires. Un total de 186 documents a été recensé, dont 56 articles scientifiques. Par ailleurs, 344 personnes ont été interrogées dans différentes villes togolaises. L'analyse des publications a révélé une augmentation des travaux axés sur l'impact des arbres sur la santé humaine (42 %), la qualité de l'air (32 %) et l'atténuation des effets du changement climatique (28 %). L'enquête a mis en évidence des besoins en recherche, notamment l'identification d'espèces adaptées au milieu urbain (43 %), l'effet des arbres sur la réduction des risques (39 %) et sur le ruissellement des eaux de pluie (22 %). Un déficit dans le transfert de connaissances entre chercheurs et gestionnaires a été relevé, limitant l'application des résultats. Ce travail constitue une base pour orienter les recherches en foresterie urbaine, en lien avec les défis du changement climatique.

*Mots clés: biodiversité, cartographie, conservation, foresterie communautaire, répartition spatiale, stock de carbone*

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Translation

## Urban agriculture: Overview of scientific research, current situation, and research needs for the protection of Togolese cities, Togo

Urban trees provide many benefits despite difficult conditions. Urban forestry is attracting growing interest and has been the subject of much research. This project identified scientific publications on urban forestry, assessed the situation in Togolese cities and identified the research needs of municipalities. Information was collected from scientific databases (Science Direct, PubMed, Scopus, etc.) and ministerial documents over a six-month period (December 2023 - May 2024). The study covered publications from 2000 to 2024 and included semi-structured surveys of environmental managers and community forest managers. A total of 186 documents were identified, including 56 scientific articles. In addition, 344 people were interviewed in different Togolese cities. The analysis of publications revealed an increase in work focused on the impact of trees on human health (42%), air quality (32%) and climate change mitigation (28%). The survey highlighted research needs, including the identification of species adapted to urban environments (43%), the effect of trees on risk reduction (39%) and on rainwater runoff (22%). A deficit in the transfer of knowledge between researchers and managers was noted, limiting the application of results. This work provides a basis for guiding research in urban forestry, in relation to the challenges of climate change.

*Keywords: biodiversity, mapping, conservation, community forestry, spatial distribution, carbon stock.*

## Perception paysanne des impacts écologiques et caractérisation de la haie vive linéaire de Dan Ankara dans la ville de Tessaoua, région de Maradi au Niger

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Cette étude fait la caractérisation et cherche à appréhender la perception paysanne sur des impacts écologiques de la haie vive de Tessaoua dans la région de Maradi. En effet, l'un des exemples représentatifs d'œuvre écologique réussie et réalisée par un privé. Le défunt Elhadji Dan Ankara est un écologiste urbain hors pair qui a planté plus de 5000 arbres tout au long de la route nationale 1sur 12 km du village de Iyatawa à l'entrée de de la ville de Tessaoua. Ce patrimoine environnemental fournit beaucoup de service à la communauté de cette ville.

La méthodologie adaptée dans le cadre de cette étude repose sur les mesures dendrométriques qui ont permis de déterminer les caractéristiques de la haie et en second lieu, faire des entretiens individuels afin de comprendre la perception qu'ont les paysans de cette haie vive sur le plan écologique. Les résultats de cette étude révèlent que la haie est composée de 5 espèces dont la plus dominante est Azadirata indica. Elle est structurée en plus de 2 lignes parallèles de plus 12 km, avec 4 mètres d'écart entre les pieds d'arbres. La largeur moyenne du houppier varie en moyenne entre 1,75 et 13 mètres. Les paysans ont bien conscience de l'apport cette haie dans leur terroir et les différents impacts positifs dû à cette dernière. Le mode de gestion de la haie est participatif et les bénéfices du point de vue écologique et humain sont très considérables.

*Mots clés: Tessaoua, Maradi, Niger, haie vive linéaire, Dan Ankara, perception paysanne, impacts écologiques.*

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Translation

## Farmers' perception of the ecological Impacts of a living hedge of Dan Ankara in Tessaoua, Maradi Region, Niger

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This study characterizes and explores the peasant perception of the ecological impacts of the live hedge in Tessaoua, Maradi region. It stands as one of the most successful private ecological initiatives. The late Elhadji Dan Ankara was an outstanding urban ecologist who planted more than 5,000 trees along National Road 1, stretching 12 km from the village of Iyatawa to the entrance of Tessaoua. This environmental heritage provides numerous services to the community of this city. The methodology used in this study is based on dendrometric measurements to determine the characteristics of the hedge, followed by individual interviews to understand farmers' perceptions of its ecological value. The results reveal that the hedge consists of five species, with Azadirachta indica as the dominant one. It is structured in more than two parallel lines over 12 km, with a spacing of 4 meters between trees. The average canopy width ranges from 1.75 to 13 meters. Farmers are well aware of the benefits this hedge brings to their land and the various positive ecological impacts it provides. The hedge is managed through a participatory approach, and its ecological and human benefits are highly significant.

*Keywords: Tessaoua, Maradi, Niger, linear live hedge, Dan Ankara, peasant perception, ecological impacts.*

## Forêts comestibles: Bénéfices et défis dans les communes de Golf au Togo

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Les forêts comestibles constituent une source durable de fruits, légumes, herbes et noix, ce qui permet de diminuer la dépendance aux circuits alimentaires industriels. Elles encouragent l'autosuffisance alimentaire locale, réduisent les îlots de chaleur urbains et capturent le $CO_2$, contribuant ainsi à la lutte contre le changement climatique. Cette étude vise à comprendre pourquoi certaines personnes choisissent de couper des arbres fruitiers, même si ces arbres leur apportent des avantages en milieu urbain. Au total, nous avons enquêté 120 ménages dont 40 ménages dans les quartiers de Doumassessé, Klikamè et Agbalépédogan, situés dans les communes de Golf 3, Golf 4 et Golf 5, respectivement. L'enquête a été réalisée pendant les mois de juillet et août 2024. Les personnes enquêtées ont un âge compris entre 30 - 70 ans et sont propriétaire de maison. Nous avons utilisé des statistiques descriptives pour déterminer la fréquence des différents paramètres étudiés dans chaque commune. Les résultats montrent que 50 % des ménages coupent des arbres pour faire place à des habitations, 40 % le font en raison des dommages matériels causés par ces arbres lors de vents violents, de fortes pluies ou d'autres phénomènes écologiques. De plus, 10 % coupentces arbres pour vendre le bois, souvent par manque de moyens pour subvenir à leurs besoins essentiels. Enfin, 30 % mentionnent à la fois le manque d'espace pour construire et les dégâts matériels causés par les arbres lors de conditions climatiques extrêmes. Cette étude servira de base pour mieux comprendre les fruits les plus consommés et les variations de leur prix dans les communes concernées.

*Mots clés : Forêts comestibles, Autosuffisance alimentaire, Changement climatique, Développement durable, Togo.*

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Translation

## Edible forests: benefits and challenges in the Golf Municipalities of Togo

Edible forests provide a sustainable source of fruits, vegetables, herbs, and nuts, reducing dependence on industrial food supply chains. They promote local food self-sufficiency, mitigate urban heat islands, and capture $CO_2$, contributing to climate change mitigation. This study aims to understand why some individuals choose to cut down fruit trees despite their benefits in urban environments. A total of 120 households were surveyed, with 40 households in the neighborhoods of Doumassessé, Klikamè, and Agbalépédogan, located in the municipalities of Golf 3, Golf 4, and Golf 5, respectively. The survey was conducted during July and August 2024. Respondents, aged between 30 and 70 years, were homeowners. Descriptive statistics were used to determine the frequency of various studied parameters in each municipality. The results indicate that 50% of households cut trees to make space for housing, while 40% do so due to material damage caused by strong winds, heavy rains, or other ecological events. Additionally, 10% cut trees to sell the wood, often due to financial constraints preventing them from meeting essential needs. Lastly, 30% cite both lack of construction space and tree-related damage during extreme weather conditions as reasons for tree removal. This study serves as a foundation for understanding the most consumed fruits and the price variations in the studied municipalities.

*Keywords: climate change; edible forests, food self-sufficiency, sustainable development, Togo.*

# Parallel Session 3.2

*Environmental justice and legacy effects of colonial and apartheid eras*

## The colonial ontologies and climate vulnerability: a planetary health perspective of Johannesburg, South Africa

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This study explores the interplay between segregated urban development, unequal vegetation distribution, and increased heat-related health risks for marginalised populations in Johannesburg, South Africa. The focus on heat-related health risk serves to foreground climate justice concerns and opportunities to confront social and environmental challenges as part of a complex urban system. Data comprised a combination of remote-sensing satellite imagery, the Gauteng City Region Observatory's 2021 Quality-of-Life Survey, and 2011 National Census. Relationships between vegetation distribution, vulnerability, and heat exposure were explored through a combination of spatial mapping and statistical analyses using linear and spatial regression models. Vulnerability included key socio-demographic variables which contribute to an increased overall risk of heat-related health outcomes, such as age, health status, socio-economic factors. The findings reveal a significant correlation between marginalisation, low vegetation levels, increased heat exposure, and heightened vulnerability to the adverse effects of heat. This disproportionate risk is further compounded by socio-economic factors such as limited access to healthcare and adequate housing. These findings support a paradigm shift in urban planning and governance. They reframe the value of resilience-enhancing green infrastructure and urban forests to encompass broader public health, economic, and social outcomes. Climate-related health risks are becoming an increasingly prominent global health challenge. The conceptual and methodological approaches used in this study are widely replicable and provide a basis for similar studies to understand the dynamics of environmental health and climate resilience globally.

*Keywords: heat risk; marginalisation; vulnerability; health; spatial mapping; South Africa.*

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## Street tree communities reflect socioeconomic inequalities and legacy effects of colonial planning in Nairobi, Kenya

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Street trees provide ecological and social benefits that sustain urban life, yet their distribution frequently mirrors socioeconomic inequalities, meaning underprivileged social groups often have fewer street trees. This uneven access sometimes has roots in historical injustices, including colonialism. We assessed the extent to which street tree communities reflect present-day socioeconomic stratification and past colonial planning in Nairobi. We sampled 2,047 trees across 12 neighbourhoods in Nairobi categorized into four socioeconomic strata to compare street tree abundance and diversity. We found substantial disparities in tree abundance. Affluent, formerly European areas (like Karen and Kilimani) harboured 91.5% of the trees sampled. Only half of the streets sampled in low-income areas and informal settlements had any trees. Species diversity resultantly showed similar inequality. High-income neighbourhoods had over 30% higher species richness and diversity than low-income areas for an equal number of trees. Street tree communities in lower income neighbourhoods exhibited greater utility value, with a higher proportion of trees that bear edible fruit or are used in traditional medicine. Overall, our results reveal pronounced spatial inequality in the distribution of street trees in Nairobi, reflecting not only socioeconomic differences but the enduring legacies of colonial planning. Overcoming this feedback requires a comprehensive spatial inventory of Nairobi's trees, and an appraisal of barriers to more equitable distribution including infrastructure and land tenure, as well as resident perceptions and needs. This would inform investments in site rehabilitation, tree planting, and maintenance – while preserving the existing canopy – concomitant with social investments to avoid gentrification.

*Keywords: community composition, environmental justice, green space, legacy effects, urban biodiversity, urban forests.*

## Fostering a sense of belonging through green infrastructure and community integration, in Cape Town's Central Business District, South Africa

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This proposal explores the role of urban forests and green infrastructure in addressing Cape Town's affordable housing crisis, which remains deeply entrenched in the legacy of apartheid-era spatial segregation. Despite extensive research on housing and urban sustainability, a critical gap exists in leveraging urban forests as multifunctional assets that support social cohesion, environmental resilience, and economic opportunity. This project focuses on the Central Business District, a historically exclusive, high-cost, and car-dependent area, and examines how integrating urban forests with affordable housing can foster inclusivity and accessibility. By reconnecting historical water channels, such as those along Buitengracht and Heereengracht Street, through a network of green corridors, the project proposed an urban framework that incorporates pedestrian-friendly spaces, environmentally sensitive water management, and urban agriculture. This network links key urban nodes, including the proposed community farm at Erf 81 and fresh produce markets, reinforcing local food security and community engagement. Public spaces are reimagined as adaptable, pedestrian-focused corridors that promote year-round social interaction, while mixed-use development integrates affordable housing programmes such as the Finance Linked Individual Subsidy Programme. By embedding urban forests into the city's-built environment, this proposal demonstrates their potential as catalysts for social and economic transformation. The findings contribute to urban planning discourse by presenting a model for integrating urban forestry policy into urban design and housing, offering a blueprint for a more just, sustainable, and inclusive Cape Town. This proposal underscores the need for interdisciplinary strategies that bridge environmental sustainability and inclusive urban development.

*Keywords: accessibility, climate resilience, housing, placemaking, social cohesion, urban agriculture.*

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## The role of urban green infrastructure in promoting human well-being and mitigating crime in the Eastern Cape, South Africa

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Urban green infrastructure is crucial in enhancing sustainability and livability of urban environments. Characterised by public open green spaces, parks, gardens, street trees, and urban forests, among other areas. Though often viewed as essential for enhancing human well-being and biodiversity, these areas can be places of criminal activity if not managed properly. We report on a survey of 400 households across seven towns in the Eastern Cape province of South Africa to assess their perceptions, experiences and potential of green spaces to promote human well-being and mitigate crime risk. Findings show that perceptions of crime were similar, with over half (58%) of the households indicating that crime has increased in green spaces. Poor access to quality green spaces was the leading contributor to crime levels within green spaces. Over two-thirds of participants indicated that crime has increased within green spaces, due to lack of development and maintenance of green spaces. However, over 70% of the participants continued to use green spaces despite rating their quality "poor" or "very poor". There were also gender disparities with the use of green spaces, 63% of female participants preferred using them during the day, while males were comfortable using green spaces at any time. Findings further indicate that green spaces in affluent areas are better managed than their counterparts, highlighting disparities resulting in inequitable access to quality green spaces. Therefore, authorities must prioritize targeted initiatives that promote the benefits of green spaces through regular thorough management and integrate crime reduction strategies for safer communities.

*Keywords: access, urban green spaces, management, perceptions, quality, sustainability.*

## Prospect to achieving equitable urban tree canopy distribution in Ibadan Metropolis, Oyo State, Nigeria

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Urban trees' benefits have garnered much attention; however, limited research has been conducted into the distribution of tree canopy cover, particularly from an environmental justice perspective. This study investigated the socioeconomic disparities linked to tree canopy distribution. Oluyole and Old Bodija communities were purposely selected. In each community, 1059 and 3261 houses were identified, and houses were randomly selected at 5% sampling intensity. Landsat 9 image from 2023 was downloaded, and spatial data was extracted. Data were analyzed using descriptive and chi-square statistics. Oluyole's vegetation cover increased from 0.08 in 2003 to 0.36 in 2013, but it reduced to 0.32 in 2023, while Old Bodija's vegetation cover increased from 0.11 in 2003 to 0.39 in 2013, however it decreased in 2023 to 0.35. In Oluyole and Old Bodija, 55.2% and 54.7% of respondents were males, 55.2% and 62.3% were between 20 and 35 years old, and 58.3% and 49.1% earned more than ₦40,000($27) monthly. Yoruba (78.5%.and 75.5%) were the predominant ethnic group, and 70.6% and 75.5% rented their homes. Oluyole residents (74.8%) believed that tree canopy cover was unevenly distributed, although having equal access to vegetation cover (59.5%). Old Bodija residents (69.8%) stated that tree canopy cover was evenly distributed, and access was equitable (69.8%). Chi-square test($\chi 2$) indicated a significant relationship between distribution of urban tree canopy cover and gender (0.041), age (0.002), and education (0.024). The study revealed that socioeconomic characteristics are associated with distribution of tree canopy cover. Policymakers should prioritize public awareness, education, and environmental justice in urban climate policies.

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## South African cities, urban planning and matters of urban forestry – A qualitative study

***Author: Rouve Bingle (PhD)[1]***
***[1]Stellenbosch University, Department of Global Health***

Trees are symbols of life and growth and have enjoyed a very long and historical relationship with humans across the world and in almost all cultures. Trees and its products have been part of the development trajectory of nations and are so significant that they have been anthropomorphised throughout the ages - they are often seen as a natural ally that crosses the human-nature divide. Although the socioeocological relationship between the two groups is ever changing and the role of nature has been weakened through modernist thought, trees are once again coming into focus but within an urban context. They are increasingly recognized for their importance to cities as they are able to provide a long list of ecosystem services. These services include environmental, economic, social and psychological benefits. This is especially important with regards to urban conditions, wellbeing and climate change mitigation. It can be argued that trees in cities are an undeniable resource that requires management and leverage to provide benefits for urban society. However, not all cities are the same and the decisions that shape them and their development is determined by a group of powerful built environment professionals. One such group is urban planners. They set the trajectory for the future of the city in terms of land use decisions – they make space for trees. Issues around availability and access to the urban forest should therefor be important to urban planners, especially as it is used as natural infrastructure to enhance the liveability of the city. South African cities have a long history of tree planting, but the concept of urban forestry is not yet widely adopted. This qualitative study explores the perceptions of urban planners regarding trees of cities and its practices. Such insights create deeper understanding in how and why our South African cities are created the way they are and allude to why some spaces have more trees compared to others. It can further contribute to discussions around "tree equity" and issues of environmental justice for urban residents.

## Availability and quality of public parks in the seven new cities of Uganda

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A study was conducted 2022 to comprehend the Urban Green parks situation in Uganda's newly gazetted cities i.e. Arua, Gulu, Mbale, Jinja, Masaka, Mbarara and FortPortal. The findings were intended to help start a public dialogue on protecting and safeguarding parks including urban forests for public parks and enable the city population to harness the health and social benefits through increased tree shade, air quality, water conservation, wildlife diversity, and recreation. Data was collected using two methods: (1) A systematic observation of the parks to determine the available public parks, and green cover, and (2) Interviews with 86 active open spaces users (n=25 female, n= 61 male) and residents living with within a radius of 1,200 metres of the study park neighbourhood. The study identified 109 parks across the seven cities. Only 30% of the parks had green spaces. Trees were the most common source of shade in the green spaces of 57% of parks, playgrounds of 49%, paths of 52%, and bordering streets of 60%, and 6% of non-park users said increased tree cover would attract them to visit. Parks have ample space which should be used to increase forest cover.

*Keywords: air, dialogue, health, plant, safeguard, trees.*

# Parallel Session 3.3

*Growing knowledge: Urban forests as classroom*

## Prospect to achieving equitable urban tree canopy distribution in Ibadan Metropolis, Oyo State, Nigeria

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## Grow-a-classroom project to expand urban canopy in public schools in Kenya

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Many public schools in Kenya face numerous challenges, including dilapidated classrooms, poor ventilation, compromised infrastructure, and vulnerability to land encroachment. Additionally, any of these schools have large tracts of bare land that are poorly landscaped, further reducing their potential to provide a conducive learning environment. These adverse conditions have led to a decline in admissions in many public schools across the country. AAK started the Grow-A-Classroom project to enhance learning environments in public schools nationwide. This project focuses on three main activities: 1. Developing new master plans for the schools: These plans showcase the planned layout and future expansion of the schools, ensuring well-organized and sustainable Growth. 2. Appropriate landscape planning: This includes planting a variety of tree species, such as timber, ornamental, and fruit trees, to improve outdoor learning experiences and the overall school environment. 3. Creating a sustainable cource of timber: By planting and nurturing timber trees, the project ensures a renewable source of construction materials to build and improve classrooms, contributing to long-term infrastructure development. This model can be replicated in the 35,000 primary and 20,000 secondary schools across Kenya's 47 counties. The project aims to achieve several significant impacts: 1. Enhanced learning environments: Proper landscaping and the use of mature timber from the trees to build classrooms and furniture create a sustainable source of materials, improving the quality of education. Schools can base their short-term and long-term development projects on the master plans to ensure that they develop sustainably. 2. Environmental stewardship: The project promotes a holistic approach to education and environmental care by fostering a culture of tree planting and nurturing in schools. This initiative contributes to increasing Kenya's tree cover, which currently stands at 12%. 3. Climate Mmtigation: Increasing tree cover within schools helps absorb more carbon from the atmosphere. The resulting carbon credits can be traded on the global carbon market, providing an additional revenue stream for the schools. This project is currently ongoing in four schools across the country whereby the master plans have been developed, and tree-growing exercises have been undertaken. Our goal is to landscape approximately 300,000 acres of land across 55,000 schools over the next 10 years. This project focuses on building partnerships with local businesses and organizations to undertake the activities to expand this initiative across Kenya.

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## Knowledge transfer, a useful tool to sustain Africa's urban green spaces: A systematic review approach

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Globalization and its associated knowledge-based economies driving many developments in the world today makes knowledge transfer an alternative tool to rely on to address many challenges confronting urban green spaces, but this remains a grey area on green spaces in Africa. This study sought to assess how knowledge transfer can be used as a tool to sustain Africa's urban green spaces. The focus was on Africa with knowledge transfer contextualised as transfer of information, practices and experiences on a given phenomenon (in this case green spaces) between two or more entities. The study utilised the systematic review approach and from the initial search of 287 publications, a total of 148 publications were utilized. The inclusion criteria focused on publications that centred on one or more of the following aspects on green spaces; planning, design, finance, maintenance, monitoring and evaluation. Based on the challenges affecting green spaces in Africa, it was found out that effective knowledge transfer can take place through a well-designed process. This process among other things should focus on avenues to identify and collect knowledge, capture and store knowledge, transfer and share knowledge, apply and measure the knowledge acquired, and lastly create new knowledge. For this process to operate well in Africa, it is recommended that there should be knowledge-based infrastructure in place to facilitate easy transfer, knowledge transfer plan, enabled environment to encourage exchange of ideas, and efforts to control cultural and socio-economic differences that may act as impediments for smooth knowledge transfer to take place.

*Keywords: Africa, globalisation, green spaces, knowledge transfer, socio-economic.*

## Schoolyards as urban forests in Niamey city, Niger: A study of species diversity and ecosystem services

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Urban green school environments play a major role in urban biodiversity conservation. Although many studies focus on urban forest diversity and values, this study focuses particularly on the diversity and functions of green schoolyards which are unforgettable urban forest models in the literature of urban forestry in West Africa Sahelian cities. We used purposive and quota sampling methods for data collection in the schoolyards 10 primary, 10 secondary and 10 tertiary schools) in Niamey city. Forest inventory and ethnobotanical survey were used for urban school tree species diversity and its values. The study recorded 62 tree species, Azadirachta indica (58.40%) and Fabaceae as dominant families across the different school types. There were more exotic tree species (53%) than local tree species in schoolyards in Niamey city. The fruit trees represented 42% (26 species) of the total tree species recorded. The stem tree density was 74 stems/ha in the school environment in Niamey. While the carbon density is 31.77 t/ha. The tree species diversity varied significantly ($H = 5.81$ $DF = 2$ $P = 0.055 < 0.05$) from the primary, secondary and tertiary schools in Niamey. We identified that the school management planted tree species for shading purpose, ornamental, food, school temperature regulation, and biodiversity conservation, climate change mitigation, for vehicle and motorcycle parking, recreational activities and for educational purposes. The study recorded some disservices such as the destruction of school infrastructure by some trees such as Terminalia mantaly and invasion of neem, which is threatening some plants such as mango from field discussion. The key urban forestry management recorded in the schoolyards are irrigation, pruning, and surveillance of planted trees and protection of the forests. The study recommends the use of food tree species in urban school environments for school feeding and nutrition, which are central to quality education. The key practical implications of tree species diversity recorded in the schoolyards are botany education for the students, shading benefits, fruit production, native tree species conservation, carbon conservation and beauty of the school. Furthermore, the future creation of school environments in Niamey must augment the use of indigenous and multipurpose tree species to improve the quality of the learning environment.

*Keywords: green school, urban tree values, urban forest, urban forestry education.*

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## The green ambiance: advocating for green spaces through urban school compounds in Kayunga district, Uganda

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Urbanization in Uganda is accelerating at an alarming rate of 4.5% per annum, bringing serious concerns such as increased pollution and reduced green spaces. A 2022 study pilot study by Kichini Gardeners, among 30 students, revealed that urban communities have limited green spaces with many converted to private property or buildings. This trend affects both youth and children (8-24 years), who already have limited spaces for interaction and self-reflection, resulting in reduced opportunities for stress alleviation which can have a severe long-term influence on their mental health. The Green Ambiance project aims to transform urban school compounds into thriving green spaces, where students can experience the restorative power of nature. The primary goal is to empower students for green space preservation, ensuring equitable access to healthy school environments. We collected qualitative data through participant observations and open interviews with 20 students to assess attitudes toward green spaces. We adopted a hands-on approach and engaged 30 students in growing fruit and ornamental trees, flowers, and shrubs within their school compound while educating them about trees' ecological and health benefits. Participants reported increased relaxation and social interaction during breaks, with the green spaces as a connecting point. Even though most urban communities lack free access to green urban parks for recreation, creating green spaces on school grounds would fill the void. We continue to campaign for greener spaces in urban environments, especially in schools to improve the well-being of all students and eventually advocate at the policy level.

## Initiative Pour l'Arbre: Une initiative des jeunes pour l'éducation à la foresterie urbaine au Niger

***Sakina Mamane Bawa[1]***

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Les jeunes jouent très important pour la promotion de la foresterie urbaine. C'est ainsi que l'initiative Pour l'Arbre a été mis en place en 2021 dans les 8 régions du Niger dont le but principal est de stimuler un esprit écocitoyen pour le développement de la foresterie urbaine ai Niger basé sur la participation de la jeunesse. Une enquête, observation des activées terrain et une revue de littérature ont été fait pour la collecte de données. Les résultats de notre étude révèlent que l'initiative Pour l'Arbre a fait plus de 200 sorties de 2021 à 2024 et plus de 10.000 plantations d'arbres plantés sur le long des boulevards, dans les écoles, les centres de santés, les camps de réfugiés sur toute l'étendue des villes du Niger. Les principales activités de l'initiative sont la plantation, éducation environnementale et entretien des arbres tous les dimanches. Elle est implantée dans les 8 régions du Niger avec à son actif plus de 1000 bénévoles amoureux de l'environnement qui s'attellent chaque semaine à mettre en place les activités de cette initiative. Par sortie, on note 32,5 % des jeunes filles et des 67,5 % des garçons. Les implications pratiques des activités de cette initiative de jeunes du Niger est l'éducation de la foresterie urbaine pour la lutte contre les effets du changement climatique et la conservation de la biodiversité en milieu urbain. Cette étude recommande la prise en compte des activités de l que l'initiative Pour l'Arbre dans les projets et programmes au Niger pour une prise en compte durable des activités des jeunes telles que la Contribution Déterminée au Niveau National.

*Mots clés : Foresterie urbaine, Engagement écocitoyen des jeunes, Education de la foresterie urbaine, foresterie communautaire a base des jeunes.*

# Parallel Session 3.4

*Contagion:*
*Transmitting healthy practices for public health and wellbeing*

## Examining Landfills as Sources of Invasive Plant Species and Associated Public Health Risks, in Gauteng Province, South Africa

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Invasive alien plant species (IAPS) represent one of the most pressing environmental and public health challenges in urban ecosystems, with landfills serving as critical pathways for their spread. In Gauteng Province, South Africa, rapid urbanisation and poor landfill management create conditions conducive to the proliferation of invasive plants. These species, often thriving in nutrient-rich, disturbed soils, disrupt native biodiversity, alter soil composition, and create dense plant cover. The cascading effects include reduced air and water quality, habitat loss, and compromised food security. Invasive plants also heighten allergen levels, exacerbating respiratory issues, and disrupt ecosystems that control disease vectors. Despite their impacts, the health implications of IAPS spreading through landfills remain understudied. This study systematically investigates the health and ecological consequences of invasive plant species in Gauteng's urban landfills. Field surveys will document invasive species present at these sites, while the Generic Impact Scoring Scheme (GISS) will assess their health-related risks. This framework enables a rigorous evaluation of each species' potential to harm human health, directly linking ecological disturbance to public health outcomes. To advance understanding, the study incorporates Species Distribution Modelling (SDM) to predict the future spread of these invasive plants into surrounding areas. This predictive approach integrates land-use patterns, climate data, and species-specific traits to identify high-risk zones for health impacts. The findings aim to bridge the gap between urban biodiversity management and public health policy. By quantifying health risks associated with invasive species and forecasting their spread, the study provides actionable insights to guide integrated management strategies. These strategies prioritise ecological restoration and health risk mitigation, contributing to sustainable urban development. This work underscores the critical need for multidisciplinary approaches addressing ecological integrity and human health. By revealing the hidden risks posed by invasive plants in Gauteng's landfills, the study positions invasive species management as a cornerstone of urban sustainability efforts.

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## How urban redevelopment is transforming public health in Addis Ababa, Ethiopia: lessons learnt from the green legacy initiative and corridor development

***Ledet Muleta[1]***
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Urban forests and green spaces are essential for creating sustainable and healthy cities. This study examines how two major urban development initiatives in Addis Ababa—the Green Legacy initiative and the Addis Ababa corridor development project—are influencing sustainability and public health. The Green Legacy initiative, launched in 2019, is a nationwide reforestation campaign that has resulted in the planting of over 32 billion seedlings, improving air quality and urban biodiversity. The Addis Ababa corridor development project, initiated in 2024, integrates green infrastructure with transport improvements, aiming to enhance mobility, reduce emissions, and provide healthier public spaces. This research, conducted between December 2024 and February 2025, investigates the extent to which these initiatives contribute to environmental and public health improvements. Using a mixed-methods approach, the study employed surveys and structured interviews with residents, urban planners, and government officials to assess the impact of green infrastructure on air quality, mental well-being, and active lifestyles. The findings reveal that while these initiatives have brought measurable benefits, challenges such as funding constraints, coordination issues, and community resistance have required adaptive planning and stakeholder engagement. By examining lessons learnt from these projects, the study provides insights for policymakers and urban planners on integrating green spaces into city development strategies. The research concludes with recommendations for scaling up similar initiatives to enhance sustainability and public health across rapidly urbanising cities in Africa.

*Keywords: biodiversity, mobility, resilience, public health, sustainability, well-being.*

## Urban residents' perceptions of access to health clinic gardens for well-being in the North-West province, South Africa

***Nanamhla Gwedla[1,2]; Sarel Cilliers[1]***

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***[2]Department of Environmental Science, Rhodes University***

Community gardens like health clinic gardens provide opportune spaces for access to various ecosystem services. Ongoing research in the North-West province, South Africa, indicates that there is greater uptake of the health gardens initiative in the province. However, little is known about their accessibility to the public. The aim of this study was to assess the potential of health clinic gardens to deliver ecosystem services for well-being, and their accessibility to the public in the North-West province. Primary methods employed include household surveys which were administered to 80 households in proximity to a health clinic garden with a willing member of the household. Key results indicate that 88.2% of respondents believe that health clinics should have gardens attached to them, and the dominant themes in support of this centred on supporting the sick and vulnerable with more than just prescription medication because "nature heals", and to provide plants that will make the environment aesthetically pleasing. A total of 83.8% of respondents indicated that health clinic gardens are not accessible to the public. Furthermore, 78.8% of respondents reported that they had never harvested anything in aid of their well-being from the health clinic garden closest to them. No respondent mentioned having gained knowledge about gardening practices through the health clinic gardens which they could then use to develop their own gardens. Health clinic gardens are well positioned to enhance ecosystem service provision and general well-being at the community scale. However, they are not used to their full potential in terms of knowledge up-scaling in the cultivation and use of plant species as a supplement of primary healthcare and food security issues. More intent engagement with stakeholders involved in health clinic gardens can improve their accessibility and render them spaces of social learning.

*Keywords: accessibility; ecosystem services; health clinic gardens; knowledge up-scaling; well-being.*

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## Climate resilience for Hyderabad metropolitan area of India and public well-being by sustainable management of urban reserve forest ecosystems

***Chandrashekar Reddy Gopidi, Forest Development Corporation***

Modern urban life style is associated with chronic stress, insufficient physical activity and exposure to anthropogenic environmental hazards. Urban green spaces which I call as natural multi speciality hospitals promote mental and physical health and reduce morbidity and mortality in urban residents by providing psychological relaxation and stress alleviation, stimulating social cohesion, supporting physical activity, and reducing exposure to air pollutants, noise and excessive heat. Hyderabad Metropolitan (HM) city is endowed with many urban forest reserves. Expansion of the city is making these urban forest reserves getting choked in concrete jungles and impacting health of its people. The climate change is further impacting the delivery of Urban Forest Ecosystem Services (UFES) to its ten million population and their health.Sustaining the fundamental ecological functions by restoring the hydrology, soil nutrient recycling, soil moisture availability and reducing fire incidents is a fundamental requirement for sustenance of urban forest reserves. Works are taken up for reducing the impact of biotic interference from cattle and removal of invasive species. For improving the biodiversity and the structure and health of the forest the climate hardy species are planted in gap areas in reserve forests and efforts are made for rejuvenation of existing rootstock in degraded forests. The visitors foot fall also studied and a questionnaire is given to the visitors to get the data on their feedback. The urban forest reserves development for its ecosystem services is equivalent to building a multi-speciality nature hospital where people from the neighbourhood can visit for morning and evening walks and spend their leisure time, the absence of these shall make people visit to the multi speciality medical hospitals for frequent health checkups because of ill effects of urbanization on health of people. Developed almost 100 reserve forest blocks and people are lining up in these places and are willing to pay for UFES as it is ensuring vibrant health for them and helping in socializing with the people. Therefore, conserving, restoring and sustainable management enabled these urban forest ecosystems adapting to the changing climate which in turn ensured Hyderabad city public, good health. Many of these developed urban forest reserves are attracting 500-5000 people per day and are visiting as they are conscious of their health and wellbeing and serving as places for environmental education and awareness.This is a paradigm shift in protecting urban forest ecosystems for public good with people willing to pay for services in the form of entry fee. This is invested back in the same areas for further development. This has developed a sense of ownership among visitors for protection and conservation.

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## The impact of homelessness in public open spaces. Case study in City of Johannesburg, South Africa

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Homelessness is a complex and pervasive issue that affects millions of people worldwide. It is defined as the condition of not having a stable, safe, and adequate place to live. It is a distressing social problem that demands urgent attention and compassion. Public open spaces are designed to be used by communities for recreation purposes, it becomes a challenge when these spaces are transformed to be used illegally as sleeping areas and no longer function as recreation areas. Communities tend to avoid using these spaces as they become crime areas and base of all social issues. This study examines the complex issue of homelessness within the urban landscape, highlighting the growing population of individuals without stable housing in the city, driven by a combination of factors including economic instability, lack of affordable housing and mental health issues. The research explores the spatial patterns of homelessness across different regions, and the challenges faced by homeless individuals in accessing basic needs like shelters and the potential interventions aimed at social support programs and addressing the underlying causes of homelessness within the city. Quantitative method including structured questionnaires to gather information on demographics, housing history, employment status, health conditions and access to services were used. GIS mapping: Visualising the geographic distribution of homeless individuals and service locations using GIS to identify patterns and hotspot.
Findings indicate that homelessness is most prevalent in Region F (inner city), followed by region B, C, and E, primarily due to the availability of part-time job opportunities. This is still an ongoing study.

*Keywords: Homelessness, public open spaces, impacts, mental Health, communities, poverty, population, socio-economic, policy implications.*

# Parallel Session 4.1

*Greening the margins: Urban forests in informal settlements*

## Community-led ecosystem-based adaptation planning in river restoration initiatives in urban informal settlements, Kenya

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Climate change poses a significant risk to human health in Africa, with marginalized urban poor populations facing the greatest vulnerabilities. Rising global temperatures disproportionately affect informal settlement dwellers, whose homes, often constructed from heat-trapping materials, exacerbate heat-related illnesses. Additionally, their proximity to water bodies increases exposure to extreme weather events such as flooding, leading to injury, displacement, and long-term health complications, including psychological distress. Limited access to healthcare, clean water, sanitation, and proper waste management further compounds these challenges, increasing the spread of waterborne and respiratory diseases. This research aims to challenge conventional river restoration paradigms and demonstrate the health and wellbeing benefits of contextualized river ecosystem and biodiversity restoration strategies for empowering local communities and addressing urban environmental injustices. The study employs a Community-Based Participatory Action Research approach, engaging over 200 riparian groups in Mathare, Nairobi County through community profiling, risk assessments, and asset mapping, with qualitative and quantitative analysis to assess environmental and health indicators. Gender, inclusivity, and equity are central to this initiative, ensuring the participation of women, youth, and marginalized groups in leadership and decision-making. Community health promoters play a key role in implementing adaptation strategies that directly address health vulnerabilities. The project also integrates an Ecosystem-based Adaptation Planning model, which enhances solid waste management, river riparian rehabilitation, and ecosystem greening. By fostering partnerships between community groups, government, and policymakers, this research contributes to climate-resilient infrastructure and policy development. Scaling such interventions can strengthen health systems and improve the well-being of informal settlement residents across Africa.

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## Climate justice and informal trader's access to urban green spaces in Windhoek, Namibia

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Rapid urbanisation, climate change and the loss of urban green space pose significant challenges to self-employed informal traders. Street vendors disproportionately face increased climate-related risks that harm their productivity, income, access to infrastructure, trading hours, and customer footfall. Although urban green spaces provide important ecosystem services, urban planning often neglects the needs of street vendors, raising climate justice concerns. This article investigates the unequal climate risks affecting informal traders, the benefits of green spaces for their livelihoods, and the vital role of informal trade in Windhoek, Namibia's economy. Qualitative research, encompassing 56 semi-structured interviews, two focus groups, and participatory mapping in four markets, highlights green spaces as essential for informal traders to adapt to heat stress and flash flooding. Due to their accessibility, communal ownership, and affordability, green spaces provide benefits often absent in traditional infrastructure. Strategically planted trees improve pedestrian and transport routes, creating gathering points that support trade. The study proposes urban design strategies for inner-city areas integrating green infrastructure with informal trade activities, emphasising adaptation planning and moving beyond conventional formalisation. These insights can guide urban planners, ecologists, and developers in creating more inclusive, climate-resilient African cities that cater to the diverse needs of all urban citizens.

*Keywords: environmental justice, ecosystem services, green infrastructure, pedestrian movement, street vendors.*

## Exploring green infrastructure within low-income urban areas in two Nigerian cities

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Green infrastructure includes networks of natural systems and environmental features that support climate adaptation in cities. It holds potential for improving quality of life and the environment through harnessing benefits for people. We investigate the extent of green infrastructure available within low-income informal urban settings, and the various factors linked to their adoption in the Nigerian context. The study involved a survey across two slum neighbourhoods in Lagos and one inner-city slum neighbourhood in Akure, Nigeria – making a total of three neighbourhoods. Random sampling method was used to recruit adult residents, who represented their households, in each of the three areas. A total of 1435 residents participated in the survey. The study found that green infrastructure adoption within the informal neighbourhoods studied is generally low. Notable green infrastructure components at the household/dwelling scale within the areas are gardens, shrubs/grasses within 6m radius, creeping plants, trees within site, and green road verges. At the neighbourhood level, over 40% of residents live within 2km distance to a wetland, while only 4.79% make frequent visits to parks. Only 2.68% of these visits are done daily/weekly. Age, educational level, income and length of stay in dwelling/neighbourhood were significant socio-economic factors that affected availability of green features in the households. The result underscores socio-environmental disadvantages in the low-income areas across both cities. It echoes the need for greening interventions in these parts of the city. Practical strategies are needed but such must consider the socio-economic dimensions, especially economic upliftment of the poor. An example is incentivising residents towards develop green infrastructure in their dwellings.

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## Incorporating urban green infrastructure in informal settlement upgrading: A case of Baruti and Sigara sub-ward, Dar es Salaam, Tanzania

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The rapid growth of peri-urban settlements and urbanization is degrading ecosystems that provide essential services. Well-managed urban green infrastructure can mitigate stormwater impacts and improve climate resilience. However, research on integrating green infrastructure into informal settlement upgrading remains limited. This study examines its role in Kimara Baruti and Buza Sigara sub-wards, Dar es Salaam which experience flooding and heat stress. The objective of this study is therefore to investigate the ways green infrastructure can be mainstreamed in the informal settlement upgrading. Between 2021 and 2022, qualitative and quantitative data were collected using ecosystem service assessments (n=5), participatory mapping (n=2), household surveys (n=140), and key informant interviews (n=12). Analysis was conducted using content analysis, SPSS (v20), MS Excel, and NVivo (v12). Findings reveal that green infrastructure includes natural vegetation (23.2%), urban farms (20.4%), rivers and streams (18.3%), home gardens (14.8%), football fields (12.7%), and abandoned spaces (9.2%). Ecosystem services include food, fuelwood, fodder, and recreational spaces. Management of urban forest involves governments and communities through waste cleaning, farming, and tree planting. While challenges include boundary conflicts, funding shortages, limited land, political interference, and limited awareness. Urban green infrastructure contribution to settlement upgrading involves promoting multifunctional spaces, community participation; land uses connectivity and integrating green infrastructure into upgrading projects and action plans. Urbanising cities like Dar es Salaam need adaptive, inclusive and community-driven policies and practices for urban forests to thrive. Support from both the government and the private sector is essential to aligning urban forestry with climate action and settlement upgrading.

*Keywords: climate adaptation, ecosystem services, peri-urban settlements, settlement upgrading, urban forestry and urban resilience.*

## A systematic review of nature-based solutions for climate adaptation and mitigation in informal settlements in sub-Saharan Africa

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A paucity of understanding remains regarding how climate change affects the ecosystem services provided to urban poor dwellers. While the benefits of Nature-based Solution (NbS) are well-documented in affluent urban areas, research on its applicability in historically marginalised informal settlements remains limited, particularly in sub-Saharan Africa. This systematic review assesses the types of NbS, prevalent ecosystem services, barriers to implementation, key actors involved in the maintenance, use and governance of green infrastructure, and pathways for policy and practice. Using the PRISMA framework, a systematic literature review was conducted across Scopus and Web of Science. Articles were screened at title, abstract and full text level and analysed using predefined inclusion and exclusion criteria. Preliminary results reveal green spaces, wetlands, gardens, and parks as main types of NbS used to address various social, ecological, and cultural challenges in informal settlements. Communities, civil society organisations and public private partnerships are key actors implementing these initiatives. Green infrastructure in these areas is at risk of overexploitation, depleting natural capital. This review highlights the exclusion of urban poor communities, particularly women and youth in planning and implementation of NbS initiatives. Pathways for policymakers and planners to develop and implement greening initiatives for urban informal settlements, ensuring inclusive decision-making and equitable access to ecosystem services. Establishing partnerships between civil society organisations and the government are key to increasing access to financial mechanisms that enhance natural capital. Further research is needed to integrate natural adaptation frameworks into sustainable planning and climate adaptation strategies, particularly in urban poor settings.

*Keywords: ecosystem services, green infrastructure, informal settlements, green spaces, wetlands, key actors.*

# Parallel Session 4.2

*Guardians of the canopy:*
*The role of traditional and ecological knowledge, gender and youth*

## Community driven reforestation at the Buffelsdraai Community Reforestation Project, Durban, South Africa

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Globally, cities are increasingly vulnerable to climate change impacts, such as the extreme rainfall event witnessed in Durban in April 2022. Such events can impact human health, physical infrastructure, regional economies and local livelihoods. Those facing the real brunt are often in marginalized communities. To minimise impacts, eThekwini Municipality has initiated and implemented different initiatives to align with its climate change mitigation and adaptation strategies. One such initiative, the Buffelsdraai Community Reforestation Project aimed to restore indigenous forest on 560 hectares of old sugarcane farmlands. The site is within the buffer zone of the Municipality's largest regional landfill site, and the carbon sequestered is committed to an emissions offset associated with the 2010 FIFA World Cup matches in Durban. Restoration efforts were achieved through planting of indigenous trees, shrubs, and herbs with ongoing invasive alien plant control. Local communities benefited through tree-growing at home-based nurseries, as well as through employment for digging holes, planting trees on the site and other site management tasks. Since inception, the project has planted 1 059 455 trees in over 600 ha of land, offsetting nearly 40 000 tons of CO2 equivalent. Over 140 indigenous tree species were included, ensuring enhanced biodiversity, and improved ecosystem services such as water flows and erosion control. Despite the successes of the project, ongoing threats from invasive alien species, conflicting social and political priorities, and unpredictable funding remain challenges. Balancing the costs, benefits, and trade-offs of restoration efforts require ongoing re-evaluation.

*Keywords: Mitigation, restoration, climate change, adaptation, resilience.*

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## Fostering equitable access to health and well-being through traditional knowledge and conservation practices of the selected succulent plants in Same District, Tanzania

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Urban green spaces foster public health, well-being, and ecological balance. However, equitable access to these spaces and their benefits remains a challenge, particularly for marginalized communities in African cities. This study assessed traditional uses and conservation of succulent plants in Same District, Tanzania, with a focus on their potential contributions to equitable health and well-being. By examining traditional knowledge and conservation practices, the research highlights the socio-cultural, medicinal, and ecological value of succulent plants, aligning with the broader objectives of ensuring inclusive access to green spaces for sustainable urban resilience. Data were collected from 196 participants across five wards using semi-structured questionnaires, field observation and focus group discussions between August and September 2024. The study documented 21 succulent species within four key genera: Aloe, Kalanchoe, Euphorbia, and Opuntia. Results indicate that succulent plants are integral to local health systems, with 78% of respondents using them in treating different diseases such as malaria. Additionally, 45% reported their cultural significance in traditional rituals. Despite their benefits, succulents face multiple threats, including overharvesting (reported by 47%), habitat loss (35%), and climate change (18%). Conservation practices observed include selective harvesting (41%), and cultivation in home gardens (29%). However, gaps in knowledge transfer and resource access hinder widespread implementation of sustainable practices. This study highlights the importance of integrating ethnobotanical knowledge into urban planning to enhance equitable access to green spaces.

*Keywords: cultural significance, ethnobotany, medicinal plants, overharvesting, succulents, urban resilience.*

## Analyse des facteurs de succès d'une opération de restauration de forêts alluviales péri-urbaines au sud du Bénin

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Les forêts alluviales péri-urbaines du sud Bénin constituent un refuge pour la biodiversité des grandes métropoles cotières. Ces écosystèmes ont été degradés au cours du temps par des activités anthropiques et les changements climatiques.. . L'objectif visé par cette étude est d'expliciter les facteurs de succès de la restauration des forêts alluviales péri-urbaines.. La méthodologie utilisée a consisté à faire une analyse des forces, faiblesses, opportunités et menaces de la restauration des écosystèmes alluviales avec les acteurs du secteur forestier. Ces réunions ont permis de questionner au niveau des huit forêts, trente à cinquante personnes soit 310 personnes., une estimation de l'état de dégradation des forêts grace ausystème d'information géographique et télédétection en utilisant les applications SasPlanet, Google Earth et le logiciel ArcGis 10.8 a été faite pour définir les superficies à restaurer et les quantités d'arbres nécessaires .Trente-huit hectares de forêts alluviales ont été restaurés Les analyses ont révélé que la reconnaissance des terres communautaires, la proximité du fleuve et l'existence de règles de gestion coutumière sont des forces à l'action. Le faible suivi technique et la non-implication des populations autochtones à certains endroits en sont des faiblesses. L'implication du service forestier et des autorités communales pour des questions d'ordre financier et de durabilité, l'existence de plan de gestion participative par endroit et la disponibilité des communautés notamment les jeunes et les femmes pour la réalisation des travaux physiques en sont des opportunités. Les incendies non contrôléset les inondations prolongées en sont des menaces.

*Mots clés: Biodiversité urbaine, Refuge, degradation des forêts, populations autochtones, jeunes femmes, gestion coutumière.*

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*Translation*

## Analysis of the success factors of a riparian forest restoration operation in the suburban areas of Southern Benin

The peri-urban alluvial forests of southern Benin serve as a refuge for the biodiversity of major coastal cities. These ecosystems have been degraded over time due to human activities and climate change. The goal of this study is to explain the success factors for the restoration of peri-urban alluvial forests. The methodology used involved analyzing the strengths, weaknesses, opportunities, and threats related to the restoration of alluvial ecosystems with stakeholders from the forestry sector. These meetings allowed for discussions with thirty to fifty people at each of the eight forests, totalling 310 participants. A degradation assessment of the forests was made using geographic information systems and remote sensing tools, including SasPlanet, Google Earth, and ArcGIS 10.8 software, to define the areas to be restored and the number of trees needed. Thirty-eight hectares of alluvial forests have been restored. The analysis revealed that the recognition of community lands, the proximity of rivers, and the existence of customary management rules are strengths for restoration efforts. Weaknesses include poor technical monitoring and the lack of involvement of indigenous populations in certain areas. Opportunities include the involvement of the forestry service and local authorities for financial and sustainability purposes, the existence of participatory management plans in some places, and the availability of communities, especially youth and women, for physical work. Threats include uncontrolled fires and prolonged flooding.

*Keywords: Urban biodiversity, Refuge, Forest degradation, Indigenous populations, Youth, Women, Customary management.*

## Transforming communities and women through storytelling and urban greening in Johannesburg, South Africa

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”She Evolves: 1000 Stories, 100’000 Trees” is a pioneering tree-planting initiative that weaves the stories and life experiences of African women into the very fabric of transformative change. In collaboration with Johannesburg City Parks and Zoo, this unique approach addresses the social challenges facing African women amidst the profound impacts of climate change on communities across South Africa. This initiative brings women together to share their stories, plant trees, and forge unbreakable connections with each other and our planet. In light of the pressing social and environmental challenges confronting communities across South Africa, there is an urgent need to reconnect and strengthen our bond with land and nature. The widening disconnect between humanity and the natural world has contributed to global crises, exacerbating mental health challenges, social fractures, and economic disparity, while pushing the natural world toward a tipping point. These challenges are especially acute in urban and rural communities in South Africa, where women and children often bear a disproportionate share of the impacts. Our mission is to transform communities through environmental stewardship and by honouring the significance of our lived experiences. By linking women’s self-determination with environmental action, She Evolves drives holistic societal change, rooting each story in a global tree of community, resilience, and care for our planet.

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## We plant trees for our lost brothers” - synergies between youth-led climate change adaptation and environmental justice activism along the Nairobi rivers, Kenya

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In Nairobi, the capital of Kenya, low-income and informal settlements experience the effects of climate change first-hand. Colonial spatial planning has relegated the most vulnerable population to ecologically sensitive land along the urban rivers. Located on riparian land, these settlements are exposed to flooding and waste from polluted waterways. Compounding this vulnerability, youth in these settlements face systemic marginalisation through police violence. This presentation explores how youth in Mathare, one of Nairobi’s most marginalised urban areas, are forging solutions at the nexus of climate change mitigation, adaptation, and environmental and social justice. Drawing on the experiences of Mathare Social Justice Centre, it highlights their innovative approaches to environmental justice by creating green public spaces and urban forests along the urban rivers. It tells the story of how a tree-planting campaign, originally initiated to honour young men lost to gang and police violence, evolved into a space for youth to organise without fear of harassment. Tree planting was perceived as environmental work, and not activism, and the youth could organise and mobilise through urban greening activities. This initiative grew into a cornerstone of the young activists’ work, forming the foundation of a vibrant environmental justice network in Mathare. The network exemplifies the intersection of green public spaces and social justice in the case of Nairobi. The importance of this has only been magnified in the recent floodings. It demonstrates how climate change adaptation and urban greening in urban areas can become vital tools to abolish systems of oppression while prefiguring alternative and more just futures.

# Parallel Session 4.3

*Pamoja: Participation, collective action and citizen science*
*Guardians of the canopy: The role of traditional and ecological knowledge, gender and youth*

## Transforming urban air quality: Green infrastructure strategies for Hawassa City, Ethiopia

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In Ethiopia, the potential benefits of urban green infrastructures remain largely underutilized due to inadequate coverage, poor planning, and limited awareness among planners and policymakers, which hinders its effective integration into spatial planning. This study aims to evaluate the effectiveness of green infrastructure in improving air quality in Hawassa, Ethiopia, by quantifying air pollution removal, its monetary value, and biogenic volatile organic compound emissions using a customized i-Tree Eco model. Air pollution removal and monetary values were estimated using tree metrics and externality values assigned to each pollutant, respectively. We stratified land use types and sample plots were randomly distributed to collect the required data for running the model. Our study reveals that Hawassa's green infrastructures remove 274.2 tons of pollutants annually, valued at $1.79 million, with SO2 being the most and CO the least removed pollutants. The highest removal occurred during the dry season, when dry deposition is higher than in the rainy season. Conversely, urban trees emitted 35.78 tons of volatile organic compounds annually, with exotic trees being the highest emitters. Our research highlights the need to update existing green spaces by ensuring their integration at both the master plan and implementation stages. This can be achieved by replacing tree species that degrades air quality with a carefully selected mix of broadleaved native and ornamental exotic species that are more effective in removing pollutants. By highlighting the dual role of green infrastructures, this study offers valuable insights for planners and policymakers seeking to integrate them effectively into spatial planning.

*Keywords: Green infrastructures; air pollution removal; economic values; biogenic volatile organic compounds; i-Tree Eco model; urban areas.*

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## The impact of green infrastructure on air pollution and respiratory health in Antananarivo, Madagascar

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Urban expansion and increasing air pollution present significant challenges to environmental sustainability and human health, particularly in rapidly growing cities like Antananarivo, Madagascar. However, no studies have examined the influence of existing green infrastructure on the city's air quality. While green spaces and parks are increasingly recognised for their potential to mitigate air pollution, empirical evidence remains limited regarding their effectiveness in reducing pollutant dispersion and deposition in low-income, rapidly urbanizing contexts. In Madagascar, road transport and charcoal-based cooking account for 80% of indoor and outdoor air pollution that cause an estimated of one to three deaths annually. This study investigates the impact of green infrastructure on air pollution levels, specifically Particulate Matter 2.5, and their potential roles in reducing respiratory diseases in Antananarivo. A mixed method was used, including (i) analysis of Normalized Difference Vegetation Index from remotely sensed data alongside air quality measurement from six sensors managed by the Madagascar's Meteorology Service, (ii) examination the relationship between respiratory disease incidence and air pollution, and (iii) assessment of local perceptions of green infrastructure's role in well-being through semi-structured interviews. By addressing the gap on green infrastructure in the Global South, this study provided critical evidence on its contribution to enhancing ecosystem services such as encouraging walking, cycling and outdoor recreation, improving public health, removing carbon dioxide, protecting and linking habitats. Findings aim to inform future urban planning decisions to foster greener mobility and sustainable energy alternatives which could improve quality of life in Antananarivo, and other cities across sub-Saharan Africa.

## How greenspaces are used and accessed to limit to COVID-19 infection in South Africa

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There is growing evidence of the benefits of greenness to human health in the context of the COVID-19 pandemic, but the pathways through which greenspaces build resilience against infection and severity remain speculative. This study aimed to determine i) whether greenness provision or exposure influences COVID-19 infection rates and severity, ii) the determinants of greenness exposure, and iii) the socio-demographic factors influencing infection rates and severity. Data were collected from 1367 residents across South Africa, including socio-demographic parameters and COVID-19 infection and severity. Greenness provision was measured using the Enhanced Vegetation Index derived from Moderate Resolution Imaging Spectrometer satellite data, and three Structural Equation Models were fitted to analyse the data. Results showed that COVID-19 infection rates and severity were significantly lower among individuals using greenspaces for physical activity, indicating that greenness exposure—rather than provision—is a key pathway connecting greenspaces to human resilience against COVID-19. Age, education level, and perceptions of greenspaces were found to predict greenness exposure, suggesting that simply increasing greenspaces does not guarantee their use by residents. This study highlights the pathways linking greenspaces to human resilience against COVID-19, as well as the mediating and moderating factors influencing these relationships, providing valuable insights for designing and implementing greenspaces in the context of pandemics.

*Keywords: enhanced vegetation index, greenness, exposure, pandemic, provision, resilience.*

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## Energy access and firewood dependency in Windhoek's informal settlements, Namibia: Implications for biodiversity conservation and sustainability in Namibia

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Rural-urban migration contributes to the mushrooming of informal settlements in the city of Windhoek. Most residents live in marginal areas in the Northern and North-western parts of the city. Frequent flooding due to impacts of climate change worsen their plight. Energy is their main challenge because the city does not provide electricity in informal settlements. The extent to which energy challenges may contribute to deforestation and biodiversity loss in the city is largely undocumented. A household survey was administered, and one focus group discussion (FGD) conducted in each of the three selected areas in informal settlements, namely, Goreangab (survey, n=95, FGD, n=12), Havana (survey, n=96, FGD, n=10) and Okuryangava (survey, n=97, FGD, n=11) in April 2019, to investigate energy sources and institutional arrangements regarding regulation of energy sources. The study revealed that the firewood which they use is either bought from vendors (53%.8) or collected (28.5%) from surrounding vegetation. About 51.2% of respondents travelled for no more than 5kms to collect firewood, while 44%, between 5 and 10kms and only 5% travelled for more than 10 km. Firewood was collected either as dry wood (54.9%), fresh wood (8.5%) or both (37%). About 51.2% who collected firewood for cooking, reported a decline in available trees while 41.5% noted an increase in the distance to collection points. Households were not aware of the regulation to obtain wood collection permit from the city of Windhoek. This study highlights the ecological implications of firewood use, particularly its impact on local biodiversity, and underscores the need for improved energy access, sustainable resource management and accelerating formalization of Windhoek's informal settlements.

*Keywords: City of Windhoek, deforestation, energy sources, households.*

## Peri urban mangrove forests and adjacent communities' perception of the degradation impact on livelihoods in Tudor Creek, Mombasa, Kenya

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Urban ecological systems are intertwined with social dynamics that define development and human aspects such as settlement, food and livelihood. Degradation rate of mangroves in Tudor creek was at a rate of 5.1 % yr-1 due to indiscriminate and uncontrolled harvesting over the past decades. This affected the adjacent communities. Urban green spaces like mangroves provide fish and invertebrates, source of livelihood and other vital ecosystem services that benefit people and nature. Their degradation therefore has implications on livelihoods and the environment. This study examined how gender relations informed mangrove use, development challenges that affected the creek and communities' perception of the ecosystem's future. Using the ODK Collect toolkit, household survey data was collected in five villages with 30 semi structured questionnaires each. Three focused groups of women, fishers and youth within the creek were also conducted. Using analysed data from SPSS, women are more confined to inter-tidal space collecting invertebrates and fuelwood. While men engage in fishing, the decrease in fish size and species is widely reported. Although community awareness on mangrove importance has improved over time, alternative options for mangrove products are limited for this community. This is evident by mangrove cutting, often associated with men. Over 80% of respondents confirm greater forest cover in the next three decades if conservation efforts shall be maintained. In conclusion, resource use varies by gender although the impact of degradation has implications to the whole community. A participatory management plan is therefore recommended to reinforce community efforts in its forest governance.

*Keywords: ecosystem degradation, gender, urban futures, SPSS.*

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## Agri-silviculture adoption key drivers in KwaZulu Natal, South Africa: A community-driven approach

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Agri-silviculture combines and integrates crops and trees managed on the same farm. Key contributions of agri-silviculture include) producing multiple products such as food, vegetables, fruits, fodder for livestock, firewood, timber, and leaf litter for organic manure production;) sustaining and improving crop productivity, which increases farmer income; improving the nutritional value of animal feed by supplying green fodder; and recycle soil nutrients, which also reduces the need to buy chemical fertilizers. However, there is a need to unlock its potential, through improved data collection to better understand the extent and impact of existing agroforestry systems, enhanced knowledge sharing to promote best practices and disseminate information effectively to farmers & communities in KwaZulu Natal, South Africa. The study aimed to identify and describe the key drivers of agrisilviculture system adoption. The major objective was to identify and describe the socio-economic characteristics of agri-silviculture system community growers (ASCG). Quantitative and qualitative designs were used as a questionnaire written in English, and stakeholder discussion and field observations were part of the data collection. A purposive and snowball sampling techniques were used to select community growers in KwaZulu Natal (2 districts, 4 local municipalities and 12 villages) and data was collected in 2023 – 2024. Results show centers of excellence should be established as lead research agents in agroforestry systems, conducting research on technical, social, environmental and economic elements of agri-silviculture systems focusing on shared learning and participatory action research. The results indicated that the majority of the agri-silviculture community growers had no access to extension service and training. Extension services have an important role in assisting farmers and communities to acquire new technology, skills, innovation and production advice. Hence, the study identified research, extension services and training as key drivers for agri-silviculture system adoption. and tackling the key factors that determine participation of the communities is essential for the adoption of agrisilviculture system. Hence, it is recommended that agrisilviculture practice should be intensified in South Africa as it contributes to food security, income generation, market access and sustainable communities' livelihoods.

*Keywords: agrisilviculture, extension services, training, research and community development.*

# Parallel Session 4.4

*Con air: Prospects for enhancing air quality*

## Citizen science for the management and early detection of invasive alien plants: Kloofendal Nature Reserve, Johannesburg, South Africa

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In South Africa, the management of invasive alien plants is typically undertaken in large, protected areas. However, most urban protected areas managed by municipalities lack the capacity and funds to record and manage invasion by alien plants. This paper reports on the role of citizen scientists in recording and controlling alien plants and the methods used in Kloofendal Nature Reserve. Alien plants were identified through surveys, with the species names and locations recorded using the GPS Essentials Application and eradicated using mechanical and chemical methods in collaboration with the Johannesburg City Parks and Zoo. A total of 58 alien plant species from 28 plant families were recorded in Kloofendal Nature Reserve. The most recorded life forms were trees and shrubs. Approximately 140,765 individual plants belonging to 58 alien plant species with many species removed in the year 2024 (n = 49,071) and 2023 (n = 23,798). The most removed life forms were shrubs (n = 77,452), herbs (n = 11,769) followed by trees (n = 10,883). Most species (n = 41, 68%) were listed as category 1b in the South African National Environmental Management: Biodiversity Act 2004 (Act No. 10 of 2004) Alien and Invasive Species Regulations with the most removed individual plants (n = 90,806) belonging to this category. This study underscores the importance of stakeholder engagement in managing invasive alien species in urban protected areas, as shown in the Kloofendal Nature Reserve. This research offers a scalable model for African countries to enhance biodiversity conservation through collaborative governance.

*Keywords: biological invasions, conflicts of interests, citizen scientists, environmental regulations, invasive alien species management, stakeholder engagement.*

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## The potential of participatory citizen science for assessing ecosystem services in urban forests in support of multi-level decision-making

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The importance of forests for the provision of ecosystem services is uncontested. Urban forests are predominantly intensively used by various stakeholders, who benefit from these services. Monitoring these services' availability is key to discuss sustainability, planning and management measures, and for decision-making. To our knowledge no comprehensive information on cultural services exists hindering planning and management. Scholars show that approaches, such as citizen sciences, defined as the voluntary participation of individuals in research projects in collaboration with experts, has potential to support this assessment. We investigated how citizen science was applied to assess ecosystem services and based on this information, collected professionals' opinions and attitudes regarding society's integration in the assessment. We performed an exploratory literature review (53 documents selected) to identify applied participatory approaches using "year of publication", "case study location", "ecosystem services addressed" and "stakeholders addressed" as selection criteria. Eighteen semi-structured interviews with practitioners and experts (e.g., nature conservation, education) were conducted to explore how and to what extent the interviewees applied the ecosystem services framework and to gain insights into their opinions and attitudes towards participatory approaches. Interview data was analysed using qualitative content analysis. This research reveals that society's active integration in ecosystem services' assessment and monitoring would foster the transition to more sustainable and healthier urban forests and raise society's awareness of the importance and maintenance of urban forests. Additionally, this would create a data basis for multi-level decision-making on planning that represents and combines opinions and voices of experts and society.

*Keywords: assessment, cultural services, monitoring, participatory approaches, sustainability.*

# Parallel Session 5.1

*Lion's share: Equitable finance and local economic development for African prosperity*

## Climate-proofing Cameroonian cities of Douala and Yaoundé: Leveraging climate finance for resilient and sustainable infrastructure

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Climate change poses significant risks to African cities, exacerbating vulnerabilities related to extreme weather events, temperature rise, and erratic rainfall patterns. In Cameroon, rapid urbanisation in Douala and Yaoundé has outpaced infrastructure development, increasing exposure to climate hazards. This study examines the role of climate finance in enhancing urban resilience through investment in sustainable infrastructure. Using a mixed-methods approach, including spatial risk assessment and financial feasibility analysis, this research evaluates innovative financing mechanisms such as green bonds, public-private partnerships, and international climate funds. Key findings highlight the importance of context-specific risk assessments leveraging geographic information systems and remote sensing to prioritise interventions. The study also identifies barriers to accessing climate finance, including limited institutional capacity and misalignment with national development frameworks. Recommendations focus on strengthening financial readiness, fostering multi-stakeholder collaboration, and integrating climate resilience into urban policy agendas. The findings have broad implications for urban sustainability in Africa, advocating for policy reforms that embed climate-proofing in development planning. By mobilising resources effectively, Cameroon can establish a scalable model for climate-resilient urban infrastructure, ensuring equitable and sustainable growth.

*Keywords: adaptation, climate resilience, equity, financing mechanisms, infrastructure, urban policy.*

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## Unlocking Nairobi's urban forests: Economic opportunities and public-private partnerships for a resilient future in Nairobi, Kenya

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The urban forests in Nairobi, Kenya, are important ecological resources that address critical environmental issues and provide economic and ecological value. This study aimed to identify the financial opportunities of urban forestry based on case studies of public-private partnership agreements to finance sustainable conservation and regeneration projects. Several barriers to the effective enhancement of urban forestry programs included underfunding, policies contradicting other policies, and the underwhelming participation of stakeholders in most programs. This research used economic analysis, policy analysis, and a survey of stakeholders on urban forestry initiatives and governance financing. The study found that urban forests in Nairobi are under-utilized for economic value such as eco-tourism, selective logging or carbon offset schemes. The study involved a comparative analysis of successful Public-Private Partnership (PPP) models in New York and Singapore, to identify those scalable strategies that can be adopted in Nairobi. The presented policy recommendations aimed at improving the governance of urban forests and providing tax incentives for developing the private sector's interest and in the continuous intersectoral collaborations for conservation initiatives. The involvement of communities in the implementation of the urban forestry programs, with an emphasis on gender and involving the youths as a way of equal distribution of the benefits through the implementation of the urban forestry programs, is crucial. The research emphasized inclusive and gender-sensitive community engagement, particularly through youth-led initiatives, to ensure equitable access to the benefits of urban forestry. The findings underscore the urgent need to unlock the economic potential of Nairobi's urban forests while maintaining a focus on environmental resilience. A combination of innovative financing mechanisms, traditional resource mobilization strategies, and corporate social responsibility initiatives is vital to promote the sustainable development and expansion of urban forests in Nairobi.

*Keywords: ecological resilience, economic opportunities, Nairobi, public-private partnerships, sustainable financing, urban forests*

## Willingness to pay for ecotourism in Maradi and Tibiri-Gobir cities in Niger based on green spaces valorisation

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Urban biodiversity is a growing area of interest in the fields of environment and urbanization. It is based on the resources of plant and animal species present in urban areas, as well as the complex interactions between species and their environment. In Niger, in urban municipalities such Maradi and Tibiri-Gobir, biodiversity presents interesting potential to study. In these two areas, urbanization (8,3% in 2001) and population growth (3.9% per year in 2012) are increasing rapidly at an exponential rate, which is causing a decrease in natural resources. Despite these challenges, there are opportunities to develop green spaces and promote ecotourism in these cities. Furthermore, plant diversity constitutes an opportunity for developing traditional medicine to which urban citizens are increasingly resorting. The objective of our work is to characterize biodiversity in the different green spaces of the two agglomerations and explore their potential for developing ecotourism activities. The adopted method involved exploring Google Earth satellite images to identify other green spaces outside of those designated in the land registry and overlaying the land registry map to visualize other potential green spaces. Then a survey was conducted in the two cities to identify the perception of city dwellers on the green spaces and their willingness to pay for ecotourism activities. A total of 432 individuals were sampled in the two cities using the random method on the basis of National Population Census of 2012 extrapolated to 2024. Nine green spaces exist in the two cities. In each green space, transects were drawn, along which large 50m x 50m plots were delimited. Then, dendrometric measurements were taken on woody species. The average density of woody plants, the coverage, and the basal area of all green spaces were calculated. The results showed that there are 521 individuals distributed across 4 woody plant species in 4 families. Azadirachta indica represents 94.8% of the total number of woody species found. Eighty percent (80%) of respondents are willing to pay 2700±5500 to have access to green spaces for ecotourism. There is a great variability according to the area of residents. However, the residents of Tibiri-Gobir are willing to pay up to 20000 of which the residents of Bouzou Dan Zambadi (Maradi) are willing to pay only 675 to have access to green spaces for ecotourism. Given the importance of biodiversity, these green spaces have the potential to host an ecotourism sector that could benefit local communities economically and culturally, while also promoting the protection, conservation, and sustainable enhancement of natural resources.

*Keywords: biodiversity, google earth, green spaces, ecotourism, Maradi, natural resources.*

## A socio-economic valuation of green spaces in Nairobi, Kenya

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Urban green spaces are vital for the sustainability and well-being of rapidly urbanizing cities. With urban densification and socio-economic disparities presenting significant challenges, the availability and quality of these spaces are increasingly under threat This study explores the use, perception, and socio-economic dynamics of urban green spaces in Nairobi focusing on how these areas contribute to environmental sustainability, human well-being, and social cohesion. Through a combination of quantitative and qualitative methods, the study evaluated the value of urban green spaces through willingness to pay for their maintenance and improvement. Landsat imagery and a random forest classifier were used to map the preferred areas used in urban green spaces. To estimate both the perceived value and actual economic benefits that green spaces provide, the simulated market approach of Contingent Valuation Method and the non-demand-based market value approach of cost-saved was used. The findings of the economic assessment of the use of urban green spaces underscored the cost efficiencies and willingness of users to invest in their enhancements, thereby emphasizing the economic significance of green spaces. The urban green spaces provide cost-effective recreational options that benefit low-income communities by improving access to physical activity, reducing healthcare costs, and fostering equity in health and well-being. Policymakers should prioritize the integration of urban green spaces into urban planning strategies by ensuring equitable access to these areas across all socio-economic groups. Green spaces should be seen as key components of climate resilience, providing natural solutions to mitigate heat islands, reduce flooding, and enhance biodiversity. To support economic development, municipalities should explore innovative financing mechanisms such as public-private partnerships, green taxes, and community donations, which can help fund the creation and maintenance of high-quality urban green spaces.

*Keywords: Accessibility, Climate resilience, Economic development, Equity, Green spaces, Urban planning.*

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## Urban forests for human well-being and climate change action. A case study of Giraffe Centre Sanctuary.

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Green spaces in urban localities are a growing concern in the 21st century, the communities interacting with these spaces have shared high concerns on the need to conserve and enrich urban forests to ensure sustainable development. The study is a unique case of inclusion of wildlife habitat at African Fund for Endangered Wildlife (AFEW-Kenya) - Giraffe Centre, in a green space at the suburbs of Kenya's capital city. The sanctuary offers tranquility of ecosystem goods, services and a home to breeding of endangered Rothschild giraffe while creating adventure to thousands of tourists visiting the Centre annually. At the core of the conservation efforts, emerging environmental problems have not only led to forage decline but also increase in invasive plant species within the sanctuary. This study aims to identify environmental challenges that impact the management of the sanctuary, profile the activities that attract visitors to the sanctuary and recommend best practices and potential interventions to address nature-based emerging issues in the study area. A survey was administered to key informants, visitors and focused group discussions were held. Key informants provided information on advantages and disadvantages of having AFEW-K in this area as compared to other green spaces within the city. The visitors informed the reasons and frequency of their visits to the area. The focus group discussions validated the data collected, added into emerging issues and proposed recommendations for the study. Literature on the study area and urban forestry status were also reviewed. The findings revealed biodiversity loss, pollution and minimal human disturbance as main environmental concerns. The sanctuary has witnessed an increase of 10% in the number of new and recurrent visitors to the Centre in the past five years. It recommends progressive enrichment planting of indigenous tree species in disturbed areas to address biodiversity loss, maintain ongoing waste recycling activities and promote public-private partnerships in urban forestry activities. The study will inform policies on urban green spaces within the country.

*Keywords: Green spaces, sanctuary, urban forest, environment, sustainable.*

## The business case for butterfly sanctuaries in urban forests: A case study of Ghaa, Madagascar and South Africa

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Urban growth threatens biodiversity, especially butterfly life. Sustainable conservation solutions are essential to maintain ecological balance and protect ecosystems. This paper proposes the construction of butterfly sanctuaries in South African urban forests to integrate conservation with economic sustainability. Using case studies from Ghana, Tanzania, Kenya, and South Africa, this paper argues that butterfly sanctuaries – though still in their infancy in Africa – can create financially independent, and self-sustaining income streams, providing benefits to communities, and governments. The case of the Bobiri Forest Reserve and butterfly sanctuary shows potential for international tourists. Evidence from Tanzania, Kenya, Madagascar suggests that butterfly farming mitigates climate change, provide a source of income for government and society, and add to urban biodiversity. In Tanzania, more than 1200 farmers shifted from deforestation to butterfly farming. Butterfly breeding centres may also be incorporated in urban design through collaborations with construction policy institutions such as the construction industry development board These benefits highlight opportunities for the rapidly growing African urban regions, to balance development biodiversity.

*Keywords: biodiversity, butterflies, conservation, ecotourism, sustainability, urbanization.*

# Parallel Session 5.2

*Ubuntu and the urban forest: Governance of nature-based solutions*

## Towards a blue - green Infrastructure master plan for Kampala, Uganda.

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Urban green spaces are critical for the sustainability of urban environments. However, urban green spaces are diminishing over the world as a result of growing urbanization. The conversion of urban green spaces has resulted in the fragmentation of habitats for wildlife species, resulting in a loss of ecosystem services. However, research suggests that habitat connectedness is critical for socio-ecological stability. This assessment looked at the biodiversity and socio-ecological dynamics in the Kampala Capital City Uganda. The study examined species distribution, species diversity, and socio-ecological views, resource consumption, and the influence on both local wildlife and human health. The timed-species counts and bio-dispersal model was employed in 16 sample spaces comprising urban tree patches, parks, wetlands and water fronts for ecological mapping of key habitats Citywide. Key informant interviews, 5 focus group discussions, and 2 validation workshops with local stakeholders including residents, environmental managers, and policymakers were conducted. The findings indicated severe habitat fragmentation; 108 species were recorded with a high proportion of singletons. Furthermore, the Balearica regulorum, Psittacus_erithacus, and Xerus erythropus (African ground squirrel) being species of conservation concern are thus termed flagship species. Kampala has a diverse bird population that lives in a variety of environments, with certain species identified as conservation concerns. The birds in Kampala ecologically constitute a “Metapopulation” that requires managing their habitats at a landscape level with emphasis put on establishing biodiversity corridors and associated stepping stones. Development of a Blue and Green Infrastructure Master Plan is needed for the conservation of these vertebrate species to enhance human wellbeing in the city and beyond and should thus be fast tracked to enhance and conserve biodiversity reservoirs in the city.

*Keywords: conservation, ecosystem services, habitats, green spaces, urban biodiversity.*

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## Socio-economic and institutional factors influencing the success of ecosystem-based adaptation interventions in Nyagatare District, Eastern Rwanda

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Ecosystem-based adaptation ( is a vital strategy for addressing climate change by integrating nature solutions to enhance resilience and mitigate challenges such as poverty and biodiversity loss. In Nyagatare District, climate change-induced hazards such as dry spells, storms, and water scarcity threaten social-ecological systemst. Through initiatives such as the Least Developed Countries Fund (LDCFII) project, the Rwandan government implemented ecosystem-based adpatation measures to build resilience at the district level. However, understanding the socio-economic and institutional factors that influence the success of these efforts is crucial for improving climate adaptation, safeguarding local livelihoods, and ensuring the long-term sustainability of the community. Here, a cross-sectional study design was used, and quantitative data were collected from 420 households in the Nyagatare intervention area in August 2024. A structured questionnaire was used to collect data, including socio-economic and institutional factors influencing the success of the EbA intervention. Cross-tabulation was used to find statistical significance, and logistic regression helped to elaborate meaningful conclusions about the factors influencing the success of EbA in Nyagatare District. The study revealed that the most prevalent implemented intervention among others was fencing paddocks with drought-tolerant trees at 90.1%, and participants confirmed this successfully at a rate of 82.51%. In multivariate logistic analysis, provision of financial incentives (AOR:3.16, 95% CI: 1.01-7.86), training and capacity building (AOR:4.33, 95%CI: 2.32-58.88), community engagement (AOR:32.49, 95% CI: 4.68-125.53), and the presence of monitoring systems (AOR:7.57, 95% CI: 2.47-27.08) were found to be significantly associated with the successful of Ecosystem-based Adaptation interventions in the Nyagatare district.The study assessed the factors contributing to the success of Ecosystem-based Adaptation interventions in Nyagatare District and reported a success rate of 82.51%. The results revealed that the factors that influenced success include financial incentives, capacity building, and community engagement. Further research on ecological factors in Nyagatare is recommended.

## Urban green infrastructure and nature-based solutions in three rapidly growing cities of Tigray, Ethiopia

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Characterizing urban green infrastructure and nature-based solutions is important for urban biodiversity conservation, ecosystem services, and climate change adaptation. Yet, the challenges and opportunities for urban green infrastructure and nature-based solutions in rapidly growing cities are not well understood. The study aimed to assess urban green infrastructure status, and typologies, nature-based solutions and identify the key challenges at Aksum, Mekelle, and Shire-Indasilassie, representatives of rapidly growing cities in Tigray, Ethiopia. We conducted 33 key informant interviews (16 females and 17 men) with interdisciplinary regional urban greenery, planners, and knowledgeable stakeholders. We also conducted site visits using detailed checklists and reviewed the historical master plans, development plans and the ongoing structure plans of the cities. The qualitative data was analysed using descriptive and content analysis. Parks, mountain green frames, riverside green, roadside green, conservation areas, and urban agriculture are the identified green infrastructure in the cities. Decision-makers and communities lack of awareness, absence of laws and directives, conversion of urban green infrastructure to grey structures, shortage of finance, lack of tenure, species diversity, and limited research have been the challenges in the development, management, and governance of urban green infrastructure. Urban activism and practicing social learning would be essential to improve the quantity and quality of urban green infrastructure across the cities in line with technically supported and socially accepted local solutions to climate change. Decision-makers and planners should place urban green infrastructure and nature-based solutions at the forefront of their day-to-day decisions to better manage urban green infrastructure to maximize people and climate resilience benefits.

*Keywords: climate change adaptation, governance, management, species diversity, typologies, urban beautification.*

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## A human rights-based approach to mainstreaming nature-based solutions: Lessons from the urban natural assets programme in Bo City, Sierra Leone and Cape Coast, Ghana

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The last decade has seen an exponential rise in Nature-based Solutions literature and global recognition as a pathway to address biodiversity loss and foster equitable and sustainable economies. Nature-based Solutions are considered an effective approach to transforming development trajectories towards nature-positive development, and building resilience to climate change, while halting biodiversity loss and ecosystem degradation. Still, nature-based solutions need to be continually tested in practice, particularly for implementation at scale. Since 2014, the Urban Natural Assets programme, implemented by ICLEI Africa, has worked with 10 African cities to address challenges in protecting and revitalizing their urban natural assets. Through data driven multi-stakeholder approaches such as learning labs, creative exhibitions and tinkering with nature, where co-production was central, the UNA programme has collaborated with communities, practitioners, researchers and other stakeholders to mainstream Nature-based Solutions into city planning and decision-making processes. Undoubtedly, achieving socially equitable outcomes is key to successful Nature-based Solutions, necessitating the integration of a Human Rights-Based Approach at all levels. This session will showcase ICLEI Africa's human rights-based approach methodology and share lessons from its application in Bo City, Sierra Leone and Cape Coast, Ghana. It will reflect on the challenge of inequality in achieving effective natural resources management and highlight the role Nature-based Solutions governance, planning and finance play in the progressive realisation of human rights. It offers the opportunity to evaluate current planning processes and advocates for a holistic understanding and response to intersectional vulnerabilities in the pursuit of just and equitable urban environments.

*Keywords: capacity building, climate change, equity, intersectionality, mainstreaming, nature positive development.*

# Parallel Session 5.3

*The green mile:*
*Monitoring and mapping changes in the urban canopy*

## Evolution of Urban Green Spaces in Nairobi's Langata Constituency Using Sentinel-2 Imagery and Machine Learning

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Urban green spaces have been considered significant in moderating urban temperatures, improving biodiversity, and enhancing air quality, thus playing a vital role in climate change mitigation and adaptation. Despite this importance, urban green spaces are under tremendous pressure in African cities due to rapid urbanization, population growth, and changing land use. This study has sought to map and quantify the changes in urban green spaces within Langata Constituency, Nairobi, Kenya from 2019 to 2023, using Sentinel-2 MSI imagery developed with Random Forest Machine Learning classifiers.It considers the application of vegetation indices like NDVI and EVI with regard to time changes in urban green spaces. The results show not only a dynamic relationship of processes between urban development and accessibility of green spaces but also pinpoint areas of significant loss that, at the same time, represent opportunities to be restored. In some aspects, the accuracy of classification reaches an overall value of up to 98.6%; thus, underlining from this perspective, too, the robustness of the techniques provided by remote sensing and their machine learning algorithms to ensure monitoring of urban ecosystems efficiently.This contribution toward the broader agenda of climate-proofing African cities was based on how this study framed green spaces as integral climate resilience tools. Its findings provided actionable insight into urban planners and policymakers, prioritizing strategies to integrate, restore, and conserve urban green spaces. This is a vital pathway toward improving the state of climate resilience in Nairobi and ensuring that sustainable development is achieved within the presence of climate change.

*Keywords: city green spaces, climate adaptiveness, remote sensing, Sentinel-2, urban forestry, machine learning.*

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## The role of digital tools in supporting urban forestry and environmental governance between 2019-2024 in Gauteng Province, South Africa: A systematic review

***Neggie Bakwunye[1] and Boikanyo Herman[2]***

Despite the growing recognition of digital technologies in enhancing environmental governance and urban forestry (henceforth interchangeably used with environmental service delivery) their effectiveness and application remain inconsistent (Schwartz, 2019; Le Roux & Jacobs, 2020). Environmental service delivery- a provision of essential environmental services—such as waste management, pollution control, and biodiversity conservation—by governments and stakeholders to promote sustainability and uphold environmental rights (UNEP, 2019; World Bank, 2020; OECD, 2021). In South Africa, it is framed by Section 24 of the Constitution (Republic of South Africa, 1996) and the National Environmental Management Act (1998), which mandate sustainable and inclusive environmental management (DEA, 2020). By highlighting current gaps, constraints, and opportunities, this study provides insightful information about how digital technologies can improve environmental decision-making and policy implementation. It also discusses the pressing necessity of incorporating digital technologies into urban forestry projects. This area remains underexplored in environmental governance discourse despite its critical role in climate resilience and sustainable urban development. Following the PRISMA guidelines, this study systematically reviewed 85 peer-reviewed documents sourced from Scopus, Google Scholar, and Web of Science. To ensure scientific rigor, the selection procedure was guided by the Population, Intervention, Comparison, Outcome, and Study Design (PICOS) framework. Studies lacking relevance, methodological quality, or falling outside the specified timeframe were excluded. To strengthen validity, the screening process cross-referenced findings with existing literature to identify inconsistencies and contextualize insights within broader environmental governance and digital tool implementation. Key findings indicated that GIS and data management systems significantly improved environmental data accuracy and resource allocation. Challenges such as budget constraints, digital literacy gaps, and inadequate infrastructure in some areas limited their impact. Mobile applications were found to enhance public engagement by enabling real-time reporting of environmental issues, although accessibility and digital skills posed barriers to broader participation. The research recommended increased investment in digital literacy training, infrastructure improvements, and financial resources to fully realise the potential of digital tools in environmental management. Addressing these challenges would allow Gauteng to strengthen its environmental service delivery, contributing to sustainable and responsive environmental practices across the province. The findings provide valuable insights for policymakers and environmental agencies interested in integrating digital solutions into environmental governance.

*Key words: digital tools, environmental governance, geographic information systems, service delivery, urban forestry.*

## An analysis of tools, policies, and actions for reducing environmental disparities

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Promoting equitable access to green spaces, especially for disadvantaged communities, is becoming increasingly crucial due to the growing inequalities and health implications of climate change. Low-income communities and vulnerable groups of citizens often live in urban areas with limited access to green spaces, being exposed more to the negative effects of urban heat islands and pollution. It is critical to ensure that these groups have equal opportunities to benefit from the positive effects of green spaces. To move toward more sustainable and equitable cities, tools such as the "3-30-300 rule", or studies such as the Tree Equity Score, can be useful in guiding equitable distribution of urban parks and gardens. However, there is a need to adopt a new paradigm of thinking, Nature- based Thinking (NBT), which considers the complex interaction between urban forests, nature- based solutions and the urban environment. Adopting participatory planning strategies is equally essential. Actively involving local communities ensures that green solutions are tailored to residents' needs and preferences. The objective of the presentation will be to identify data, policies, and up-to-date tools for monitoring and evaluating practices that can help reduce social inequities in the distribution of urban forests. By 2050, it is estimated that we could see an increase in population in the world's cities of about 2.5 billion. Of these, 2.25 billion, 9 out of 10 people, will be living in Asia and Africa. These continents will thus be instrumental in defining the urban transformation of the future. These projections, combined with rising temperatures and the increasing frequency of heat waves, raise a complex picture for urban action. The systemic issues of pollution, inequality, and health, exacerbated by the climate crisis, require to be addressed with an urgent and holistic plan of action. Governments, regions, and municipalities must take actions at multiple levels possibly covering all areas of intervention: from national and urban policies to strategic planning, from operation and maintenance to communication and awareness, involving all the sectors of the civil society (from politics to private). In cities where the projection of growth is bigger will be crucial to address urban planning with a focus on decongestion spaces to counter uncontrolled and poorly managed housing speculation, while working on strengthening climate-responsive landscapes, water management, blue and green infrastructures and inserting them into a wider Socio-Ecological framework. This approach offers significant opportunities for designing more sustainable, equitable, and healthier built environments.

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## Evaluating the balance between green space and urban infrastructure using google earth engine in Kigali, Rwanda

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Tree crown quantification and mapping are essential for better management of green resources and estimating the benefits of urban forests. Urban planners and land administrators require a quick and reliable tool to balance urban infrastructure and green spaces. Traditional methods, including field surveys and the use of black box software, are time-consuming, especially for large areas. The introduction of Google Earth Engine has facilitated access to various datasets, enhancing capacity to address environmental issues. Currently, the availability of very high spatial resolution remotely sensed imagery and automation algorithms provides the opportunity to delineate and map individual tree crowns within urban infrastructures. This study aims to map urban trees and their distribution, including tree canopies in Kigali City, using WorldView-2 imagery data, and to develop a remote sensing-based tool and method for continuous monitoring of urban trees. The Pan-sharpened image of WorldView-2 was used to improve information content. Two approaches were attempted: first, the Normalized Difference Built-up Index and the Normalized Difference Vegetation Index were computed and classified using the Random Forest classifier. A threshold was created from Normalized Difference Vegetation Index and Normalized Difference Built-up Index to discriminate between urban infrastructure and tree cover. Second, image segmentation on WorldView-2 was performed in the Google Earth Engine environment. The results from both approaches were vectorized, both provided equally good results. Tree crowns and canopy cover were accurately extracted with an overall accuracy of 99.70% and a kappa statistic of 0.9963. A total of 864,002 trees were counted and mapped. This study demonstrates a quick and accurate method for obtaining inventory data on individual and clustered trees. Such a database can be optimally used in urban planning, highlighting the importance of green spaces in urban clusters. Decision-makers in Kigali City can integrate GIS and remote sensing to monitor urban green spaces, providing more accurate data while saving time.

*Keywords: Canopy, NDVI, image segmentation, urban trees, remote sensing.*

## Evaluation of the design and management of urban parklands to render recreational and ecosystem services, South Africa.

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This study investigated how urban parklands can optimize recreational benefits for people while maximizing delivery of ecosystem services, whilst considering social preferences and aesthetics. A gradient of tree density was investigated: (a) open grassland, (b) open parkland with scattered trees and (c) closed-canopy tree stands. Triplet plots were replicated in four urban parks spread across different climatic regions. The density of tree vegetation in each triplet was assessed using stocking and basal area measurements combined with terrestrial laser scanning, to enable an estimate of the carbon sequestration potential of the vegetation in each treatment. The leaf area index of each treatment was determined using optical techniques and the fraction of seasonal radiation interception by canopies was calculated in each case. Temperature fluctuations and windspeed data were recorded in seasonal campaigns among all treatments in each triplet. Maintenance costs for vegetation types were obtained and a questionnaire was developed to test public perceptions and preferences about vegetation densities incorporated in urban park designs. Early results show that radiation interception ranges from 22 to 41% in open canopies and from 67 to 89 % in denser canopies. The effect of radiation interception is responsible for a cooling in temperature of 4 to 6 ˚C during the afternoon period of summer months. The tree canopy also traps long-wave heat radiation form land surfaces, thereby keeping minimum (pre-dawn) temperatures above that of open grassland. The final set of results will provide evidence-based guidelines (in terms of quantified ecosystem services) for urban park design and management.

*Keywords: carbon sequestration, climate regulation, fire risk, radiation interception, tree density, wind speed reduction.*

# Abstracts: Poster presentations

## Assessing urban forests' capabilities in mitigating heat islands: a comparative study of three Moroccan cities

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Rising temperatures, prolonged droughts, and water scarcity pose escalating challenges for North African cities. In Morocco, intensifying heat waves compounded by the urban heat island effect threaten urban health, liveability, and resilience. While prior studies have noted cooling effects of urban forests as a promising nature-based solution, yet their typology, size, location, and overall impact in mitigating excessive heat remain understudied. This study focuses on three Moroccan cities—Tangier, Rabat, and Marrakesh—selected for their distinct climatic zones, urban morphologies, and varied urban forest typologies. Through an integrative approach combining geospatial analyses (2015–2025) with a comprehensive literature survey, we assessed species diversity, tree health, canopy cover, and site location to determine the cooling potential of urban forests. Preliminary findings reveal that smaller urban forests dispersed throughout cities, as observed in Marrakesh, contribute more effectively to citywide temperature reduction. Meanwhile, urban forests in Tangier and Rabat reduce heat and improve air quality at a more localized scale. These results underscore the importance of planning strategies that account for topography, prevailing wind patterns, and urban form. They also suggest that repeated, smaller green spaces hold significant promise for rapidly expanding cities, offering an adaptable approach for mitigating the urban heat island effect. The study concludes with evidence-based recommendations for policymakers, urban planners, and environmental stakeholders seeking to implement urban forests as a climate resilience strategy in North Africa and beyond.

*Keywords: Nature-based solutions, North Africa, Moroccan cities, urban heat island, urban forests, urban resilience.*

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## Equitable Access to Health and Well-being: Building Inclusive Cities for All in Africa

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Rapid urbanization in African cities has created unprecedented challenges and opportunities to improve the well-being and quality of life for millions. As cities grow, disparities in access to essential services like healthcare, clean water, and green spaces contribute to a widening health gap, disproportionately affecting marginalized populations, including low-income families, the elderly, women, and youth. This poster explores a transformative approach to urban planning focused on creating equitable access to these vital services, aiming to establish African cities as spaces where everyone, regardless of socioeconomic status, can lead a healthy and fulfilling life. Through case studies from cities such as Nairobi, Johannesburg, and Accra, the presentation will showcase successful initiatives in accessible healthcare, safe housing, clean water systems, and the development of inclusive public spaces. These case studies illustrate how prioritizing equity in urban design can lead to measurable improvements in public health, safety, and social cohesion. Additionally, this study addresses innovative solutions for fostering mental health through green spaces and recreational facilities, which reduce stress, encourage physical activity, and strengthen community bonds. Policy recommendations include promoting integrated health and urban development policies, increasing investment in social infrastructure, and leveraging public-private partnerships to build community-centered facilities that are safe, accessible, and sustainable. This discussion is aimed at city planners, policymakers, and community leaders committed to reshaping urban environments to support physical and mental well-being for all. By focusing on equitable access, this work advocates for an urban future where health is a right, not a privilege, and cities become engines of well-being, opportunity, and resilience for everyone

## Urban Resilience in Algeria: Leveraging Forests, Green Spaces, and Biodiversity Strategies for Sustainable Cities

***Ferrah Imene***
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Urban forests, green spaces, and protected areas are essential for enhancing the resilience of cities, particularly in the face of climate change. In Algeria, these natural assets are becoming increasingly important for promoting environmental sustainability, improving public health, and fostering overall urban well-being. The forests of Algiers and the Lac de Réghaïa, a designated Ramsar site, are prime examples of how urban areas can integrate biodiversity conservation and climate resilience into urban planning. These sites contribute significantly to the environmental health of the region and provide vital resources for sustainable development. Algeria's Forest Law, Green Spaces Law, Environmental Protection Law , and the National Biodiversity Strategy (2017) all support the protection and sustainable management of these crucial natural resources. Urban forests, green spaces, and protected areas like the forests of Algiers and the Lac de Réghaïa Ramsar site are essential for enhancing urban resilience in Algeria. By investing in the conservation and expansion of these natural resources, Algeria can build cities that are more sustainable, resilient to climate change, and healthier for their populations.

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## Optimizing benefits of plant-based green infrastructure for human and ecosystem health, climate proofing and sustainable city landscapes in the humid tropics

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Urban green infrastructure plays a very important role for human comfort and health and that of the ecosystem, climate adaptation, conservation of biodiversity, improve carbon sequestration and reducing global warming and the sustainability of cities and landscapes. In particular, in the frame of climate change challenges, there has been increasing prominence for plant-based urban green infrastructure integration and climate stress amelioration in urban management. However, plant-based UGI is poorly developed in addition to poor adoption and appreciation to its implementation in tropical cities. Forest species, physiological functions and ecological attributes are important for regulatory services and benefits they play in enhancing human and ecosystem health in cities. The paper will highlight the relevance plant-based urban green infrastructure, their characteristics, ecological processes and physiological functions to sustainability and climate resilience of city landscapes. In addition, information will be provided on the characteristics of some urban park and street trees, such morphological (shading and tree water use) and physiological attributes, carbon stocks and sequestration potentials, biogeochemistry (C and N mineralization: evolution of CO2) and potential for climate amelioration. There are no adequate management guidelines and protocol for informed species selection, establishment, after care for plant-based urban green infrastructure development in tropical cities. The need to achieve sustainable tropical city landscapes, thus it is necessary to identify hindrances and bottlenecks to implementation and decision-making, increase interest and awareness and formulate policy and practice towards the integration of forest trees and urban green spaces (UGS) for mitigation of climate and future environmental threats

*Keywords: Biodiversity, climate, ecosystem, forests, sustainability, urbanization.*

## Gillooly's Farm – Public/private collaboration to revitalise an urban park in Johannesburg, South Africa

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Gillooly's Farm, situated in Bedfordview, Johannesburg, is a historically significant urban park, popular for its recreational spaces, natural dam, and biodiversity. However, years of neglect have led to infrastructure decay, environmental challenges, and diminished community use. This research investigates how public private partnerships (PPPs) can rejuvenate the park while addressing urban ecological challenges. Drawing from local and international case studies like Vattenriket in Sweden and Nirox Sculpture Park in Johannesburg, the study proposes a roadmap for revitalization. Key findings suggest that integrating green infrastructure, educational programs, and sustainable management models can transform the park into a hub for urban farming, ecological restoration, and inclusive public engagement. These efforts will promote biodiversity, improve local livelihoods, and offer long-term sustainability. This research underscores the role of PPPs creating resilient urban spaces that balance community needs with ecological preservation.

*Keywords: revitalization, Public-Private Partnership (PPP), ecological restoration, community engagement, green infrastructure, urban farming.*

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## The restorative power of trees – Healing trauma in Inner-City Johannesburg

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Johannesburg, South Africa, remains deeply scarred by the socio-economic inequalities and spatial injustices resulting from apartheid-era urban planning. These challenges are particularly evident in the inner city, where marginalized communities face a lack of access to restorative green spaces. This study explores the role of urban forestry and green space in addressing trauma, particularly for vulnerable groups such as women and children affected by urban precarity and gender-based violence. The research is grounded in principles of restorative urbanism, biophilic design, and the "15-minute city" concept, emphasizing equitable access to nature. A case study of El Kero Park illustrates how a collaborative, community-driven greening initiative transformed a neglected, high-crime space into a sanctuary that fosters social cohesion, safety, and mental well-being, particularly for women and children. The findings argue that tree-centred urban design not only mitigates environmental challenges but also serves as a critical tool for social justice and resilience in Johannesburg's complex urban landscape.

*Keywords: urban forestry, trauma recovery, biophilic design, social cohesion, spatial justice, community engagement.*

## Climate-Proofing African Cities: Strategies for building resilience and sustainability in the face of climate change in South Africa

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African cities are experiencing rapid urbanization, with an estimated 50% of the continent's population projected to live in urban areas by 2030. However, this growth is accompanied by increasing vulnerability to climate-related disasters, such as floods, droughts, and heatwaves. Climate-proofing African cities is crucial to building resilience and sustainability in the face of climate change. This study explores the challenges and opportunities of climate-proofing African cities, with a focus on the role of urban planning, infrastructure development, and community engagement. A review of existing literature and case studies from various African cities reveals that effective climate-proofing requires a multi-faceted approach that incorporates both physical and social infrastructure. The study identifies several key strategies for building resilience and sustainability in African cities, including: (1) integrating climate change into urban planning and policymaking; (2) investing in climate-resilient infrastructure, such as green roofs and flood-resistant construction; (3) promoting community engagement and participation in climate adaptation efforts; and (4) fostering collaboration and knowledge-sharing between cities and stakeholders. The findings of this study have important implications for urban policymakers, planners, and practitioners working to build resilience and sustainability in African cities. By highlighting the challenges and opportunities of climate-proofing, this research aims to contribute to the development of more effective and sustainable urban climate adaptation strategies in Africa.

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## Afro futurist perspectives on reforesting Johannesburg's inner city: The Drill Hall case study

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Our health is tied to our environments. Physical space is always socially produced and reflects the diverse needs, interests and beliefs of this who use it (Madeddu and Zhang, 2021). The history of African urban spaces is deeply rooted in coloniality and in South Africa, is still reflective of apartheid's divisive agenda that sought to stifle the development of black people. We are profoundly affected by our environment and our surroundings can help heal our spirits or to harm them (Dee, 2000), and our current experience of the inner city in Johannesburg is not conducive to healing. But what if our urban lifestyle could allow us to reap the urban dividend while being firmly rooted in nature and our indigenous lifestyle? In undoing the impact of colonialism and apartheid in our urban spaces, we need to be as intentional and act with more vigor than ever. Feng shui is China's vernacular approach to environmental planning. Each location or community needs to retrace its own vernacular planning tools and apply them in context. This paper seeks to present the principles of Feng Shui as useful tools for promoting urban wellbeing and consciously reforesting the city of Johannesburg. Apart from bringing spiritual and practical benefits, feng shui is also good design. The paper will use Drill Hall as a case study. Centered on African indigenous lifestyle practices such as composting, creative waste management, ancient preservation methods and community-led self-governance, the Drill Hall has become a leading example of how nature-based solutions can take centre stage in urban regeneration. Urban forests can become a tool for holistic healing. By using indigenous practices and planting indigenous trees, the Drill Hall contributes to creating a visual representation of what it means to be climate conscious in Africa. The Drill Hall demonstrates the transformative nature of plants and having them in buildings, especially neglected buildings in the inner city can improve safety, wellbeing and access to indigenous plants. Environmental planners have the responsibility to put the needs of nature and humans in balance, and Feng Shui is one of the tools to achieve this spatial harmony.

## Harnessing urban forests for local development in Nairobi, Kenya

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The rapid urbanization of Nairobi presents significant economic opportunities within its urban forest areas, paving the way for sustainable living initiatives. This study emphasizes that well-managed urban forests can evolve into vibrant centres for business development, addressing pressing urban challenges such as unemployment and environmental degradation. The research design integrates economic data analysis, policy reviews, and stakeholder interviews to assess urban forestry programs' sustainability and governance frameworks. Findings indicate that Nairobi's urban forests, particularly City Park, along with Karura Forest and Ngong Road Forest, hold significant potential as catalysts for eco-tourism development, the cultivation of small enterprises, and the creation of green employment opportunities. However, several barriers, including inadequate funding, ineffective policy structures, and limited stakeholder participation, hinder the realization of their full economic benefits. The study examines global urban forestry models, highlighting successful New York and Singapore programs, to pinpoint practical strategies that Nairobi can adopt. To establish Long-term conservation objectives, municipalities should enhance their governance systems and offer tax incentives to encourage private sector participation through grant programs. Equitable benefits from urban forestry necessitate community involvement, leveraging gender-sensitive and youth-focused approaches alongside inclusive engagement practices. The research findings highlight the urgent need to transform Nairobi's urban forests into valuable resources while enhancing environmental stability. To ensure the sustainable development and maintenance of Nairobi's urban forestlands, the study proposes targeted funding strategies through innovative financing methods and corporate social responsibility programs.

*Keywords: community engagement, economic development, Nairobi, public-private partnerships, sustainable financing, urban forests.*

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## Making Mali's urban forest profitable in the face of climate change

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Mali's cities, particularly Bamako and Ségou, are facing growing environmental challenges linked to climate change, including the increase in urban heat islands and the loss of biodiversity. Urban forestry represents an innovative solution to improve the resilience of local infrastructures and communities, while generating economic opportunities. This study aims to analyse the economic potential of urban forests by exploring the valorisation of non-timber forest products and the creation of green jobs. A mixed methodology was adopted, combining surveys of residents and economic players, a spatial analysis of green spaces and an assessment of forest resource value chains. The results show that urban woodlands can be made profitable through the production and marketing of products such as medicinal plants, wild fruits and essential oils, thus providing a source of income for local populations. However, lack of funding, the absence of a structured regulatory framework and weak private sector involvement limit the development of these initiatives. The study highlights the need to strengthen partnerships between local authorities, NGOs and private companies to ensure the economic and ecological viability of urban forests. Incentive policies and innovative financing strategies are recommended to encourage investment in urban forestry, thereby helping to combat climate change and improve the well-being of Malian city dwellers.

*Keywords: biodiversity, climate resilience, forest products, green economy, heat islands, urban forestry.*

## Urban forests as green infrastructure in Abuja, Nigeria

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Urban forests represent parts of the environmental infrastructures that play a central role in maximizing human and society wellbeing. The objective of this paper is to assess the provisions of urban forest as a source of urban green infrastructure and resilient facilities in Abuja. Field evaluation methods include the application of Normalized Difference Vegetation Index and Fussy distribution that was applied to quantify differences between near infrared and visible pixels in multi spectral remote sensing images for plots and vegetation areas. Urban street tree inventories and species enumeration was conducted while fuzzy membership distribution for vegetation and open spaces were employed to determine urban green resilience scenarios evaluated under ecological, social, economic and aesthetic dimensions. Results of specific areas in Abuja shows 69 tree species were identified, street view google photographs provides an innovative view in the development phases, urban green spaces and non-green spaces. However, the Normalized Difference Vegetation Index evaluation was presented for 2020 and 2015 phases. The calculated land cover types show green spaces (23.33%), non-green spaces (76.62%) considered under the urban plan phase I and phase II by the percentage of the study area. In the context of urban greening and resilience, the study advocate for a comprehensive urban forestry plan strictly implemented not only in Abuja but as part of urban and peri-urban African model cities in the mitigation of ever-increasing CO2 urban emission rate.

*Keywords: urban green, human society wellbeing, Abuja Nigeria, resilient facilities, Normalized vegetation Index; street view.*

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## Roots of opportunity: Growing South Africa's economy through urban forests

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In South Africa, urban forests have become a game-changing instrument for promoting environmental sustainability, community development, and economic progress. This study investigates how urban trees may work as multipurpose areas that combine economic opportunity, cultural preservation, and recreation. The research highlights important tactics for utilising urban forests to increase tourism, generate green jobs, and raise property values by using a mixed-methods approach that includes case study analysis and stakeholder interviews. The results show that urban trees may serve as gathering places for historical tourism, cultural festivals, and environmentally friendly events. They can also support local businesses and food trucks. Nonetheless, the report points up important obstacles, such as a lack of finance, noise pollution, and the requirement for efficient waste management systems. To overcome these obstacles, policy solutions are suggested, highlighting the value of community involvement, integration of renewable energy, and public-private collaborations. The study emphasises how urgent it is to expand urban forestry programs throughout Africa, emphasising gender inclusion, equity, and youth involvement. To guarantee long-term sustainability, suggestions include setting up recycling facilities, encouraging private sector participation, and creating finance mechanisms. By offering practical advice to stakeholders, practitioners, and policymakers looking to capitalise on the socioeconomic and environmental advantages of urban forests in South Africa and elsewhere, this study adds to the expanding corpus of information on urban forestry.

*Key words: urban forestry, South Africa, policy interventions, economic growth, environmental sustainability, and community development.*

## Exploring the challenges of urban forest management in Ekurhuleni informal settlements, South Africa

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Urban forests in Ekurhuleni informal settlements are crucial in climate resilience, biodiversity, and socio-economic well-being. However, their management faces challenges such as poor growing conditions, limited resources, development pressures, and a lack of public awareness. Climate change exacerbates these issues, causing extreme heat, vegetation loss, and increased risks to human health. Despite Ekurhuleni's potential in agriculture and forestry, policy execution, resource allocation, and community participation remain inadequate. This mixed-method study identifies barriers to urban forest management and proposes policy-driven solutions. Field observations will document environmental and infrastructural challenges, while structured questionnaires will collect data from 40 purposefully and randomly sampled forest workers and residents. Qualitative data will be analysed descriptively, and quantitative data will be statistically processed to reveal trends and patterns. The study explores gaps in urban forestry policies, emphasizing insufficient funding, weak enforcement, and conflicting land-use priorities. It advocates for integrating urban forestry into municipal climate adaptation plans, using remote sensing for monitoring, and fostering gender-inclusive and youth-led forestry initiatives. To ensure sustainability, the study recommends resource mobilization strategies, including public-private partnerships, community-driven afforestation, and international climate financing. Long-term success depends on collaboration between government agencies, NGOs, and the private sector. Strengthen urban forestry policy enforcement and implementation—secure diverse funding sources, including climate finance and municipal investment. Enhance community participation, particularly among youth and women. Integrate urban forestry into climate adaptation strategies. Utilize remote sensing and community-based monitoring.

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## Urban connectedness matters: why some schools excel and others struggle to engage with climate change response in Singida, Tanzania

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The capacity of schools in Tanzania to engage children and young people in climate change response varies significantly, with some excelling and others struggling to foster an atmosphere that inspires climate action. Understanding the dynamics and prerequisites that underlie different levels of climate change education and engagement is critical to efforts to enhance schools' role in the climate response. Using qualitative methods, we produced data through a peer research approach, focus group discussions, key informant interviews, and participant observations. We involved forty school-going children and young people, eight teachers, four school leaders, eight parents, and three district-level stakeholders. Through thematic network analysis, we identified that the closer a school is to urban locations, the more actively engaged it is in addressing climate change and deforestation. Specifically, we found that schools in urban or relatively close urban centers had better access to basic infrastructure and resources, engaged parents and communities, and enhanced networks and collaboration with strong change agents. This facilitated a better response to climate change issues such as urban deforestation and promoted urban forestry initiatives. These place-based resources created a conducive context for schools to facilitate students' climate awareness, agency, and action. The findings help explain differences in schools' capacities to engage children and young people in the climate response. They point to inequalities in schools' access to much-needed resources and the need to respond to resource needs such as building the structures needed, training and attracting engaged teachers, and funding innovative projects in rurally located schools to be able to respond to climate change impacts.

*Keywords: climate change, community collaboration, educational inequality, environmental awareness youth engagement, urban forestry.*

## Abuja and the economic practices of urban forest livestock production

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By applying a number of indigenous advancements in farming methods and techniques, the urban forests can be converted into healthier spaces. Is it possible to use urban forests for animal production while also empowering the local economy? Are there farmsteads and other economic activities? In the neighbourhoods near the Abuja Enterprises Agency (Jahi), Plot 75, Cadastral Zone B15, Jahi, Abuja, through observation, oral and photographic interviews, and agricultural excursions, this aided the young and old population in obtaining jobs, generating income, promoting social inclusion, and expanding livestock farming. The results show that different combinations of farming, forestry, and housing are used to feed the cattle and sheep, and around five farmers also build their own distinctive farm homes and earn a living. Mr. Sule, 32, has been claiming to produce livestock in the forest zones. By raising cattle and engaging in other agricultural activities, I was able to provide for my family, enhance my quality of life, and enable my kids to attend school. In order to ensure that urban forests are utilized and that projects have long-term success, this paper suggests urban policy intervention, overcoming the various challenges, opportunities, and barriers. Additionally, partnerships with corporations, government entities, and non-governmental organizations can help ensure that future research can serve as a model for other African nations.

*Keywords: Abuja policy, economy, forestry, farming, housing, indigenous.*

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## An analysis of the health effects and relocation of tree cutting for cooking in the gbessa community in the federal capital territory of Abuja, Nigeria

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Even though there are numerous studies that oppose the practice of cutting down trees for cooking, we were unable to locate any that examined the health effects of using firewood for cooking or whether the Gbesa community cuts down trees for cooking and whether their actions have any negative health effects. With the use of questionnaires, oral interviews, and visual aids, we examined fifty community members who were cutting trees, twenty-five residents who used fuel wood for cooking, fifty wood sellers, and one hundred commercial wood users .We went on to examine the literature review and, using questionnaires given to women in the 30- to 40-year-old age range, some of the children aged 12– 16 who collected firewood and conducted site visits to households. We learnt that the majority of forests are being hacked down for cooking fuel. For business objectives, like selling, and turning a profit. According to those interviewed, there is a chance to sell the wood and use it for cooking. because it has monetary value. We advise that this practice be discontinued, and that reforestation be done, even though there was no justification for the health issues and negative effects of cooking with firewood.

*Keywords: research, communities, vendors, and firewood.*

## Vers des Villes Africaines Résilientes : Stratégies pour renforcer la résilience Climatique, Burkina Faso

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Les villes africaines font face à d'importants défis socio-économiques exacerbés par le changement climatique, nécessitant une recherche urgente sur leur résilience. Cette étude a employé une méthodologie complète incluant l'analyse des politiques, l'engagement communautaire et l'évaluation des initiatives de foresterie urbaine. Les principales conclusions révèlent que les gouvernements locaux doivent développer des politiques de résilience climatique intégrées qui incorporent des systèmes d'alerte précoce et des infrastructures vertes, telles que des parcs urbains et la gestion des eaux pluviales. Ces mesures non seulement atténuent les impacts du climat, mais améliorent également la qualité de vie des résidents. La participation communautaire s'est révélée essentielle, avec des programmes éducatifs favorisant la sensibilisation et encourageant des pratiques durables parmi les citoyens, en particulier les jeunes et les femmes. De plus, les partenariats public-privé ont été identifiés comme vitaux pour mobiliser un financement innovant, tel que les obligations vertes, pour soutenir ces initiatives. Les résultats indiquent qu'une représentation équitable dans les processus décisionnels est cruciale pour une mise en œuvre efficace des politiques. Des mécanismes de suivi et d'évaluation sont nécessaires pour évaluer l'impact des interventions de résilience, garantissant transparence et implication de la communauté. Les implications de cette recherche vont au-delà des préoccupations environnementales ; elles soulignent la nécessité de politiques inclusives qui abordent l'équité, la jeunesse et le genre, tout en reconnaissant les défis uniques auxquels sont confrontées les villes africaines. En adoptant une approche holistique qui intègre des infrastructures durables, l'engagement communautaire et un financement adéquat, les villes africaines peuvent surmonter les défis climatiques actuels et promouvoir un développement durable pour les générations futures.

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*Translation*

## Strengthening climate resilience in Burkina Faso.

African cities face significant socio-economic challenges exacerbated by climate change, necessitating urgent research on their resilience. This study employed a comprehensive methodology that included policy analysis, community engagement, and evaluation of urban forestry initiatives. Key findings reveal that local governments must develop integrated climate resilience policies that incorporate early warning systems and green infrastructure, such as urban parks and stormwater management. These measures not only mitigate climate impacts but also enhance residents' quality of life. Community participation emerged as essential, with educational programmes fostering awareness and encouraging sustainable practices among citizens, particularly youth and women. Additionally, public-private partnerships were identified as vital for mobilising innovative financing, such as green bonds, to support these initiatives. The findings indicate that equitable representation in decision-making processes is crucial for effective policy implementation. Monitoring and evaluation mechanisms are necessary to assess the impact of resilience interventions, ensuring transparency and community involvement. The implications of this research extend beyond environmental concerns; they highlight the need for inclusive policies that address equity, youth, and gender, and recognise the unique challenges faced by African cities. By adopting a holistic approach that integrates sustainable infrastructure, community engagement, and adequate financing, African cities can navigate current climate challenges and promote sustainable development for future generations.

*Keywords: community engagement, green infrastructure, monitoring, public-private partnerships, resilience, sustainable development.*

## Analyse de l'intégration de changement climatique dans les planifications du développement de la Commune Rurale de Gangara (Région de Zinder).

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***Malam Abdou Moussa, Maître de Conférences***

Le plan de développement communal (PDC) est un outil de gouvernance territoriale sur lequel repose en grande partie les possibilités de financement et de partenariats d'une commune. L'élaboration de ce document programmatique, de pas quinquennal, se base normalement sur l'analyse des forces, faiblesses, opportunités et menaces. Les aléas climatiques sont l'une des principales menaces susceptibles d'anéantir les investissements pluriannuels de développement. Leur prise en compte dans les PDC est donc indispensable. Ce travail a pour objectif d'analyser l'intégration et le financement des stratégies d'adaptation aux aléas climatiques dans deux générations de PDC de la commune rurale de Gangara (Tanout). Pour ce faire, l'approche méthodologique se base sur i) la caractérisation des risques climatiques et agroclimatiques de la commune à travers l'analyse des données de la pluie, de la température et des vents, ii) l'analyse diagnostique des PDC à l'aide d'une grille d'évaluation de la prise en compte des aléas et des fonds de mitigation qui leurs sont alloués dans le budget quinquennal et iii) l'analyse des données qualitatives issues des entretiens avec les responsables et conseillers municipaux et les membres de l'observatoire de suivi de vulnérabilité (OSV).
L'analyse des données climatiques a mis en évidence une occurrence croissante des pauses pluviométriques dont la durée maximale peut atteindre 27 jours, ce qui est par ailleurs confirmé par les membres de l'OSV. C'est donc le premier risque qui affecte les productions agropastorales de la commune. Cependant, les deux générations de PDC n'ont ni évalué ni prévu de stratégie d'adaptation à cela. Aucun fonds de mitigation n'est prévu dans le budget de la commune, qui repose à 95 % du financement des partenaires. L'analyse de l'évolution des contenus des PDC a, certes, montré une amélioration de prise en compte des facteurs climatiques mais le non respect de gradient latitudinale de la pluviométrie met en doute la pertinence des informations climatiques. Pour bonne planification de l'adaptation, la commune doit compter davantage sur sa capacité propre en se basant sur les ressources naturelles productives de son territoire.

*Mots clés : changement climatique, planification, adaptation, PDC, Gangara, Zinder*

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*Translation*

## Analysis of the integration of climate change into the development planning of the rural commune of Gangara, Niger (French)

The municipal development plan (PDC) is a territorial governance tool on which a municipality's financing and partnership possibilities are largely based. The development of this five-year programmatic document is normally based on the analysis of strengths, weaknesses, opportunities and threats. Climate hazards are one of the main threats likely to wipe out multi-year development investments. Their consideration in the PDCs is therefore essential. This work aims to analyze the integration and financing of adaptation strategies to climatic hazards in two generations of PDCs in the rural commune of Gangara (Tanout). To do this, the methodological approach is based on i) the characterization of the climatic and agroclimatic risks of the municipality through the analysis of rain, temperature and wind data, ii) the diagnostic analysis of PDCs at using an evaluation grid for taking into account hazards and the mitigation funds allocated to them in the five-year budget and iii) the analysis of qualitative data from interviews with municipal officials and councilors and members of the vulnerability monitoring observatory (OSV). The analysis of climatic data has highlighted an increasing occurrence of rainfall breaks whose maximum duration can reach 27 days, which is also confirmed by the members of the OSV. This is therefore the first risk that affects the agropastoral production of the municipality. However, the two generations of PDC have neither assessed nor planned an adaptation strategy for this. No mitigation fund is provided for in the municipality's budget, which relies on 95% of partner funding. The analysis of the evolution of the contents of the PDCs has, of course, shown an improvement in the consideration of climatic factors, but the failure to respect the latitudinal gradient of rainfall calls into question the relevance of the climatic information. For good adaptation planning, the municipality must rely more on its own capacity based on the productive natural resources of its territory

*Keywords: Climate change, planning, adaptation, PDC, Gangara, Zinder.*

## Analyse sociologique des mesures d'adaptation contre des effets négatifs du changement climatique au Niger: cas de l'inondation de la ville de Maradi en Aout 2024

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Le Niger est l'un des Pays Sahéliens qui subit le plus, les effets graves du changement climatique tels que les sécheresses et les inondations qui perturbent la saison agricole. D'après une étude menée par le bureau de la coordination des affaires humanitaires, environ 100 000 hectares de terres arabes sont perdus chaque année en raison de l'érosion hydrique, entrainant la perte des cultures et de moyens de subsistance pour des milliers de ménages. La plupart des inondations surviennent durant la saison des pluies de juillet à septembre. En moyenne 35 000 ménages totalisant 200 à 300 000 personnes sont sinistrées chaque année. A cela s'ajoutent les dégâts et les pertes économiques sur les habitations, les champs, les jardins et les animaux. La présente recherche aborde la question du changement climatique au courant de la saison pluvieuse 2024 car cette année à enregistrée un record jamais connu au Niger. En effet, ce phénomène préoccupe la conscience des chercheurs et des organismes internationaux du monde entier, car ces effets négatifs du changement climatique occasionnent chaque année des sinistrés dans la majeure partie du Niger, avec des graves conséquences sur les conditions de survie de la population. Cette population sinistrée, est la première victime à être exposée des tous genres de risques. Ainsi, cette recherche a pour objectif d'analyser les mesures d'adaptations aux effets du changement climatique, sensibiliser la population sur ses effets néfastes et proposer des pistes à suivre pour limiter l'intensité des inondations dans les villes du Niger. Pour se faire, une démarche empirique est adoptée dans la collecte des données. Des entretiens semi-directifs sont administrés aux personnes victime d'inondation (sinistrés), autorités communales et associations de sociétés civiles (OSC). Les résultats de cette recherche montrent que la population de la ville de Maradi manque de stratégies pour réduire les risques d'inondation et aussi de capacité des personnes, des organisations et des systèmes pouvant faire face aux effets néfastes du changement climatique. Il ressort des résultats de cette recherche que dans la ville de Maradi, la réserve d'arbre en milieu urbain qui représente l'élément important pour atténuer les effets nocifs du changement climatique est en envoi de disparition.

*Mots clés : changement climatique, effets néfastes, sinistrés, inondation, adaptation.*

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*Translation*

## Sociological analysis of adaptation measures against the negative effects of climate change in Niger: The case of the Maradi flood in August 2024

Niger is one of the Sahelian countries most affected by severe climate change effects, such as droughts and floods, which disrupt the agricultural season. According to a study by the Office for the Coordination of Humanitarian Affairs, approximately 100,000 hectares of arable land are lost annually due to water erosion, leading to crop failures and loss of livelihoods for thousands of households. Most floods occur during the rainy season from July to September, affecting an average of 35,000 households and displacing between 200,000 and 300,000 people annually. These floods also cause significant economic damage to homes, fields, gardens, and livestock. This research examines the issue of climate change during the 2024 rainy season, which recorded unprecedented flooding levels in Niger. This phenomenon has raised concerns among researchers and international organizations worldwide, as the negative effects of climate change continue to create disasters across much of Niger, severely impacting the survival conditions of affected populations. These displaced populations are the first victims exposed to various risks. The objective of this study is to analyze adaptation measures to climate change effects, raise awareness among the population about its adverse impacts, and propose strategies to mitigate the intensity of urban flooding in Niger. An empirical approach was adopted for data collection, using semi-structured interviews with flood victims, municipal authorities, and civil society organizations (CSOs). The findings of this study reveal that the population of Maradi lacks strategies to mitigate flood risks, as well as the necessary capacity among individuals, organizations, and systems to cope with the adverse effects of climate change. Additionally, urban tree cover, which plays a crucial role in reducing the harmful impacts of climate change, is rapidly disappearing in Maradi.

*Keywords: climate change, adverse effects, disaster victims, flooding, adaptation.*

## Politique forestière en milieu urbain face au changement climatique au Burundi

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L'objectif de la recherche était de montre l'importance arbres plantés au tour des rivières qui traversent la ville de Bujumbura. Le choix du sujet a été motivé par notre observation directe des dangers liés au changement climatique qui sont l'inondation, le débordement de la rivière, le glissement des terrains, la montée du niveau de la rivière, la tornade, .....
Au cours de notre recherche, deux méthodes ont été privilégiées. Une analyse documentaire de la revue existante et une enquête sur terrain. Les données ont été récoltées grâce à un guide d'entretien soumis à nos enquêtés. Le choix des enquêtés a tenu compte de l'effectif suffisant, du genre, de l'âge, du sexe, du niveau de vie et d'étude et du rôle dans la société. Notre réflexion est partie de l'hypothèse selon laquelle les arbres plantés autour des rivières diminuent les dangers dus au changement climatiques encourus par la population riveraine. Les résultats montrent que la forestation autour des rivières améliore les conditions de vie de la population face aux changements climatiques. Nos enquêtés apprécient l'initiative des autorités d'instaurer des travaux communautaires au moins une fois la semaine. Cette initiative, a été une occasion de planter des millions d'arbres. Notre recherche a révélé qu'une étude est nécessaire pour connaitre le genre d'arbre qui résisterait mieux. Trois sur quatre des enquêtés évoquent la non disponibilité jeunes plans sélectionnés dans l'objectif d'encourager la forestation urbaine. Dans le cadre légal, les enquêtés saluent le pas déjà franchi et souhaite l'amélioration des lois existantes.

*Mots-clés: foresterie urbaine, changement climatique, protection des berges, prévention des inondations, reforestation urbaine, politique environnementale du Burundi.*

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## Achieving Water Resilience, increased Biodiversity and Community Upliftment by re-establishing Pocket Forests and Native Grassland

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Water for the Future is an NPO with the goal of revitalising the Upper Jukskei River in inner-city Johannesburg by implementing nature-based solutions through community participation. Urban problems of climate-change enhanced weather extremes like heatwaves, storm-water flooding, and ageing waste-removal infrastructure, are exacerbated by population densification and a lack of capacity by the City, all leading to the poor water quality of the river. The successful rehabilitation of the water course is therefore dependent on the education and economic upliftment of diverse local communities situated between eastern Johannesburg and Alexandra Township. With the financial and technical support of the Johannesburg Inner City Partnership through the IDC funded Social Employment Fund, The University of Johannesburg Process, Energy and Environmental technology station (UJ-PEETS) and SUNCASA funded by Global Affairs of Canada, we are training hundreds of workers in implementing alien-invasive removal, biomass processing, and the re-planting of biome-specific flora. Water for the Future is referencing scientific knowledge were reintroducing the Soweto highveld grassland is concerned, and how best to reintroduce wetlands to strategic areas along our pilot site. These will serve as key points providing sustainable urban drainage (SUDs), stabilisation of the water table and nature-based purification of the contaminated water. Research shows that native grassland is more effective than urban forests where water retention, carbon absorption and soil regeneration is concerned. However, the strategic introduction of pocket forests offers a nature-based solution to education in urban agriculture, building food security, heat island mitigation and beautification: and thus, to community engagement.

*Keywords: Nature-based solutions, heatwaves, storm-water flooding, urban, Johannesburg.*

*Thank you for engaging with this collection of research and insights. We encourage you to continue the conversation, connect with presenters, and explore new collaborations. To facilitate further discussion, we have included presenter email affiliations.*

*We hope this event inspires meaningful dialogue and action toward a more just and sustainable future across Africa.*

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