Report of Urban Ecolution
Participatory Scenario Planning Workshop

URBAN ECOLUTION: Predicting synergies and trade-offs of water-related ecological infrastructure for climate adaptation in peri-urban settlements

16-18 July 2019, NUST Hotel School

Report compiled by: Dr. Jessica P. R. Thorn and Amayaa Wijesinghe
University of Cape Town, African Climate and Development Initiative
University of York, York Institute of Tropical Ecology

Facilitated by: Dr Jessica Thorn (jessica.thorn@uct.ac.uk) (University of Cape Town/University of York)

With Amayaa Wijesinghe amayaa.wijesinghe@linacre.ox.ac.uk (University of Oxford); Valentina Giombini valentina.giombini@gtc.ox.ac.uk (University of Oxford); Saima Haukelo snh516@york.ac.uk (University of York); Erikka Mokanya emokanya@gmail.com (Urban Ecolution)

Website: http://www.acdi.uct.ac.za

Introduction

The Urban Ecolution Research Programme (UE) seeks to improve knowledge and capacity for the delivery of environmentally sustainable development, social equity, and risk reduction in peri-urban settlements in Namibia and Tanzania. UE will also explore the role that ecosystem-based adaptation and ecological infrastructure can play within the larger national and local adaptation plans of both countries. It is funded by the International Development Research Centre of Canada, the University of York, the African Institute of Mathematical Sciences, UKAID, African Academy of Sciences, UN Economic Commission for Africa and pan-Africanist WISER.

The launch of UE in Namibia, as well as a participatory scenario planning workshop, was held from 16-18 of July 2019 at the NUST Hotel School in Windhoek. The workshop brought together 35 participants (see Appendix 1 for delegate information) representing many sectors and stakeholder groups. During the workshop, a scenario tool called "*Kesho*" (meaning "tomorrow" in KiSwahili) combined geospatial datasets with different stakeholder views on the drivers and nature of land use change. The diverse, plausible impacts on ecosystem services, biodiversity, natural capital, social cohesion, economic livelihoods, infrastructure, land cover and land uses, and protected areas was also used, especially in the face of a changing climate.

During the workshop, participants:

(1) Combined futures thinking with strategic foresight, to achieve a holistic planning and investment approach to deal with interlinked environmental, health and housing challenges across scales and sectors

(2) Developed a shared system understanding of the local dynamics and key drivers of hydro-climatic risk to extrapolate trends

(3) Identified diverse, plausible scenarios that align with the Sustainable Development Goals Agenda 2030 and African Union Agenda 2063.

(4) Co-produced recommendations to address failures and present new opportunities with a wider range of 'outside-the-box' possibilities

The outputs of the workshop are expected to inform the City of Windhoek's Integrated Climate Change Strategy and Action Plan (currently in draft form), with a special focus on the sections pertaining to Human Settlements and Biodiversity. The report below presents the activities and outcomes of the Participatory Scenario Planning Workshop in detail.

Acknowledgements: This work was supported through the Climate Research for Development (CR4D) Postdoctoral Fellowship [PDF/CR4D/18/167] implemented by the African Academy of Sciences (AAS) in partnership with the United Kingdom's Department for International Development (DfID) Weather and Climate Information Services for Africa (WISER) programme and the African Climate Policy Center (ACPC) of the United Nations Economic Commission for Africa (UNECA). It is also funded through the African Women in Climate Change Science fellowship implemented by the African Institute of Mathematical Sciences. We acknowledge funding from the UK Research and Innovation's Global Challenges Research Fund (UKRI GCRF) through the Development Corridors Partnership project (project number: ES/P011500/1).

Contents

Day 01, 16th July 2019: Project launch and Past, present and future land use transitions 1
Day 02, 17th July 2019: Scenario narrative construction 3
Day 03, 18th July 2019: Scenario validation and semi-quantification 4
Appendices 6
Appendix 1 - Delegate registration list 6
Appendix 2 – Scenario Narratives 8
Appendix 3 - Semi-quantification of drivers of land use change 21
Appendix 4 - Semi-quantification of land cover change 39
Appendix 5 - Semi-quantification of ecosystem services provision 45

Recommended citation: Thorn, J. P. R. and Wijesinghe, A. (2019) Report of Urban Ecolution Participatory Scenario Planning Workshop, Windhoek , Namibia. Report. 01/2019. Cape Town: University of Cape Town.

Day 01, 16th July 2019: Project launch

Registration of participants and informal interactions - 08:30 – 09:00

The launch of the URBAN ECOLUTION Project was held on the morning of Day 01. Dr. Jessica Thorn started the session at 09:00 am with an introduction to the project, as well as a breakdown of the workshop's objectives, which include:

- Combining futures thinking and strategic foresight to extrapolate trends
- Achieving a holistic planning and investment approach to deal with key conservation and developmental challenges across scales and sectors
- Identifying diverse, plausible climate, demographic, and land use scenarios
- Co-producing recommendations to address failures and present new opportunities
- Enhancing capacity in participatory scenario planning analysis

All the participants were given the opportunity to introduce themselves by highlighting the following: Name, organization, their role in the organization, where they come from, whether they have carried out scenario analysis previously, and what they have used it for. The participants represented diverse organizations, including the FRACTAL Project (University of Namibia), Namibian University of Science and Technology (NUST), Barnard Mutua Architects, Ministry of Land Reform, Ministry of Urban and Rural Development, Katutura Youth Enterprise Centre (KAYEC), Hans Seidel Foundation, Greenspace, Shack Dwellers' Federation Namibia (SDFN), RASON, Namibia Housing Action Group (NHAG), Ministry of Environment and Tourism, City of Windhoek (Health and Env and Human Settlements Divisions), Pupkewitz Foundation, Coalition on Climate Change, Desert Research Foundation of Namibia (DRFN), as well as councilors and representatives from 3 constituencies (Tobias Hainyeko, Samora Machel and Moses Garoeb).

Dr. Thorn then introduced the participants to the Chatham house rules, which would ensure that all participants could share information without any fear of negative criticism. The participants agreed that the 'Rules of Engagement' for this particular workshop would entail: Punctuality and sticking to the schedule; cellular devices on silent mode; talking to the point as a sign of respect for others' time; remembering that everyone is working towards a common vision; and active participation.

Figure 1: Introduction to the Urban Ecolution Research Programme by Dr. Jessica Thorn

Dr. Thorn proceeded to an overview of the URBAN ECOLUTION Project, introducing the project partners and the primary objectives. The immediate relevance of exploring the role that ecological infrastructure can play in aiding climate adaptation plans Windhoek was highlighted. Amayaa Wijesinghe made a presentation on the role that ecosystem-based adaptation could play in increasing climate resilience of peri-urban settlements, drawing

on preliminary results of data collected for the MSc dissertation. Similarly, Valentina Giombini also presented insights from her MSc research, which focused especially on the ephemeral river system and riverbanks in Windhoek, and the scope for utilizing these as managed green spaces.

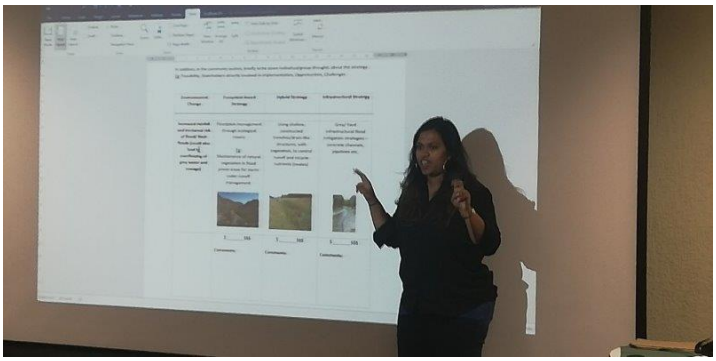


Figure 2 and 3: Presentations by Amayaa Wijesinghe and Valentina Giombini, who were carrying out research for their MSc dissertation projects (University of Oxford) under the Urban Ecolution Programme

Mr. Faniel Maanda, Head of the Human Settlements Division of the City of Windhoek (CoW), gave the keynote address for the morning session of the workshop. He presented key facts and figures about the history and present situation in the informal settlements of Windhoek. He also elucidated CoW's plans for the informal settlements, and the challenges that had to be overcome in order to achieve these goals.

The participants were issued with notes in order to write down their expectations for the 3-day workshop. In relation to this three sets of paper were provided and participants guided on how to list down; i) expectation and what they would like to learn (pink note) ii) skills they would like to acquire (green note) iii) what they would use this for (yellow note).

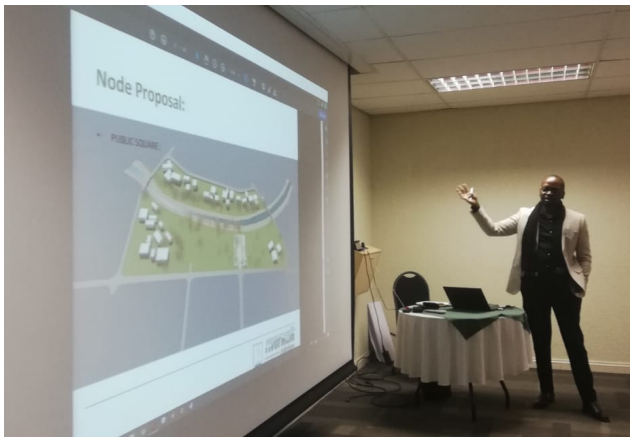


Figure 4: Key note address by Mr. Faniel Maanda, Head of the City's Human Settlements Division

Figure 5: Presentation on Riverwalk and the proposed plan to transform Windhoek's riverbeds into multifunctional urban green spaces

Arch. Francis Mutua presented a novel project in the pipeline for the CoW, named the Riverwalk. He also elaborated on how Riverwalk could transform Windhoek's riverbeds into multifunctional green spaces, and the synergies it could create with a proposed Urban Spine Project.

Expectations

In summary, the participants' expectations included:

- Learning how informal settlements can be improved or completely formalized
- Practical solutions and best practices for climate change adaptation (long and short term), with a strong consideration of holistic urban design and ecological infrastructure
- Learning how scenario analysis can identify solutions and help drought conditions etc.

The skills which participants would like to acquire included:

- Critical thinking
- Negotiation and coming to a consensus with various stakeholders
- How to do scenario analysis

The participants wanted to apply this knowledge:

- To complement and use in current and future community and informal settlement planning
- To carry out further research
- To communicate and carry out further awareness

Tea break and networking

After a convivial break, the participants came together again, and the second half of the morning session was opened by Ms. Konelia Iipinge, who gave a presentation on the work done by the FRACTAL Project (Future Resilience for African Cities and Lands). Mr. Olavi Makuti then gave a presentation about the CoW's response to climate change. He gave a summary of the impacts that the city could expect in the future, and introduced the CoW's Integrated Climate Change Strategy and Action Plan (ICCSAP), which is currently in draft form.

Definitions

Dr. Thorn then led an exercise that explored participants' perceptions and definitions of key concepts and framings that would be used in the workshop. Firstly, participants identified the key characteristics and features that could contribute to a "**resilient city**". These included:

- Presence of an 'interactive' city
- Presence of a healthy city
- An inclusive city
- "Absorb shocks" effectively
- Presence of an adaptive response
- Clean water and environment
- Biodiversity
- Equal opportunities and societal equity
- Socially, environmentally and economically equal society
- Integrated planning and holistic approach
- Zero crime

- Means of making livelihoods
- No boundaries - "Boundary less"
- Meeting of basic needs

The distinction that participants would make between **formal and informal** was also explored, as follows:

Formal	**Informal**
Structured way of thinking → structured Buildings Recognised: legal, have names, procedural Long term Security (power over it in terms of decisions) Serviced land Hard infrastructure Boundaries Regulated Bulk infrastructure, sewage, water Isolated	Organic growth Irregular Poverty No order →no arrangements → unplanned Self-arrangements Order in chaos Cheap building materials Fluid Overcrowded (densification) Some areas are sparse Tolerated Fear Land use conflict Insecurity Eviction Non-belonging Young migrants that are full of energy No corruption Social networks Conflict of interest Land allocation involves 'nepotism'

Participants also identified what they would term '**urban green infrastructure'** in Windhoek, as compared to hard/grey infrastructure, such as roads, rails, power lines, bridges, dam, walls and sewage lines:

- Parks and Playgrounds
- River
- Dams
- Gardens, food and agriculture
- Naturalness →'ecological infrastructure'
- Vegetated pavements
- Wetlands
- Swales
- Riparian buffer strips
- Reuse and reclamation of water (multi-purpose function)
- Trees
- Recycling waste water

Panel discussion

This exercise was followed by a panel discussion, exploring the various dynamics of mainstreaming ecological infrastructure into the CoW's plans, with a special focus on informal settlements. Panellists included Dr. Anna Muller (NHAG), Mr. Abraham Harris (NUST), Mr. Faniel Maanda (CoW- Human Settlements Division), and Architects Leon Barnard and Francis Mutua (Barnard Mutua Architects and RiverWalk). The discussion was followed by a question and answer session, and this wrapped up the launch and the morning's workshop proceedings.

Lunch and fellowship

Dr. Thorn gave a summary of the morning's proceedings, and then carried on the workshop process by facilitating a discussion on the importance of understanding the past and the future. She also took participants through the process of scenario analysis, and explored key concepts such as complexity, uncertainty, coupled natural human systems, resilience, and adaptation pathways.

The participants were actively engaged in an activity that involved identifying;

- Which stakeholders were in the room and which ones were not
- Which sectors were represented and which ones not represented
- Which gaps in scale of operation were there and institution type

Figure 6: Participants being prepped with information about the workshop's objectives, and the co-production exercises that would be carried out over the three days

Given that participants for the workshop belonged to various sectors and organizations, those in attendance and their total numbers were then categorized as follows;

Institution type/Scale	Community	Local	Regional	National	International	Multiscale
CBO	0	0	0	1	0	0
NGO	1	1	0	0	2	1
Research	0	2	0	1	2	4
Private sector	1	0	0	0	0	0
Government	0	1	3	2	0	0

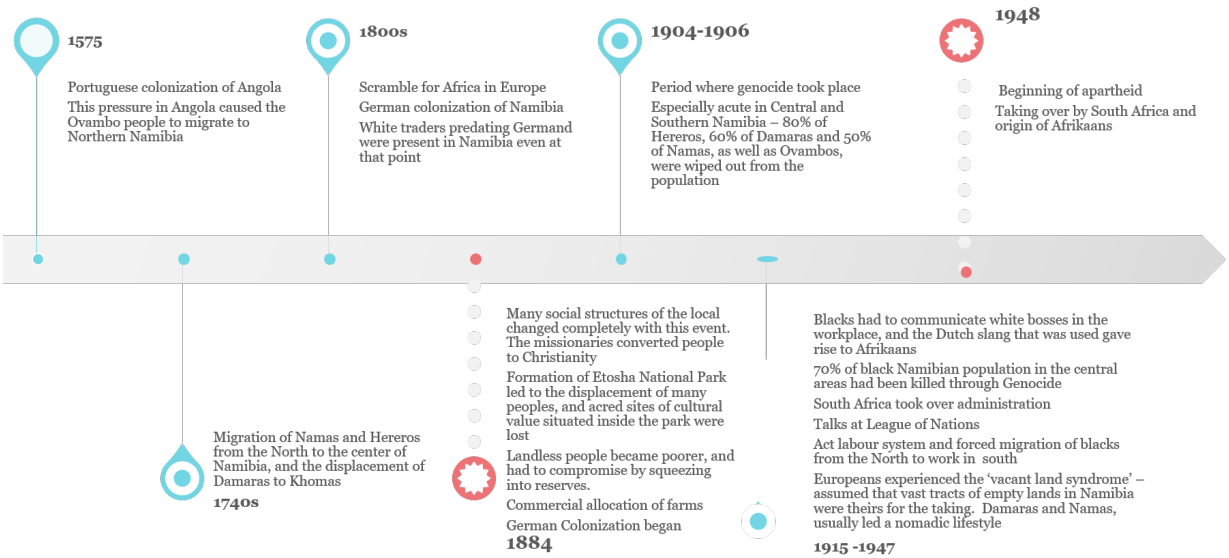
Most representatives came from cross sectoral approaches or environment (n = 6, ea.), while other came from education (n=5), housing and land (n=4). No representatives from finance, health and transport were included in the workshop, representing a bias that participants were asked to be aware of.

Past, present and future land use transitions

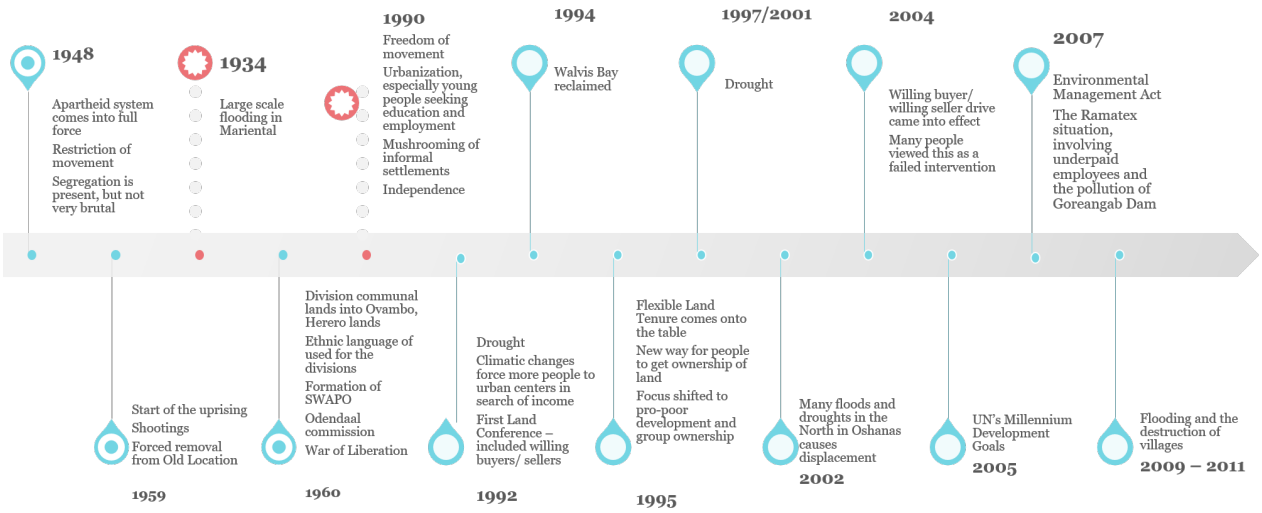
Dr. Thorn led participants in a discussion of major events in the historic land use change of Windhoek. In particular, participants were encouraged to identify moments of scarcity or abundance. Pre-colonialism, post-independence, present day and the future were some of the broader periods under which the discussion was conducted. Participants were then divided into four groups, and the groups were asked to co-produce the timeline for Namibia and Windhoek, from pre-colonization to the future. The participants presented their timelines, with special emphasis of the key policies and events that drove land use change and probable political, social, technological, economic and environmental changes expected. The timelines developed by participants are presented below.

Figure 7: Participants engaged in creating and presenting timelines

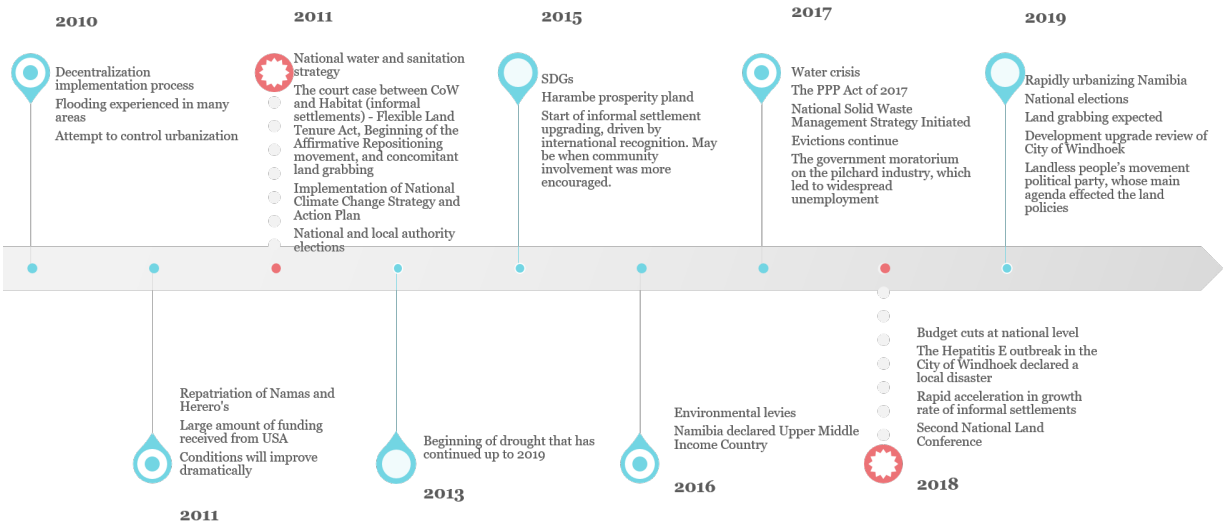
Past timeline (1740-1948)



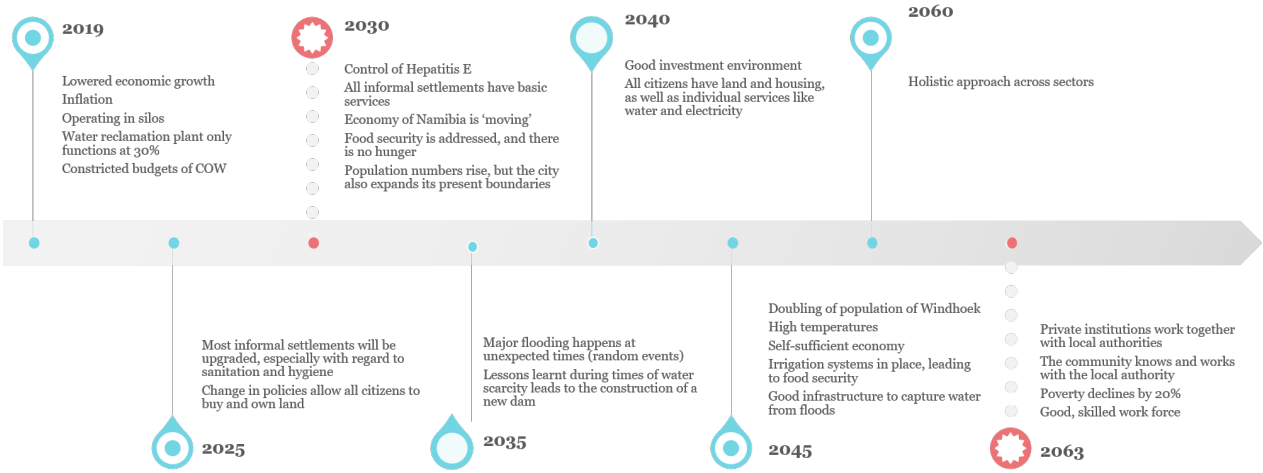
Past Timeline (1948 – 2010)



Present Timeline (2010 – 2019)



Future Timeline (2019 – 2030 – 2063)



Ecosystem ranking exercise

Ms. Wijesinghe introduced participants to the concept of 'ecosystem services', and presented a list of ecosystem services that may/ may not be available to residents in Windhoek. Participants were then asked to select the 15 most important ecosystem services, according to their individual experiences, and the choices were then clustered and ranked (as shown below).

Ecosystem service	**Rank**
Space for recreation	15
Tourism	15
Regulates erosion	13
Air purification	11
Environmental education opportunities	11
Drinking/irrigation water	11
Meeting and socialization space	9
Provision of firewood for cooking/heating	8
Medicinal resources	8
Microclimate regulation (i.e., shade/cooling effect)	8
Breaking impact of flood waters	8
Habitat for species	8
Connectivity for humans and biodiversity	8
Space for exercising	8
Enhances soil water storage	8
Provides fish	8
Provision of tree pods for animal feed	7
Beautification, aesthetics and inspiration	7
Fruits and greens to increase food security (household consumption)	6
Raw material for livelihoods (traditional crafts including baskets, brooms, natural products)	6
Captures wastewater, industrial and agricultural runoffs	6
Provision of building material (e.g., timber for frames)	5
Carbon capture and storage	5
Nutrient cycling / decomposition	5
Mental wellbeing, relaxation, psychological comfort	5
Community, and cultural, tribal identity	5
Provision of grasses for animal feed	4
Maintenance of soil fertility	4
Reduces water-related diseases (e.g., malaria, dengue, cholera)	4
Provides meat (e.g., bush meat, rodents, birds)	4
Tubers for food security	3
Sacred sites, spiritual and religious value (e.g., churches, marriage)	3
Makes soil less hard	3
Capturing sediments in (storm) water runoff	2
Provision of tree pods for cooking/heating	0

Provision of wood carving materials	0
Fruits and greens to increase food security (for sale)	0
Breaks down pollutants in the water	0

Other services that participants suggested	
Provision for renewable energy	2
Provision of proper sanitation	1
Regulates seasonal changes	1
Access to Daan Viljoen Reserve for ancestral community	1
Centres for entrepreneurship training	1

With this activity, day 1 drew to a close, with the summary of the day provided by Dr. Thorn. Participants were asked to give their feedback on the workshop so far, and remarked the benefits of international knowledge and expertise diversity, the usefulness of "rationalizing where we are heading", "learning about our histories, present situation and potential futures", "clarifying definitions", the "interactive and engaging discussions, "the diversity of views represented" as well as the ability to establish a common vision of the future through the method of scenario planning.

Day 02, 17th July 2019: Scenario narrative construction

Registration – Between 8.00 am – 8.30 am.

After welcoming remarks from Dr. Thorn, a summary recap of the previous day's activities was made, and activities planned for the second day of the workshop were outlined. This included a review a common objectives, such as data collection in order to inform an evidence-based decision making process.

Boundary setting

Scenarios are best suited to looking at the future through the lens of a specific issue. Without this grounding, there is a danger that they will be too general. Boundary setting aids analytical choices made in scenario analysis. It aids the stakeholders in determining the parameters, and assumptions of the scenarios. Given the number of variables and analytical approaches to scenario analysis, there will be a wide range of scenarios used that describe various outcomes. Transparency around key parameters, assumptions, and analytical choices will help to support comparability of results between different scenarios developed in different contexts.

Participants decided on which landmarks they would consider the boundaries of Windhoek. They also identified the sectors and stakeholders that would need to be aware of the information co-produced by the workshop, as well as the tools that could be used to disseminate the information to these sectors and organizations.

Spatial scale for scenarios

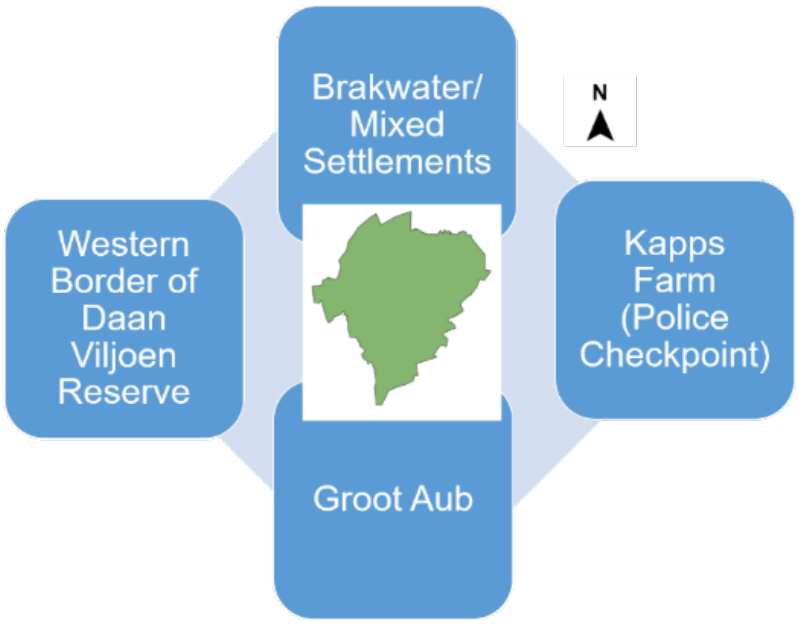


Figure 8: Geographic boundaries of scenarios were delineated in these limits

Temporal scale for scenarios? 2030 (SDGs) and 2063 (AU African Agenda)

For who are the scenarios for?

End users identified are urban and town planners; Architects; the Ministry of Environment and Tourism; Educators in primary and secondary schools and in tertiary institutions (University of Science and Technology (NUST) and University of Namibia (Department of Geography and Biosciences), Environment Investment Fund, Funders (e.g., UNDP, GIZ, German Development Bank, ADB, Agricultural Bank of Namibia, Environmental Investment Fund), Desert Research Foundation of Namibia; Namibia Nature Foundation; World Wide Fund for Nature; Residents and elected community leaders; Constituency and City of Windhoek Counsellors; Human settlements and Environment and health divisions within the City of Windhoek; Southern African Science Service Centre for Climate Change and Adaptive Land Management; Development Workshop; Green Space and the Namibian Housing Action Group

What tools should we use to communicate results effectively?

Social media: Facebook, Twitter, LinkedIn, YouTube; a website; animated videos; Radio – advertisements and talk shows in OshiWambo, Herero, Damara, Nama, Afrikaans, French, Lozi, German and English; scientific publications; Newspaper articles: Namibian, New Era, Informante; Infographics; participatory workshops and meetings; and booklets or pamphlets

Focal sectors?

Education, health and sanitation, environment, Poverty alleviation, Small and Medium enterprises, energy, mining, climate, water, tourism, agriculture, land, food security, transport, infrastructure, finance, justice, gender, trade and industry, home affairs, housing, rural and urban development

Figure 9: Cluster and ranking activity

Identifying the driving forces for 2030 and 2063

Drivers of change are the social, economic, environmental, political and technological factors that are most relevant. The scenario development team prioritized these according to their **importance (highest impact)** and **predictability (certain/uncertain)** in affected desired outcomes related to land use change in Windhoek. Participants worked, first individually, and then as a group, to identify driving forces (key drivers of change that might shape how the region changes over in 2030 and 2063. The drivers of change were first clustered into groups, and then ranked by group. Similarly, participants were also asked to list out desirable futures, representing the best that could happen, as well as undesirable futures, representing the worst that could happen (see McBride et al 2017).

Drivers of change cluster	Ranked frequency
Leadership, political will, multiscalar cooperation and collaboration. Pragmatic, flexible, accountable local authority that takes a practical, effective approach to policy implementation and enforcement. Good development plans.	20
Community engaged, informed and involved in decision making, civil regularly maintaining its infrastructure, authorities have a good understanding of local needs, participatory democracy with closely competing political parties	16
Inclusive, equitable, self-sufficient economy, which is stable and robust against the global economic crises	14
Unemployment rates and livelihood security	6
Climate instability (droughts and floods, veld fires)	5
Targeted curriculum in schools, education, capacity building	4
Population growth (natural and rural urban migration)	7
Private investors in infrastructure, and dedicated funding (domestic and international)	3
Political instability and social unrest	3
Recognition of indigenous knowledge, true reflection of ancestral heritage, peace and tolerance to national reconciliation	3
Policy reform, including land reform	3
Green technologies, carbon emission regulations are implemented, integrated environmental holistic management	2
Embrace dryness as the "new growth" and water rationing	2
Large-scale infrastructural investment, including housing investment	2
Access to food and nutrition, food security	2
People's mind set	2
Health and outbreak of epidemics	2
Deforestation and environmental degradation	2
Rural development and changes in agriculture and farming techniques	2
Privatization of communal land	1
Education	1
Access to social welfare	1
Sanitation	1
Service delivery	1
Good parenting	1

Holistic approach to savings	1
Security and monitoring crime	1
Public choices and lifestyle	1

Desirable futures cluster	Ranked frequency
Access to secure tenure and land for the poor, planned settlements, informal settlement upgrading and financial systems giving all people access to housing	18
Economic stability, more employment and recognition of informal traders, end of poverty, SMME integration with residential areas, more investors, SADC common monetary zone realized	18
Advanced renewable technology and reduced emissions	12
Sustainable water harvesting, sustainable access and supply and community based adaptation to drought	11
Green, resilient cities , planned roads and sustainable urban form, city to city - town to town learning, Walkable, cycle-able city	11
Active youth engagement in decision making, youth employment, and a having a change of mind set of their possible contribution to society's development, Involvement of children in day to day decisions	11
Better education and education curriculum, mainstreaming climate change in education, more public grants for tertiary education	8
More social cohesion and integration and less segregation, inequality	8
Implementation of policies	7
Better healthcare	7
Political accountability, social stability and good governance	6
Collaboration, improved legal systems, working in a holistic manner	6
Food security and no need for food banks, Agricultural expansion	6
No war and conflict, peace, less crime, positive behaviour change	6
Environmental awareness and education in primary schools	5
Meeting social spaces, clean, green healthy neighbourhoods	4
Community has a greater say in their development, government accommodating to local needs, local capacity is built, decentralization in decision making	4
Sustainable access to water	3
Improved technology and industrialization	2
High education	2
CITES stand against ivory trade	1
Zero corruption	1
No poor sanitation and unhygienic environments	1
Cultural evaluation	1
Reduced inequality , Gender equality and women empowerment	2
Change in land use - more sustainable	1
More street lights	1
Responsible drinking of alcohol	1
No animals dying	1

Undesirable futures cluster	Ranked frequency
Faster growth of informal settlements compared to formal settlements, high density and unsafe houses, land grabbing and informal land tenure, sprawl	17
Continued social/gendered/economic/tribal inequality and divided apartheid city, civil unrest over resources, political and social tensions	16
Overexploitation of natural resources, deforestation, desertification, shortage of natural land	14
Extreme poverty, a growth in unemployment rise and an economic recession	13
Climate change (floods, droughts, natural disasters)	10
Poor governance, corruption (particularly the misuse of the budget for housing), nepotism and stakeholders operate in silos therefore misusing national finances	10
Air, land. carbon pollution and dumping or burning of solid waste near homes	8
A lack of sanitation facilities leading to unhygienic environments, disease outbreaks and high death rates	6
Sustained water scarcity, and clean drinking water or running water inside homes	6
Hunger and continued subsistence agriculture	6
Poor service delivery and infrastructure	5
Increased gender based violence and crime, sitting streets at night time, bad influences and friends	4
Alcohol abuse, smoking	3
Poor education system, and not enough loans and grants for tertiary students	3
Feral dogs	1
Dusty roads	1
Promotion of donors' agenda for funding projects	1
Overpopulation	1

Introducing scenario narratives

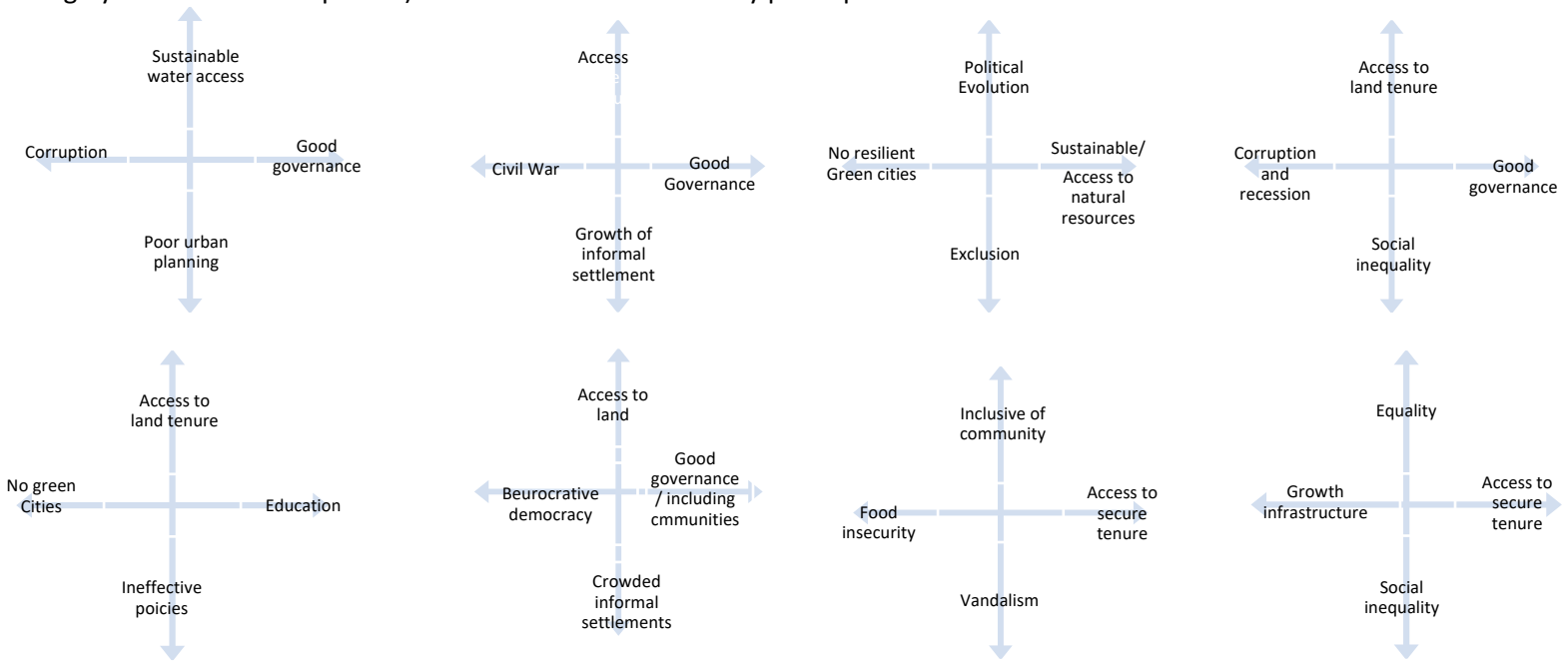
Tea break and networking

After the tea break, an animation film was presented to participants, in order to provide an example of scenario building and futures thinking.

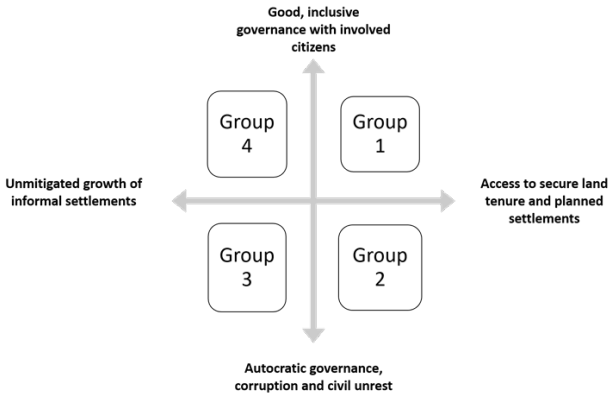
.

Creating scenario logic and morpho-matrix

Participants were asked to develop 2 x 2 scenario matrix with each axis depicting the prioritized key driver of change. Participants were asked to split into pairs or small groups, and decide on the key uncertainties that could affect present and future narratives in the city. Then these were chosen via discussion and voting by the group based on the combination of drivers that are most interesting (i.e., divergent from one another and both highly uncertain and impactful). The uncertainties chosen by participants are shown below:



Based on these inputs, and the key drivers that appeared across most axes, it was decided that narratives would be built along two broad axes:


Good, inclusive governance with involved citizens
Group 4
Group 1
Unmitigated growth of informal settlements
Access to secure land tenure and planned settlements
Group 3
Group 2
Autocratic governance, corruption and civil unrest

Scenario narrative construction

The participants were split into four groups after lunch, to develop scenarios according to the agreed upon morphomatrix. This was characterized by the formation of a story line for the scenario specific to each group. They were asked to incorporate into the narratives prioritized drivers of change; think across scales and sectors, especially scales at which adaptation/maladaptation could take place and identify trade-offs that exist between land uses. The summary of narratives presented by each group are shown below. For full narratives, please refer to Appendix 2.

Shila Nawa – The good life

Good, inclusive governance with involved citizens AND Access to secure land tenure and planned settlements

This is the best-case scenario, where strong local authorities deploy equitable development initiatives, which have strong community buy-in at their core. By 2030, affordable housing options are available, and informal settlements have been upgraded. Land policies in general benefit all people. Water demand as well as solid waste has been managed through sound planning, behavioural change and appropriate tariff structures, and sanitation facilities are available to all. The implementation of the ICCSAP is well under way. School curricula have been reformed, and students are also taught subjects such sustainability and civic duty. Safe, multifunctional public open spaces are established, and the Riverwalk initiative is successful. Food security is improved through widespread health and nutrition campaigns, and urban agriculture becomes a norm.

By 2063, a transparent meritocracy has been established in both central and local government. Although there are disruptions that set back the economy, overall, there is robust growth, which is shared equitably by all citizens. Windhoek has started solar-powered desalination efforts, and water supply has continued uninterrupted. Sound climate adaptation strategies have helped natural ecosystems regenerate, and Windhoek is recognized as a benchmark internationally. Historically ingrained social inequalities have been ameliorated by the design of a city that connects previously segregated areas. Private investors and NGOs help the government to further update health and education sectors, and crises such as disease outbreaks, Eg. Hepatitis E, are rare.

Zula for survival

Autocratic governance, corruption and civil unrest AND Access to secure land tenure and planned settlements

By 2030, the Flexible Land Tenure Act of 2012 has been put into practice, and citizens have access to land tenure, due to strong lobbying from concerned stakeholders. Although residents now have tenure of a plot, building formal housing is expensive, and many remain in shacks. Land grabbing is commonly practiced. Upgrading is also slow, as good governance is absent. Sanitation issues remain critical, and intergovernmental agencies intervene. High-rise development has become more common, as competition for land intensifies. Corrupt governance and economic malpractices lead to a recession, and “zula” (hustling) for survival intensifies. There is growing societal and gender inequality. Health care is accessible, but of a low standard. Water shortages become more frequent. There are no opportunities for recreation in the wider city, and natural environment is neglected. Food insecurity remains an issue, but the

availability of their own plot prompts people to grow their own food. However, poor governance also prompts complacent Namibians to become more self-resilient, while actively holding government accountable for failing systems.

In 2063, citizens are making use of land they own, trading it as an asset etc. Due to poor planning, the informal areas continue to grow at a slower rate, as more migrants come into Windhoek from rural areas. However, Windhoek has now become less attractive for migrants due to lack of development. Other cities adopt strategies of desalinization and development, pulling in more migrants. Absence of adaptation to impacts of climate change lead to unbearable living conditions, and health and environmental services deteriorate. Everything is dealt with on an 'emergency basis', such as food banks for acute food insecurity. The income disparity continues becomes wider, as policies that benefit the elite in the city drive in a deep societal wedge. However, the communities have become even more self-sufficient by this time, and carry on trying to survive despite little support from municipality. The youth become active, mobilizing for change. However, mismanagement of water resources becomes a crisis, and social unrest and conflict erupt before long.

Survival of the fittest

Autocratic governance, corruption and civil unrest AND unmitigated growth of informal settlements

The lack of transformational leadership at top levels of governance has led to social inequalities and corruption by 2030. Youth unemployment has increased, and this dire situation leads to more self-employment, even though entrepreneurs lack a supportive environment. Recession leads to societal order breaking down, and crime, theft, drug and alcohol abuse increase. Droughts and water scarcity also intensify impacts of recession. Intergovernmental organizations put pressure on Namibia to implement sustainable development, but it becomes a challenge to administer due to lack of institutional will and capacity. Climate resilience and adaptation is not addressed. As informal settlement areas expand and become denser, land degradation also intensifies. The energy gaps will widen, and the health crisis will deepen due to lack of proper sanitation. There will be malnourishment and food deserts in the informal settlements. Social inequalities have increased, and the income disparity is wider. The needs of the elite will be catered to, while the poorer communities become increasingly marginalized.

By 2063, authorities are spending municipality budgets as they see fit, with no input from local communities. Poverty has worsened, and water, land and air pollution has become a problem. The water in the aquifer become depleted, as water shortages worsen. Water scarcity makes climate vulnerabilities more acute, especially in informal settlements. This leads people to practice autonomous adaptation, with support from NGOs, as the crisis deepens. Citizens, especially youth, carry out protests against corruption, and become more proactive. The environment is severely degraded, and worsening environmental and climate impacts prompt emergency services and mobile clinics to be stationed around the informal settlements. The informal economy grows, and cheap labour increases. Certain emergencies, such as the energy crisis, will force authorities to provide some form of renewable energy. The authorities will continue to make plans, with little implementation.

Embracing informality

Good, inclusive governance with involved citizens AND unmitigated growth of informal settlements

By 2030, the communities in informal areas will mobilize in order to lobby for change, as the need for alternative solutions becomes clear. The progress in informal settlements in other areas of the country will further drive residents to demand for change, supported by SDFN and other stakeholders. Interventions that are specifically suited to Windhoek's informal settlements will be designed, with the community directly participating in the process. The work of the National Housing Enterprise will become more effective, and low cost housing will be available to shack dwellers who can afford it. The municipality will make strides towards achieving water security, renewable energy sources, proper sanitation and economic development. There will be an economic recession, but it will prompt authorities to take action towards better management of public funds. Municipality will work with national players to address climate adaptation and emergency response. Attempts will be made to make the informal settlements more safe and secure through mobile police stations and implementation of "neighbourhood watches". There will be actions to integrate various ethnicities, while celebrating the unique cultures in each. Employment opportunities, training and funding for SMEs will be available. The private sector will be lobbied, in order to provide equal opportunities to citizens.

By 2063, transportation services will improve. There will be the introduction of policies that allow residents themselves to upgrade incrementally, although this will require change in mindset. Frequent droughts and extreme flooding will make people push for climate-adapted cities, with an efficient use of water, especially through water recycling. Rainwater harvesting will become commonplace. Renewable sources of energy will be deployed. Reception centres set up to manage recent migrants will control the mushrooming of informal settlements. There will be well-planned services in informal settlements, with a good structure. Disease outbreaks will be controlled, and access to good healthcare will be provided.

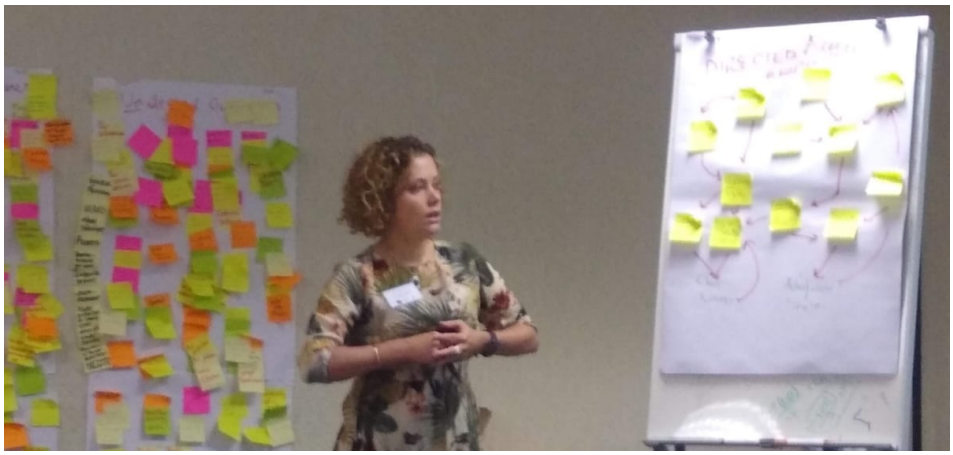
After a brief presentation of the scenarios, Dr. Thorn then gave a summary of activities that had been undertaken during the second day of the workshop, together with feedback of the process.

The workshop ended at 5.30 pm after which participants had tea.

Close of Day 2 and Networking

Day 03, 18th July 2019: Scenario validation and semi-quantification

Registration was conducted between 8.00 am-8.30 am. Dr. Thorn welcomed the participants to the workshop, and reminded them of the aims and objectives for the day. This was followed by presentations, where members of the various groups were invited to give a summary of issues that had been discussed the previous day.



Dr. Jessica Thorn welcoming participants for the third and final day of the workshop

Consolidation

Group discussion continued with the participants working on consolidating the narratives by reading the narrative developed by another group and then reviewing which elements of the narratives were missing based on the drivers of change prioritized the previous day. In addition, participants reviewed whether the name adopted for the narrative fits best with the narrative provided.

Consistency and plausibility analysis (Appendix 2)

To ensure consistency and plausibility analysis, the groups reviewed the narratives of another group, hence confirming or validating the consistency of the scenarios. This session also looked at traceability and the global, national and local scenarios (e.g., IPCC). The discussions also explored existing policies and plans (e.g., 2030, county development plans) that could lead to possible barriers and bridges for scenarios, internal consistency by check that one future state would not happen in combination with another, level of deviation where range of possible alternative futures are taken into account and, level of integration in order to understand to what extent components relevant to the subject incorporated and bought together to form a unified whole.

Coffee and networking

Semi-quantification of scenarios (Appendix 3 – 5)

Through a group discussion, Dr Thorn guided the participants in semi-quantifying the key drivers of change and land cover classes, as well as expected changes in ecosystem services (for the 2030 and 2063 horizons). Other issues that were looked into were the status of each impact variable for the baseline year and the likely direction of observed change in each impact variable. Participants then assigned percentage change per factor per scenario and in land cover class per scenario.

Feedback and discussion session focused on consistency analysis feedback and discussion.

Lunch

After lunch, participants continued the building of the matrix to forecast land use change and land cover class transition under each scenario.

Ms. Wijesinghe then carried out an activity to understand economic trade-offs of various adaptation interventions involving ecological infrastructure, hard (grey) infrastructure and hybrid solutions, and participants discussed and recorded perceived feasibility of climate adaptation strategies, as a pair-wise activity.

Participants were then asked to reflect on the key lessons learnt through the workshop, and made recommendations on the best ways to address failures as well as present new opportunities in development corridors. They also pointed out the entity affected and entity responsible.

As the workshop came almost to an end, Dr. Thorn led a session on critical reflection and evaluation, and did a recap of the activities that had been undertaken. The participants were given the workshop evaluation form, in order to give feedback about the workshop. This allowed them to reflect on the strengths and limitations of the scenario planning approach.

Dr. Thorn appreciated the time and commitment of the participants, all supporting organizations and individuals. The participants were then issued with certificates of participation in the workshop. The 3rd and final day ended with a group photo and a networking session at 5.30 pm.

Close of Workshop, Tea and Fellowship

Figure 10. A quick group photo at the end of day three

Appendices

Appendix 1 - Delegate registration list

Name	Affiliation	Role	Sector	Scale of influence	Email
Martin Davids	Moses Garoeb Constituency	Elected Counsellor	Politics	Constituency	martinmrdavid@gmail.com
Fanuel Son Shivute	Samora Michel Constituency	Elected Counsellor	Politics	Constituency	amupex@gmail.com
Christopher Likuwa	Tobias Hanyeko constituency	Elected Counsellor	Politics	Constituency	clikuwa@khomascr.gov.na
Kornelia Iipinge	University of Namibia - Future Resilience for African Cities and Lands Project	Windhoek Embedded Researcher	Climate change	International	kniipinge@unam.na
Saima Haukelo	City of Windhoek, Health and Environmental management	Intern	Environment	Municipality	salma5ndina@gmail.com
Valentina Giombini	University of Oxford	MSc student Environmental Change and Management	Environment	International	valentina.giombini@gtc.ox.ac.uk
Amayaa Wijesinghe	University of Oxford	MSc student Biodiversity Conservation Management	Environment	International	amayaa.wijesinghe@linacre.ox.ac.uk
Jessica Thorn	University of York, / University of Cape Town	URBAN ECOLUTION Principle Investigator	Social-ecological systems	International	jessica.thorn@york.ac.uk
Erikka Mokanya	URBAN ECOLUTION	Research assistant	Environment	National	emokanya@gmail.com
Olavi Makuti	City of Windhoek, Health and Environmental management - FRACTAL	In charge of climate change adaptation strategy	Environment	National	Olavi.Makuti@windhoekcc.org.na
Vilho Mtuleni	Desert Research Foundation Namibia / SASSCAL University of Hamburg	Central Technician SASSCAL	Research	National	vilhomsnake@gmail.com
Florian Marembo	SDFN	Chairperson	Housing/Land	National	florianmarembo@gmail.com
Braam Harris	NUST - Architecture and spatial planning	Landscape architecture lecturer	Research	National	braamha@gmail.com
Gaby Hansen	NUST - Architecture and spatial planning	Landscape architecture lecturer	Research	National	ghansen@nust.na
Royal Mabakeng	NUST - Land and Property Sciences	Junior Lecturer Land Administration	Research	National	rmabakeng@nust.na
Penda Barkia Nembwaya	Namibia Nalitongwe	Community representative	Community development	Local	N/A
Anna Muller	Namibia Housing Action Group (NHAG)	National Co-ordinator and Co Director	Housing and land	National	amnhag231@gmail.com nhag@iway.na
Melki Sedik Namupolo	Namibia Housing Action Group (NHAG)	Head of community data collection	Housing and land	National	meliz9010@gmail.com
Tapiwa-Chipo Maruza	Namibia Housing Action Group (NHAG)	Senior architectural technologist	Housing and land	National	tapiwachipomaruza@gmail.com
Robson Mazambani	Shack Federation member - Gobabis	Climate change unit	Housing and Land	Local	musiwa.robson@gmail.com
Leon Barnard	Barnard Mutua Architects/ Riverwalk	Design and Town Planning	Architecture	National	adriaan@barnardmutua.com

Berny Baisako	Katutura Youth Enterprise Centre	Social Media Coordinator	Training and youth development	Local	bbaisako13@gmail.com
Francis Mutua	Barnard Mutua Architects/ Riverwalk	River Walk	Architecture	National	francis@barnardmutua.com
Priscilla Heita Shaanika	Ministry of Land Reform	Chief survey technician		National	pheita20@gmail.com
Tsukhoe Garoes	Ministry of Urban and Rural Development	Habitat Research and Development	Research	National	tgaroes@murd.gov.na
Deon Shekuza	Namibia Youth Coalition on Climate Change	Environmental Activist	Climate change, environment	National	dshekuza@gmail.com
Ronnie Hochohobes	Shack Dwellers Federation	Head of the data collection at community level	Housing and land	National	hochobesr@gmail.com
Laura Ashila	Department of Urban and Transport Planning	Planning Design and Traffic Flow - Stormwater	Urban planning	National	Laura.Ashipala@windhoekcc.org.na
Meryl Pupkewitz	Pupkewitz Foundation	CEO	Social development	National	meryl.barry@pupkewitz.com
Faniel Maanda	Human Settlements, City of Windhoek	Manager of Human Settlements	Housing and land	National	Faniel.Maanda@windhoekcc.org.ca
Alfeus Shekunyenge	Ministry of Environment and Tourism	In country facilitator responsible for the national determined contribution	Climate change	National	alfeuscuba@gmail.com
Ofniel Kakero	CoW	Town Planning	Urban Planning		ofk@windhoekcc.org.na
Helena Sylvanus	CoW	Town Planning			17070@windhoekcc.org.na
Cecilia Ndunge	Hanns Seidel Foundation - Think Namibia Campaign	Manager of Promoting Renewable Energies in Namibia (PREN) Project	Climate change, energy	National	pren_project@hsf.org.na cihndunge@gmail.com
Martin Shikongo	City of Windhoek – Biodiversity and Natural Resources	Manager Biodiversity division	Biodiversity	National	Martin.Shikongo@windhoekcc.org.na
Jose Junior	WWF	Intern	Biodiversity	National	smulonga@wwf.na mulongas@gmail.com
Dr Chris Brown	Namibian Chamber of Environment	CEO	Environment	National	ceo@n-c-e.org
Imelda Munika	SDFN Youth	Treasurer	Housing and land	National	Imeldamuny88@gmail.com
Martin Mendelson	RAISON (Research and information services of Namibia)	Director	Environment	National	raison@raison.com.na
Benedict Libanda	Environmental Investment Fund of Namibia	CEO	Environment	National	blibanda@eif.org.na
Uakazuvaka Kazombiaze	Parks, Sports, Recreation and Cemeteries Division, City of Windhoek	Manager	Environment	Municipality	uakazuvaka.kazombiaze@windhoekcc.org.na

Appendix 2 – Scenario Narratives

Shila Nawa – The good life

Good governance, citizens have equal access to services, opportunities and information, inclusive and involved communities AND Access to secure tenure, planned settlements

This is the best-case scenario. We are able to see good governance, with strong political will and local, national and international stakeholder collaboration. The citizens regularly participate in maintenance and upkeep of infrastructure, and through participatory democracy, the leaders have an understanding of the communities' needs. Concurrently, a pragmatic, flexible local authority implements development plans effectively, is accountable to the people, and enforces policies. We see the presence of closely competing political parties, and the presence of a strong opposition party. An inclusive economy allows for equitable distribution of wealth, and this stable economy is resilient to recurring global economic crises. Citizens are economically self-sufficient, while the informal economy is recognized. There is a shift from writing and talking to actual implementation.

By 2020, there is a massive campaign for water demand management, as there is a state of emergency following major droughts across Namibia. The Goreangab Dam remains polluted. All stakeholders appreciate the need for adaptation to a changing climate in line with the predictions and recommendations of the IPCC. In this scenario, everyone benefits, including local residents, the City of Windhoek, NamWater, and the Ministry of Agriculture, Water and Forestry. Water tariffs are enforced, and users are penalized for over use. The separation of shared community bills allows households to pay for their own consumption, and be responsible for their usage. This increases public revenue and reduces community debt. At the same time, household water savings are also incentivized with non-monetary means such as tax-breaks, food vouchers etc.

The CoW's Integrated Climate Change Strategy and Action Plan is fully implemented across all sectors of society. Due to severe droughts, flash floods and increases in temperatures, both climate adaptation and mitigation is addressed. There are better collaborations between city departments, and collaborations with external stakeholders (local NGOs, academia and international). Collaboration and integration of different sectors and stakeholders ensures that various interventions minimize trade-offs and maximize synergies between different sustainable goals, exploiting existing bodies such as the National Spatial Data Infrastructure and professional bodies. Well-designed projects harness internal and private funding. Corporate social responsibility is increased through incentives provided by government and by the collaboration of private businesses and government in state-led development projects. We educate our children and youth to think differently, including consideration of climate and its links to health, conservation, water saving, electricity, and sustainable sources of energy and resources.

By 2020, national and city solid waste policies are implemented effectively in response to the continued degradation of urban environments. Effective implementation is achieved through partnerships with research institutes, private sector, international funding, and affected communities, based on evidence-based strategies. The clean-up campaign, as well as reuse, reduce and recycle campaign, is upscaled in all suburbs. There is an awareness and education campaign for poorer communities to separate their recycled products, and separating stations are more widely available and run by Rent 'n Drum, in partnership with the City of Windhoek. Funding for contractors is appropriately designated. Other private companies buy into the recycling business. Indigenous practices of reuse is encouraged once again. At the same time, there is a stronger sense of individual responsibility for solid waste management.

By 2025, curricula and type of education is reformed at all levels (i.e., primary, secondary and tertiary levels). Education considers political accountability and responsible foreign direct investment. More schools train students on urban gardening. An urban design course that incorporates sustainability and environmental management is implemented at NUST. Students benefit by having access to grants and studentships, or more reliable income, so that more mature students can also attend, despite the recent economic recession. There is an increase in interest in studying environmental management, because there is more money in the industry, rather than doing accounting, architecture, etc. Once students have graduated, they are absorbed into the work force and do not have to rely on voluntary projects for work experience.

We see an overall increase of the prioritization of the environment in decision making. People are more empowered to criticize and evaluate the promises of politicians, and politicians themselves do not hold all the power. There are consequences for illegal actions, and tenders are no longer illegally issued. Political elections, although focusing on emerging issues, do not overlook long-term environmental governance. This leads to more social-ecological system sustainability, achieved through the work of the Ministry of Environment and Tourism, local authorities, regional council, and communities. Environmental Impact Assessments for mega infrastructure developments are no longer compromised, and construction does not occur in ecologically vulnerable areas. We enforce the Polluter Pays Principle, 2% Voluntarily, and Environmental Tax/Levies are used towards environmental issues.

Different open spaces are multi-functional, such as high-quality parks. The city starts to make proper provisioning for open spaces, by clearly zoning areas according to their ecological dynamics and social values, and carries out appropriate planning. A denser, compact city will have “more eyes on the open spaces” to address crime in the open green spaces. People will use the spaces more, because they are attractive, and they are used for recreation, exercise, relaxation, socializing, etc. There is a backbone of security, such as neighborhood watches, 24-hour surveillance cameras, and an active city police service. Crime is also reduced because prisoners are retained with some sort of work and have responsibility. Youth have more access to employment and education through collaborations with private sectors and universities, the establishment of internships, and provision of loans and grants to students.

By 2030, all citizens have access to secure land tenure, supported by appropriate financial systems outside of conventional banking, in order to access housing. Settlements are planned, and existing informal settlements upgraded. Affordable access to housing opportunities with services becomes more widely available. There is a change to a more flexible land tenure policy. The poor can access new financing options, both from bank loans that do not distinguish between formal, informal or temporary employment, as well as saving schemes, such as that of the Shack Dwellers Federation. There is more community-based involvement in housing decision-making, enumeration and upgrading schemes. Low cost housing is truly affordable, where people are not displaced when low cost houses are built. For those who cannot afford houses, land is provided and people have to provide their own services. Corruption is kept at bay when city puts out tenders to construct homes, through the enforcement of more transparent systems that are made public, and fully disposing proposals. Funding is strictly accounted for, with stronger checks and balances for both the local and national authorities.

By 2040, the Namibian economy is more stable. We have paid back loans to the African Development Bank and Foreign Investors. We have domestic autonomy over our own land, and land ownership is clearly defined. We have a long term lease with certain conditions for selling land to foreign investors, so biodiversity is better protected and mining revenue is locally accrued, with profit returned and reinvested to the local economy, rather than going internationally. Jobs are created.

By 2030, there is a permanent management of water demand, and not only when the crisis hits. Water system leakages are all repaired and maintained and public awareness about water efficiency is increated through campaigns. Water security is improved through the artificial recharge of aquifers. There is affordable access to clean water and sanitation. Electricity lines are installed in all current informal settlements. Alternative renewable energy sources are prioritized, and the use of paraffin and gas declines, through a solar renewable energy policy which makes solar energy more affordable. The Ministry of Mines and Energy plays a more active role in renewable energy technology leap frogging. Everyone, both rich and poor, is under one umbrella for renewable energy. Buildings are designed in a green way, with solar panels, fog mist spray system, indigenous gardens, rainwater harvesting, zeroscaping, etc.

Food security is improved because there are widespread health and nutrition campaigns. Large/small scale urban agriculture throughout the city develops, and there is wider recognition of the value of agriculture, which is not only a poor man's enterprise, but also something that is culturally respected. This happens through training and providing examples of using low water systems. There is local trade within small communities exchanging nutritious and diverse foods. We would not depend as much on large-scale agriculture, which is inappropriate for our water restrictions. Space efficiency is better enforced.

By 2063, we see both the central and local governments are accountable and transparent. There are equal socio-economic and employment opportunities for all citizens. The Ministry of Justice leads legal and policy reforms that decentralize decision-making, which benefits and consults all citizens. The community is more involved in decision-making, remains engaged and informed, and has equal access to services, opportunities and information. A more bottom up approach from the local to national levels, means authority is shared, and local communities need to be held more accountable. The anti-corruption commission is effective. Greedy, corrupt government officials are removed from positions of authority and punished. There is continuity in human resources working in public roles, and not a short turn over. Leaders of the country are well informed. Meritocracy drives processes. Namibia has a robust, independent and accountable economy. Overall, we have a healthy, happy populace.

Windhoek is rich in biodiversity. Broken sewer systems are repaired, so that the river systems and dams' toxicity and pollution is reversed. Biodiversity protection policies are implemented, and ministries at high levels take biodiversity protection and climate change seriously. Namibia is playing a much stronger role in international climate change policy-making, both across the continent and internationally. We have an organized and informed representation. There is solar-powered desalination and access to permanent sustainable water resources, and Namibia sources the funds for desalinization plants. Water access and supply has higher prioritization.

The embedded inequality over 40 years is substantially deconstructed. A strong sense of social cohesion and community forms throughout Windhoek. There is a reinvigoration of neighbor engagement and support. The urban form allows for more interaction between previously segregated areas during apartheid. Public spaces allow for people across cultures and races to integrate, particularly allowing children to play safely together.

Universal healthcare is supported by the central government, along with UNESCO and Red Cross. There are few, controlled and managed diseases, and the outbreaks of Hepatitis E are managed as we have good sanitation. Dry pit latrines are well managed and maintained. People have better trust in public health services and no longer resort to costly private health services. The government is responsible for health and education, and existing health services are upgraded. Private investors are playing a stronger role in public services, including health and education.

***Comments from plausibility analysis*:** In terms of the park and garden design, it must be emphasized that invasive trees are not encourages, but exotic non-invasives that are adapted to a waterless environment can be considered. Indigenous ground cover will lead to stability of soil, and the prevention of erosion. Must be careful about thinking that politicians will change, because the chance that they will prioritize environmental governance is less. This scenario also needs to be more explicit about the mechanisms to stop corruption in CoW.

Zula for survival

Access to secure tenure, planned settlements AND corruption, civil war, economic recession, with autocratic and bureaucratic decision-making, social inequality and discrimination

In this scenario, the flexible Land Tenure Act of 2012 (which was initially tabled in 1995) facilitates easier access to land tenure. With land tenure, people who own land add value to their own property – for instance, gardens to enhance food security. They build flats and rent it, and get income for bills, school fees etc., even without formal employment. This leads to more security. Secure land tenure also gives families a sense of dignity, belonging, and they feel protected by the law. Although people have built flats behind their houses in the poorer areas even at present, people also want garden areas, because they can grow their own tomatoes and other self-sustaining gardens, and they are able to obtain these in this scenario. Staying in a three-story building is a serious cultural change, because Namibians want single story residences. This scenario offers affordable and acceptable housing, as high-rise may not be acceptable. However, attractive pricing and the availability of social and recreational spaces, also incentivizes moving into apartment buildings.

For instance, the CoW project called Ongose, which has high rise elements in it, integrates new socio-ecological considerations, but Ongose is challenged, because it is driven by a profit motive. Located behind Havana, it is thought that they will not consider a portion of their land for the poor. However, having this kind of big development beyond the informal settlements also equalizes society from a spatial perspective, and in some ways starts the process of integrating the city.

Even though there is an economic incentive in informal living, as it is cheaper than formal living with associated electricity and water bills, major change in mindset of the people makes secure land tenure a reality. However, people in informal settlements still need electricity, water, streetlights, sanitation, and roads, and they have lived for so long without these services. Local authorities continue to 'plan' on paper, but because there is no implementation of services. There are organizations like UNICEF, Red Cross and Un-HABITAT who step in, because of emergency disaster situations like Hepatitis E outbreaks. The community works with these organizations, which in some ways to replace the municipalities, because the CoW doesn't take action fast enough. But in Windhoek's case, the authorities still want to be involved, and they may even take down illegal structures.

However, with poor governance, land grabbing is a free for all. Moreover, land tenure proclamation takes a long time, in turn stalling land servicing. Substantial corruption takes finances away from priorities of servicing and job creation, and into the pockets of few individuals. This leads to an economic recession and unemployment. The gap between the rich and poor grows, while principles of equity fall. Bureaucracy that does not allow flexible and accommodating policies is present. Things take a long time to happen. All government administrative processes are lengthy, and bribery is commonplace, in order to 'jump the queue', especially to get tenure plans and upgrading plans approved.

There is unequal distribution and use of limited available resources. Families need two incomes in a household to be able to support themselves. Single parents are unable to afford education for children, who are forced to depend on other partners or parents. Minority voices are not heard and discriminated against, while the majority rules. Local municipal officers have a false sense of control. Without good governance, class, race, and tribe geographic boundaries are established. People do not trust each other. There is growing social and gender inequality. Children and youth beg ("zula") and hustle as extreme poverty grows. People are willing to do anything to survive. The population goes into "survival mode", i.e., there emerges more theft, prostitution, break-ins, and cattle stealing.

In informal settlements, there are people who grab land, put up a shack, rent it out to other people, and then repeat the process again elsewhere. People see land as a speculative opportunity to make money, and by the time the municipality gets there, the deals have already been made. This trend steadily increases, even in the short term. When secure land tenure is given, it is given as 'one man one plot', but opposition and undercutting of from those who stand to lose their rent income, for a barrier to giving secure land tenure to people. However, as there is some form of secure tenure in many parts, and densification starts to ease as plots are demarcated according to a plan.

There is affordable access to health, but of a low standard. There are no opportunities for recreation, exercise, or open spaces, because such facilities have not been created. Stress levels increase due to unemployment, economic insecurity, and children's education being unavailable/ of low quality. Therefore, alcohol and substance abuse increases. Laborers sit idle along the sides of road waiting for work. The health sector is now challenged, spiraling into disrepair. There is an increase in communicable and non-communicable diseases, as people take less responsibility for their surroundings, and authorities are not accountable. Air pollution persists due to continued reliance on vehicular travel, as well as unregulated industrial pollution. Poor governance means food deserts persist, and people living in lower income areas reside in "food deserts". Flush toilets are more common, because people are willing to pay for the water to flush if they have a toilet. However, they are not connected to sewage pipes of the municipality, and cannot get cleaned by the water reclamation plant.

By 2030, regulations and acts take years to be enacted, by which time reforms of acts are necessary. People's sense of civic duty disintegrates as they become more frustrated with authorities and the state of living. Houses are expensive even though tenure is secure, and so the unemployed youth cannot afford housing. With this dissatisfaction, we see the Affirmative Repositioning Movement rising. A landless people's movement develops, as well as youth led activism. Unrest erupts when government decides to raise taxes in an effort to counter economic deficits.

Slowly open spaces start to diminish, as people build in whatever land that you can get. The gap between rich and poor keeps increasing, because the informal conversations that happen between people who belong to the same network will ensure that the money stays within a few people's pockets.

There is no demand-side and supply-side management of water resources, leading to severe scarcity. This impacts and aggravates further land degradation, health and livelihoods. Harvesting of water becomes more widespread, and contouring of land is a survival technique, even if it is against official regulations. At the same time, since there is an absence of good management, people become more proactive in finding other more renewable, off grid sources of energy (mostly solar), depending on affordability. However, the water reclamation becomes more important, especially desalination, even if it's costly, because the water crisis is so acute.

Initially, all sectors of society experience vulnerability due to bad governance. However, over time, residents are forced to become self-reliant and resilient, because they cannot depend on the government support. This spiral downwards changes Namibians from being complacent about a situation, into challenging government and demanding accountability. Education institutions become more prominent in terms of research and helping people improve their lives (NUST for instance), and new external stakeholders play a stronger role in the public sector, not just the municipality.

By 2050, local authorities slowly lose control of how people access land. This results in war and unrest. Rates and taxes cannot be recovered from all residents in Windhoek, which has a knock on effect on government services. Through corruption, a handful of developers win tenders and gain money, without the development actually taking place. Those in informal settlements who would gain land rights would be those with the right connections, i.e. nepotism and bribery. In some cases, when consultation is poor, people sell the plot that they receive, and go and establish an informal settlement somewhere else. Others use the land as an asset and source of income. As Windhoek expands, the private farm lands become municipal land (agreements started in 2018).

In 2063, there are more informal settlement areas. Yet, as services deteriorate due to poor governance, many people migrate out of Windhoek to other cities such as Walvis Bay and Rundu, or internationally. Desalination becomes a way to get water for the coast especially, making water cheaper near the coast, and people move away. Pumping water to Windhoek is very expensive, and it's pumped against gravity, making it very difficult.

Drought conditions are country-wide, and there is a mass dying off of animals and trees. In Windhoek, there is a steady death of trees, leading to acute issues of survival. Windhoek is decentralized from urban to rural, and is no more the dominant city. People are not stuck to Windhoek. If there are good jobs elsewhere, they go away. Many people also go back to rural areas – particularly near rivers, since political situation is unbearable. Vibrant economies are created elsewhere, along with desalinization policies. Regional and local government outside Windhoek take their own control. This leads to a brain drain in Windhoek. Many are discouraged from coming to Windhoek due to the climatic conditions (high temperature and water scarcity), and the absence of adaptation to those. This allows for an equilibrium based on carrying capacity.

The gap between rich and poor continues to widen, as policies are designed to empower the rich and industries. The situation in 2019, where less than 10% owns most of Namibia's resources, is still present, except in a worse state. There is no enabling environment to promote investment. More Chinese influence on the mineral resources and infrastructure of the country and a lack of good governance means national interests are not protected**.** Elites start monopolizing, and there are landlords who are the only ones who have access to land. Import dependency grows. A reciprocal currency arrangement is established with South Africa, leading to coupled recession with South Africa affecting the entire region. More global changes take place (climate change, economic recessions), and Namibia is increasingly vulnerable to these. Everything is dealt on an 'emergency basis' (reactive policy as opposed to a proactive policy).

Health systems are unable to cope with disasters, epidemics and growth rates, and are under pressure as they are not upgraded. The natural environment is neglected and degraded due to emergencies, and the lower priority given to it. Many people take resources without thinking about sustainability. By 2063, the access to land tenure is no longer available, as the bureaucracy takes over and becomes inflexible and corrupt, leading to a regression to pre-2019 conditions.

Nevertheless, by 2063, the community takes ownership, and carry out protests, marches, and holds government to account, becoming more like Angola in how people take service provision and maintenance into their own hands. CoW does not want to lose power and will try to suppress the rising population, but by 2063, the municipalities' role disintegrates. Wise use of water, even in the North, as the droughts increase, but even then water runs out, and there is severe social unrest. This is felt even more acutely in the arid areas. There are many plans, but implementation is poor throughout this period, and therefore things fall apart. There are climate migrants going out of Namibia, but also there is a strong feeling among Namibians that their country is the most important, because even the rural areas will be water-scare and drought prone, leaving people nowhere to go to. Water wars become very common.

***Comments from plausibility analysis*:** How can access to secure tenure lead to increased inequality? It could benefit the most vulnerable – is this scenario completely contradictory? In reality, access to secure land tenure should decrease inequality in society, but this scenario says things will get worse anyway. This stance may be too extreme. The timeline shows rising inequality and more land speculation, coupled with an emergent activism and civil society demanding more public services – what happens? Retaliation from the government or more successful outcomes? Security of tenure for whom? (N.B. It was decided during further discussion that secure land tenure would be difficult to grant and maintain under an autocratic and corrupt governance system, making this scenario an implausible one.)

Survival of the fittest

Continued growth of crowded informal settlements, vandalism AND Corruption, civil war, economic recession, autocratic, bureaucratic decision making, social inequality and discrimination

In this scenario, by 2030, we see the continuation and worsening of the situation in 2019. There is a lack of political change, and the system is one that is not designed to support everyone. The same ruling party is in charge, and the former freedom fighters hold onto power. Tribe politics persist, where people are seen as Ovambo or Nama, rather than Namibians, and only a few people are benefited. We see self-enrichment because of social inequality. The people in power take farms free of charge at the expense of the poor. There is a misuse of funds. There is also a lack of accountability. No investment goes into infrastructure that helps the masses, and this is coupled with a backward-thinking education system. The lack of change in decision making at higher levels leads to bad governance. In this scenario, the poor suffer, as they don't have access to resources. The rich get richer over time due to inequality.

By 2025, more youth are unemployed, and they do not have a strong voice or representation. The government continues to be the biggest employer in Namibia. The number of graduates increases, but they are not absorbed into the economy. Unemployment is very high because of the corruption rate. Little is done to create job opportunities. This leads to the escalation of poverty. There are ethnic and tribal divisions caused by previous wars – and people feel they want to stick together now as well. This bringa conflict, and there is no development. With poor governance, there is a non-functional system where people are not following regulations, order or justice. Democracy does not function in this civil unrest. There is a lot of crime, theft, drug and alcohol abuse. Self-employment becomes the way forward. People have innovative ideas, but they struggle to source start-up capital, present collateral and find training in business management and technical skills. People find financial support through their social networks, and these networks increase in importance. Others that have community organization are able to access funding from government-led initiatives. However, ownership is a challenge and free riders emerge. Those who are successful in this situation are hardworking

and passionate. Non-governmental organizations play a stronger role in funding or training community-led initiatives. However, many of these are Namibian-led, and are not sustainable in the long term. There is also insufficient discussion about why people would get involved and where you would want to take the project in the future.

On the other hand, government policies do support vocational training rather than focusing on masters and PhD students, in order to grow the unskilled workforce, which is currently very small. At the international level, the Continental Free Trade agreement means more people trade internationally. The International Labour Organization report drives new types of entrepreneurship, and people take advantage of this. The UN sets a standard through the SDGs to support reproductive health. At a high level, it is acknowledged, but as it trickles down through ministries, it becomes more of a challenge to implement and administer.

By 2030, the informal settlements expand and densify, and there is land degradation. The ecosystem services and all biodiversity declines. There are more brown spaces because of the increase in informal settlements. People grab land from the little open space left in Windhoek. This means green space dwindles, and there are no recreational areas or public spaces. The kids do not have a place to play while growing up and this leads to dysfunctional childhood development. People think only about themselves. Sacred forests in Namibia are deforested through illegal deals, such as rosewood forest issues that have licensing benefits. Licenses are issues without the correct clearance. Attempts to apply governance and the speed of mitigation attempts are not in line with environmental degradation (e.g. policy response). This leads to the development of a stronger civil society, such as that of the SWAPO youth league struggle, and Affirmative repositioning. Young people want to take action, stand up, and are free to speak. In response, there is retaliation through a violent response. Even if there are good individuals in power, there is a lack of skill within ministries.

The communities on the ground do not care, and the chiefs are susceptible to selling off their natural resources to foreign investors. As poverty remains unaddressed, there is an increase in exploitation of ecosystems. Governments do not give rights to communities for the ownership, and there is no prioritization of the biodiversity economy. In 2063, the press has more difficulty to speak out about degradation. There is an insufficient response from national and local authorities, such as with border control. People understand and respect soccer fields, but there is not sufficient areas for children to play after school. Counsellors do not spend their budgets, and do not involve the community when funds are disseminated.

There is water, air and noise pollution because there are a lot of people dispersed in a large area. There is a knock on effect of uncontrolled increase in shebeens, which impacts the development of young children. Water pollution is a deep problem because there are no sanitation systems in place, and the informal settlements are not considered for basic access to services of energy, health and food. There is an outbreak of diseases because hygienic systems are not in place. Systems are damaged due to high levels of vandalism. Some communities, which are wealthy and have access to education, are empowered with information and resources to withstand scarcities. However, people in the informal areas who have bad education do not know where to access water.

More people are vulnerable to the impacts of climate change, because there is less water. With less forage, animals come into the urban centres. People in the North migrate to the city due to environmental change in the Northern areas. Many people living in the informal settlements are the most vulnerable to the impacts of climate change because they are living in risky zones. There is no climate proofed infrastructure. Government does not spend money on drip irrigation or climate resilient technologies. This means local communities are more dependent on NGOs and donors. Namibia comes into the international spotlight as one of the countries that will suffer the most from the impacts of climate. The government is not able to negotiate internationally

for appropriate funding from the Adaptation Fund, and it is not considered a priority because of its economic status as an upper middle-income country. There are no climate funds that are spent on the city. Technology needs to be imported. Adaptive capacity is mostly autonomous, rather than top down planned adaptation intervention. Small-scale technologies (e.g., drip irrigation) are favoured over large scale interventions, and are adopted over peer-to-peer learning and practical demonstrations at the local level. However, this is not coordinated.

With poor governance, energy provisioning continues to be centralized by NamPower. In 2019, very good top down decisions were made at the Ministry of Mines through the Harambe Prosperity plan, supporting renewable energy. But over time this was not sustainable. People in informal settlements depend on firewood for cooking and heating because they don't have access to electricity. Township residents jump over to farms to collect firewood, causing conflicts with the farm owners. There is high deforestation. This causes respiratory problems. Poor governance does not promote adaptation policies, and so with climate change temperature rises and rainfall is more erratic. People in the shacks have to deal with heatwaves, and they suffer from headaches because there is no ventilation.

In terms of health impacts, there is uncontrolled open defecation. Many people die due to spread of diseases. There is a massive outbreak of Hep E. This attracts a clean-up campaign across the city and international bodies come in to help with public health. However, the small initiatives to respond are haphazard and uncoordinated. Dry flush eco toilets are installed to deal with the drought. There is more young pregnancy and alcoholism, as individuals become despondent. Malnutrition increases because of a lack of awareness, and there are food deserts in the informal settlements. A few households take up urban agriculture, aquaponics and hydroponics and vertical farming but on a small scale, because of a lack of planning, and capacity building, lack of knowledge on soil conservation techniques, and a lack of public space to grow vegetables.

In terms of transportation, poor governance means that the roads are not serviced, and potholes are not repaired. There are logistical problems, as roads are damaged and vandalised. There are restrictions of movement using curfews and road blocks. High social inequality means that the poor come out of the settlements and knock on doors to look for work, and some may even beg. The rich associate the poor with crime and drugs, and they do not want them to come into the city. Continuous dependence on oil makes energy very expensive. The winners are the old crooks, the elites. They hold onto power, and they protect their power and, certain ethnic groups are prioritized and dominate decision-making. The communities on the ground are the losers, because they are not getting the services they need. The officials provide lip services as decision makers only be listen, without implementing anything. Their needs are not prioritized. Promises are not implemented. Practical solutions do not come into place.

By 2063, with a lack of government provisioning, the civil society takes more control of their situation. Some people who want to make change, such as the youth, start to stand up to know their rights and environmental issues, depending on their access to resources and information. People start to have a better understanding about environmental issues.

Water is very expensive, privatized, and inaccessible to the poor. Informal areas do not have clean potable water – leading to conflicts for water resources. People settle closer to the water resources, leading to pollution from solid waste, faeces, and metals. This would be detrimental to the health of people who wash themselves in polluted water, which is also used by animals. Human wildlife conflict erupts around water access. There is no regulation of water use by the Ministry of Environment and Tourism. Underground water is extracted.

Floods and water-related diseases are more frequent, leading to death. With less trees in the informal settlements, more people suffer from heat stroke, as there is no shade for relief from the heat. In response, there is an increase in the number of mobile clinics close to neighbourhoods, to deal with emergencies and climate risk. However, funds are misused. Services expand from addressing TB and HIV, to other services. There are more innovations for cooling driven by the community. Local communities start to prioritize shady areas, which are closed off as meeting places. WASH schemes become more widely applied to raise awareness for cleanliness. Health extension workers play a more important role.

With increased solid waste and a lack of alternative employment, waste increases in value, and SMEs start to convert waste into money. The informal economy grows, and cheap labour increases. The civil war destroys the education system. Graduates do not have anywhere to be absorbed. Uneducated people are exploited. The Black market thrives.

In terms of energy, there is no more wood left surrounding the settlements to use for energy. New energy alternatives are adopted for cooking, such as solar efficient stoves. This is privatized, therefore people have to pay for energy. The way of cooking has changed altogether (Tso tso stove). Non-renewable energy resources are over exploited, and there is pressure from the international community to shift the transport industry to renewable fuelling sources. It is affordable to use solar energy because Namibia is rich in this resource. Concurrently we have oil refineries that are installed. There are more communities that begin to adapt by necessity. The cost of renewable energy becomes more affordable over time. Overall, there is growth in consumerism and urbanization.

There is more use of public transport such as buses, trains but this is a little expensive. There are *matatus* instead of taxis. Travel costs for coming to the CBD increase. The government's plans for the BRT is implemented but poorly unmaintained. The wealthy drive in cars.

***Comments from plausibility analysis*:** After crippling drought what would the impacts be on international trade - Would we have food shortages? What would happen to fish? Would we have something to trade? People are settled and not nomadic, reliant on rainfall and drought – they have to be resilient, so this forces people to think more about the future. There will be nowhere to move if they can survive so they need to be adaptive. Solar energy will be cheaper. Natural gas could be cheaper – but this could lead to other risks, and affect the broader economy making some people richer and leave others as they are. Mental health impacts from pollution as poverty increases bring in the more vulnerable to churches, and make them resort to other means of mental stability. The government rethinks of how communities need to be dealt with. Contamination from industrial grey water and open defecation would pollute underground aquifers – which are being used in this scenario.

Embracing informality

Good governance, citizens have equal access to services, opportunities and information, inclusive and involved communities AND Continued growth of crowded informal settlements, vandalism

In 2030, there is pressure from the community, who work together and fight for land tenure. With the spread of information people know about the possibilities of change in informal settlements, so more options become available. This precedent has been built up over time, even before 2030, and with this increase in community cohesion between shack dwellers, people become more organized. There are strikes and demonstrations in informal settlements, asking local authorities to be answerable for services with urgency. The progress of

informal settlement upgrading in other parts in the country demonstrates that more structured informal settlements can be achieved. The continued degradation of the Goreangab Dam, together with the scarcity of clean water, push communities to fight for clean water and a healthier environment. This increase in organised, Community Based Organisations (CBOs), together with an active youth, drives the movement for change and improvement of informal settlement. The stresses of an economic recession and the high unemployment rates lead people to demand even louder for change. Professionals, such as architects, town planners, students, and spatial planners, come together to collaborate on similar projects for urban development, creating more integration.

There is an election year, and a lot of informal settlements are developed. However, there is a greater prioritization of need for low cost, affordable housing, and priorities are also set and implemented throughout the presidential term. By 2030, votes are not based on the election year promises. Rather, votes are based on outcomes from previous promises. The large youth population of the informal settlements causes a shift in political power, challenging the existing ruling party with the formation of new strong opposition parties such as the Landless Movement Party of Namibia, thus making those in power more accountable to the resolutions made at past Land Conferences.

With good governance, the red tape that is preventing the separation of household bills for water, rates and taxes within a single community, is removed. This is a positive step, as in the past, settlements such as Greenwell Motongo C were not developed because a few people were defaulting on paying bills. This separation of bills also encourages more efficient use of electricity, and it is now easier for each household to pay for their own consumption. Community debt is eradicated. There are collaborations between departments in the CoW such as debt management, engineers, and IT.

To improve implementation, there are assessments of ministries based on outputs and performance. This leads to efficient offices, speedy bureaucratic processes, and improved accountability. Budget allocations are determined according to true needs, following evidence-based research, and resource allocation is progressive, based on results. For example, in the new financial year, the government revaluates the efficacy of certain key actors in housing delivery, such as the National Housing Enterprise and the Shack Dwellers Federation of Namibia. Feasible and realistic targets are set at the beginning of every financial year, and an independent commission is put in place to evaluate progress and development. The agenda is therefore a result of a collaboration of all ministries and stakeholders, and avoids repetition and duplication of efforts. Results are shared on a similar platform. Existing bodies, such as Nation Spatial Data Infrastructure (NSDI), extend their mandate to maximise synergies and minimise trade-offs of different sustainable development goals (SDGs).

Corruption is curbed, with stricter policies being enforced. Historically practiced deterrents become more stringent and effective, and go beyond fines. The management of the budget is improved, and funds are allocated according to the population profile of the city (i.e., the proportion of people living in informal areas). Expenditure in the CoW is reduced where deemed unnecessary (e.g., expensive police cars with high maintenance, higher management positions are more appropriate remunerated). The economic recession calls for a greater accountability and better management of public funds to ensure the efficient use of limited resources. Previously, the informal economy was not able to participate fully as it did not receive the necessary recognition. These vendors were not officially registered, and could not access loans from the financial systems. By 2030, more provisions are made for informal economies, and revenue generated by the unskilled workforce is reinvested into local economies.

With good governance, resources are assigned to deal with emergency response, and adaptation is better managed. For fast and free emergency response, stations are established near informal areas. Community training and network ambulance service is tailored to settlements, especially through the use of small vehicles that can access narrow streets. In addition, mobile police station are placed in informal settlements, and community "neighbourhood" watches are established, making the area more secure. Innovations develop, such as having mobile clinics that move to different areas on different days of the week. In this way, people can seek medical help that is affordable. Similarly, this mobile model applies to the care of young children, to provide them with a foundation for school and support working parents (e.g., kindergartens and pre-schoolers, afterschool care). Waste collection shifts from a few skips to a system where each household is provided by the municipality with bags that can be collected from a common area close to the house, or next to main roads. Households no longer burn their waste next to their homes, reducing the risk of shack fires.

The previous top-down approach to sanitation provision in informal settlements meant the presence of foreign interventions that didn't meet the needs of communities. It wasted public expenditure. Maintenance and management was also an issue. To counter this, by 2030, planning is suitable to each context, in terms of the layouts of the settlements. For other planned developments, such as toilets, the community is involved in decision-making. Electricity and sewerage mains are installed. This is different to the previous context, where ground-truthing was not carried out prior to planning to understand barriers to implementation (e.g. management of toilets). There is investment in formal upgrading, rather than investing in flush toilets that use water. In the meantime, the community is trained to make pit-latrines, solving issues of maintenance too. Family wide Eco-sanitation (maintained pit latrine) is installed, and this is low- cost, easy to install and low in water consumption, compared to flush toilets. The community is educated to increase awareness of using toilet by-products as fertilizers and energy, thereby changing mind-sets of appropriate sanitation. Water is managed in alternative ways, and every five households are provided with subsidised rainwater tanks and water taps. There is an enforcement of fines against vandalism, corruption and environmental degradation.

Since spatial separation of tribes leads to political division too, cultural awareness and education takes place, and Namibia's diversity is celebrated. Concurrently, the community is engaged through training workshops about environment, gender equality, abuse, and health, as well as readily available care and emergency management. Decentralized support and information helps residents navigate bureaucratic processes. People employed in SMEs are registered and recognized, while vocational training is more widely implemented. This training includes land management, and is connected to market spaces, to allow improved market access. Loans and funding opportunities are more widely available, and coordinated through a legal framework.

There are increased investments in green areas in the city, especially football fields and playgrounds. Areas are cleaned, maintained, and have lighting for security purposes. Communities are engaged in the planning and maintenance of green areas, therefore giving a sense of ownership and purpose to areas and facilities that meet community needs

Pressure is put on the private sector to eradicate discrimination against the poor, and enforcement of laws that ensure equality leads to behaviour change. Once discriminatory behaviour is being challenged by legal action, change occurs on a large scale. For example, Dialler-Cab and pizza delivery will be available in informal settlements

By 2040, there is increasing investment in public transport to increase buses, and service multi-purpose routes, which are not only targeted towards the workforce, but encompass the diverse needs of citizens.

By 2063, there are more flexible policies. People are allowed to register small erven and develop incrementally, using alternative local building materials. At first, there is resistance to this change of policy, and since this also required a change in mind-set, it was always unlikely to happen before 2030. By 2063, tribalism and division is discouraged, and all cultures are understood and appreciated. This is a result of a long–term process, one which started before 2019. It takes a long time to reach a de-colonisation of mind-set. The need to overcome the "divide and conquer" mind set still exists. This change involves awareness campaigns, and examples from leaders and individuals. A unified culture helps development and understanding, and collaboration between tribes.

Frequent droughts and extreme flooding make people push for climate-adapted cities, with an efficient use of water, water and solid waste recycling. Riverbeds are managed so as to minimize the effect of floods and decrease the speed of water. Rainwater is harvested during the rainy season using tanks. Deployment of solar energy helps mitigate the effects of climate change and provides low-carbon, secure energy, even to off-grid households. Policy coordination and the use of international funding bodies helps increase the climate resilience of the city.

Sewage systems are renovated and maintained, especially along river systems. People start to use the by-products from toilets to generate energy such as charging and electricity points, and as fertiliser in urban agriculture. Electricity is decentralised, and solar renewable energy is widely adopted. This is achieved through ad-hoc policies and international funding opportunities. Good governance means there are tailored solutions to infrastructure development and service provision in informal areas. For example, small vehicles for narrow streets as a long-term investment. There is water security, waste management, and access to good education.

A low-carbon public transportation system allows for many and widespread stops, a city-wide network, reliable, frequent, affordable service, and clean buses. Transport is used not only for movement for work towards central business district and more affluent neighbourhoods, but for all purposes, such as shopping, leisure, visiting friends etc. Alternative transport is encouraged with the construction of bicycle lanes, coupled with awareness raising campaigns.

For those arriving to the city, reception areas manage new arrivals and incoming migrants to control the mushrooming of informal settlement. Reception areas are defined in advance, as they are mandated to manage the long-term settlement of new migrants. The settlements are well-structured and serviced areas, and communities work alongside planners as the settlement areas are developed. Disease outbreaks are controlled, and decrease with the increase in access to good health services, which were invested in during the previous period.

At an international level, there is legal action to sue the United States and historical polluters for causing climate change. BY 2063, the global south has experienced how badly climate change has affected the world, and therefore, Namibia is ready for action.

***Comments from plausibility analysis*:** What about youth, do they become more self-sufficient? Will this situation encourage more entrepreneurship? Think about involvement of the ministry of finance and building standards and national and local authorities. When speaking of societal integration, we need to think about strategies that are not resource intensive, and are flexible. It must also be a policy that is specific to Namibia's context. The Shack Dwellers Federation, and other key organizations like UNICEF and UN-Habitat, can play a crucial part in service delivery.

Appendix 3 - Semi-quantification of drivers of land use change

Group 1: *Shili Nawa – Good Life*

Participants are asked to provide estimates of how scenario conditions in 2030 and 2063 will effect rates of ….and why

Increases: ++ Increases slightly: + Unmodified: 0 Decreases slightly: - Decreases: --

Keys identified drivers of change	**Parameter value**	**Why does this change happen?**	**Likely change in 5y time steps (%)**	**Degree of uncertainty (%)**
Land and habitat fragmentation	-	- More people therefore development, but in moderation - High-rise / compact city	3	30
Wildlife populations	+	- Regulation to protect wildlife within boundary - Good rainy season	2	30
Water availability	+	- Proper water management and innovative ways to deal with availability - Good rainy seasons	7	60
Water quality	+	- Quality control - Protection of valuable resource	7	60
Education and rep in decision making	+	- Awareness – new curriculum will assist with decision-making and planning – planning design etc.	3	20
Social cohesion	++	People will be happy - Recreation - Proud Namibian	2	60
Equality (between rich and poor)	+	- Less inequality	7	60
Land speculation	-	- Change in governance + good governance and land tenure – policy change	7	60
Industrialization and technological transfer	++	- More ‘specialized’ professionals - New technology – more opportunities – smart life	2	30
Urbanization	+	- People flock to cities, more opportunities - Good life	4	20

Gender and youth representation	+	- Youth empowerment - Gender equality	7	60
Vegetation and tree cover (shrubs, grasslands, etc)	+	- Increase due to protection of vegetation - Recreation and habitat stability	N/A	N/A
GDP per capita	+	- Good economy - Stability and no corruption	N/A	N/A
Economic growth per annum	+	- Natural capital to be considered as capital, not just monetary	N/A	N/A
Income generation	+	- Entrepreneurs	N/A	N/A
Employment opportunities	+	- Creative innovations	N/A	N/A
Trade	+	- Trade investment with other countries or cities	N/A	N/A
Spatial planning and zoning	+	- Policy change – flexibility in policy	N/A	N/A
Climate variability and change	+	- Climate agreement and national/ local - Decreased climate impact	N/A	N/A
Flooding	-	- Control of development and change of river courses	N/A	N/A
Drought	-	- Measures in place to adapt to droughts	N/A	N/A
Intense, erratic rainfall	-	- Measures in place to deal with climate change adaptation	N/A	N/A
Extended dry seasons	-	- CC adaptation measures	N/A	N/A
Heat waves	-	- Pervious surfaces	N/A	N/A
Agricultural productivity	+	- Diversified technological innovation	N/A	N/A
Food security (accessibility, quality and availability)	++	- Urban gardening	N/A	N/A
Noise and air pollution	-	- Noise pollution will increase and air pollution decrease because of enforced laws	N/A	N/A
Crime	-	- Employment rate increased - More job opportunities created	N/A	N/A
Transparent leadership	+	- New policies will force leaders to be transparent in all they do	N/A	N/A

Corruption and lack of political good will	-	- New laws will force people to be honest	N/A	N/A
Health facilities	+	- Universal health system in place	N/A	N/A
Schools	+	Quality education will be provided	N/A	N/A
Higher education institutions	+	Funds are available to fund the establishment of higher institutions	N/A	N/A
Moral and social fabric/cultural behaviours /values	+	- With good governance	N/A	N/A
Human-wildlife conflict	-	- Planning of protected area with city boundary	N/A	N/A
Land grabbing	-	- Secure land tenure	N/A	N/A
Encroachment of parks	-	- Invasive plant species are regulated	N/A	N/A
Corporate social responsibility	+	- Good governance	N/A	N/A
Human population	+	- Urban migration increases because of good life in the city	N/A	N/A
Live stocking density	+	Agricultural practices increases in the Southern part of Windhoek	N/A	N/A
Irrigation water	+	Provision of semi-purified water from WW treatment plant	N/A	N/A
Drinking water	+	We have multiple water sources	N/A	N/A
Energy access	++	We have renewable energy sources	N/A	N/A
Renewable energy (solar, wind, geothermal, etc.)	++	- People are educated and finance is available for renewable energy	N/A	N/A
Roads	++	- Move Windhoek Transportation Master Plan is implemented	N/A	N/A
Communication (e.g., internet and mobile phone towers)	++	- Windhoek becomes a smart city, technological transfer; free wifi	N/A	N/A
Labour availability	+	- More job opportunities	N/A	N/A
Conservancies	0	N/A	N/A	N/A
Poverty	- -	- Robust economical equity	N/A	N/A
Safe, efficient, reliable, affordable transport	+	Move Windhoek Master Plan implemented	N/A	N/A

Government policies/ stricter environmental policies	++	- Environmental policies implemented	N/A	N/A
National debt	- -	Good governance	N/A	N/A
Asset capture	0	N/A	N/A	N/A
Local market access	++	SME's opportunities and funds available	5	40
International market access	++	International markets are interested in ecosystems	4	30
Invasive species	-	Encouragement of indigenous species	2	20
Participation and representation in decision making	+	Encouragement of local communities	1	20
Fire regimes	-	Natural occurring fire	3	50
Tourism and recreation industry	++	Encouragement of open spaces for recreation and tourism	5	40
Truck industry	-	Promoting public transport	5	30
Taxi industry	+	Public transport creates lower carbon footprint	4	20
Pastoralists	-	Supply of access to water and energy	1	10
Farmers	++	Local farming is encouraged for food security	2	30
Petty traders	++	In support of their livelihoods support	3	20
Foreign investments	++	Foreigners will provide green climate funding	2	40
In migration	++	More people are interested in living in the good life city	4	40
Outmigration	0	Good life – no one wants to leave	1	30
Capacity building	++	Education and power to the people creates capacity building	7	20
Road safety	+	Effective enlargement	10	40
Railway collisions of wildlife	-	Effective transportation	20	30

Group 2: *Zula for survival*

Keys identified drivers of change	Parameter value	Why does this change happen?	Likely change in 5y time steps (%)	Degree of uncertainty (%)
Land and habitat fragmentation	++	Demand for land to upgrade standard of living of city; CoW not able to manage development	75	5
Wildlife populations	0	Already wildlife populations are already decimated; very little left; only baboons left	5	5
Water availability	- -	Droughts to continue for another 5 years; no additional sources of water expected	80	5
Water quality	0	As resources become more scarce, wise + responsible use of water will require good quality	5	5
Education and rep in decision making	+	Even if unemployment increasing, education to be seen as increasing opportunity for employment- agreement that collective decision making is important	20	5
Social cohesion	+	Community to have one voice; community goal for development	30	5
Equality (between rich and poor)	- -	Rich and poor do nothing to close the gap and spatial division because of fear	40	5
Land speculation	++	More access to land, but corruption and non-conducive local authority climate	30	5
Industrialization and technological transfer	-	Certain industrial areas becoming deserted – eg. Prosperita; others slightly increasing / developing (eg: Lafrenz)	20	5
Urbanization	++	Drought to compound current pattern	40	N/A
Gender and youth representation	+	Youth participation becoming more active in development agenda	30	N/A
Vegetation and tree cover (shrubs, grasslands, etc.)	--	Drought and overuse to cause further desertification	30	N/A
GDP per capita	--	Job losses, retrenchment, economic recession and austerity	30	N/A
Economic growth per annum	--	As above	30	N/A
Income generation	-	As above, but more self-reliance expected	20	N/A
Employment	-	As above	20	N/A

opportunities				
Trade	-	Drought effect on meat exports + overfishing	25	N/A
Spatial planning and zoning	0	Planning remains monopoly of restrictive professionals + zoning not facilitating development	10	N/A
Climate variability and change	+	Drought to continue + rainfall to be variable + unpredictable	20	N/A
Flooding	+	Drought to make soils more vulnerable to denudation/ erosion	20	N/A
Drought	0	To continue	10	N/A
Intense, erratic rainfall	+	As with flooding (above)	20	N/A
Extended dry seasons	0	See drought	10	N/A
Heat waves	0	See drought	10	N/A
Agricultural productivity	-	Linked to continued drought	20	N/A
Food security (accessibility, quality and availability)	-	Linked to drought, but also may cause local (household) small scale interventions	10	N/A
Noise and air pollution	+	Reliance on wood for energy + individual cars for transport	15	N/A
Crime	+	Job insecurity to increase	20	N/A
Transparent leadership	0	Corruption to increase but also increase in popular movements holding leaders accountable	5	N/A
Corruption and lack of political good will	+	As above	10	N/A
Health facilities	-	Corruption to divert funds as targeted according to needs	25	N/A
Schools	-	As above	25	N/A
Higher education institutions	-	As above (dependant on state subsidies)	15	N/A

Moral and social fabric/cultural behaviours /values	-	Livelihoods becoming more fragile and susceptible to breakdown	10	N/A
Human-wildlife conflict	+	Wildlife now become alternative survival means	10	N/A
Land grabbing	+	Corruption + CoW losing control over land management	20	N/A
Encroachment of parks	+	As above	15	N/A
Corporate social responsibility	+	Pressure of corporations to become more accountable to population	15	N/A
Human population	++	Population growth (natural) + uncontrollable Little family planning Increase in land tenure – more migration	9	20
Live stocking density	--	Less space + fodder Increase in shift to alternative livelihoods Dying off of animals	7	50
Irrigation water	--	Mismanagement, poorly managed water pipes	7	40
Drinking water	--	Climate change, severe water scarcity Secure tenure – increase in access to taps	7	40
Energy access	-	Non-renewable, less fuelwood but tenure	3.5	50
Renewable energy (solar, wind, geothermal, etc.)	0	Bad governance	0	50
Roads	+	Land tenure – people invest	3.5	50
Communication (e.g., internet and mobile phone towers)	+	Land tenure – people invest	3.5	50
Labour availability	++	Need for more jobs	7	50
Conservancies	-	Poor gov, corruption means conservancies are sold off	5	50
Poverty	+	Corruption will increase, with no equality	7	20
Safe, efficient, reliable, affordable transport	0	More people demands transport but there is a lack of investment	0	50

Government policies/ stricter environmental policies	0	Corruption but good planning	0	30
National debt	++	Corruption, bad deals	8	50
Asset capture	++	Corruption, bad deals	8	50
Local market access	+	Informal settlements Food, retail, building supplies, malls Take services to the people	3	40
International market access	0	Economic crisis Driven by the economy	5	50
Invasive species	+	Riverbeds Does not require lots to do – rain to stimulate growth	4	55
Participation and representation in decision making	+	Sections + branch Community information meetings To inform communities of current and future developments	6	30
Fire regimes	+	Informal settlement veld fires Candles, lamp oil left unattended	4	20
Tourism and recreation industry	+	Formal and informal settlements Bus tours, bicycle rides and individuals Tourist attraction	5	35
Truck industry	0	Industrial areas Cargo and goods transport Economy driving	4	50
Taxi industry	++	Within the boundary Transport in short and long distances Create job opportunities	6	20
Pastoralists	--	Around the boundaries No fodder due to drought	4	50
Farmers	-	Around the boundaries Drought	6	30
Petty traders	N/A	N/A	N/A	N/A
Foreign investments	-	National Economic breakdown	7	50

In migration	++	People are coming for better livelihood	7	20
Outmigration	0	There are more job opportunities in the city	6	40
Capacity building	+	More vocational training offered	5	50
Road safety	-	CoW loss of management/control	10	N/A
Railway collisions of wildlife	+	Wildlife may resort to railway reserves for grazing	10	N/A

Group 3: ***Survival of the fittest***

Keys identified drivers of change	**Parameter value**	**Why does this change happen?**	**Likely change in 5y time steps (%)**	**Degree of uncertainty (%)**
Land and habitat fragmentation	++	Increasing demand for houses and humans take from it Increasing population, few care about biodiversity	7	20
Wildlife populations	-	Human involvement, deforestation Destroying animal habitat Human animal conflict increases	3	20
Water availability	- -	More population, more demand Drought, projected for the next 5 years	2	10
Water quality	-	Depending on the suburb CoW water pipes and allocation of taps	3	25
Education and rep in decision making	--	Depends on where the child comes from – their suburb Can't afford transport	2	20
Social cohesion	+	More youth will be included in decisions Working together will secure jobs	4	30
Equality (between rich and poor)	--	Few rich will indulge with NGOs and poor's development No social bond between rich and poor	7	15
Land speculation	+	People would want to know what's happening to the land	4	40
Industrialization and technological transfer	++	We are revolving as a country More people will start to use technological services	7	40
Urbanization	++	Greener pastures More informal settlement expansion	7	20
Gender and youth representation	+	More involved in decision making Youth wants to be included in development panels Better plans	4	10

Vegetation and tree cover (shrubs, grasslands, etc)	--	Land in demand for residential purposes Industrialization area cleared for industry	7	30
GDP per capita	--	GDP/C will decrease among the population as the richer become richer and the poor remain the same	7	30
Economic growth per annum	++	This will increase, as in 5 years' time, investors will be interested in our resources	8	10
Income generation	--	At a certain level people will have less income generation as local capacity is killed by foreigners	7	30
Employment opportunities	-	Employment will decrease as there is a high population of graduates	3.5	10
Trade	++	If we have better decision makers, we believe we will have better trade	7	30
Spatial planning and zoning	++	Planning will increase as we have more stakeholders looking into land issues	7	30
Climate variability and change	++	This will increase as more people are using harmful sources of energy that destroys the ozone layer	7	30
Flooding	--	Will decrease as we have storm management teams to help build catchment areas to avoid floods	N/A	N/A
Drought	+	Will increase due to the high deforestation	3.5	15
Intense, erratic rainfall	-	Will decrease as most of the vegetation is cut down, which contributes towards rainfall.	3.5	10
Extended dry seasons	++	Lack vegetation, landscape occupied	7	30
Heat waves	+	It will increase as temperature tend to increase due to climate change	3.5	10
Agricultural productivity	++	It will increase as backyard garden in practiced commonly	7	30
Food security (accessibility, quality and availability)	++	Food security will be high as GRN tend to implement strategies on quality control	7	30
Noise and air pollution	++	With a generation with high youth population, noise pollution will increase (entertainment etc)	7	30
Crime	++	Definitely will increase due to lack of job opportunities	7	30

Transparent leadership	--	This will decrease as the youth of today is learning from the current leaders that are corrupted	7	5
Corruption and lack of political good will	++	It will increase due to the factor of self interest	7	50
Health facilities	++	To reduce high spread of diseases, hospitals are being constructed	7	30
Schools	++	Will definitely increase as ministers, parents have seen the importance of education	7	10
Higher education institutions	--	Lack of institutions as some are fake and not accredited	7	10
Moral and social fabric/cultural behaviours /values	-	This will decrease due to high influence of western culture	6	30
Human-wildlife conflict	++	It will be high because more animal habitats are being destroyed	7	30
Land grabbing	++	It will increase due to the fact that land is in demand	7	30
Encroachment of parks	-	This will decrease as more land is being cleared for land use purposes	3.5	10
Corporate social responsibility	-	Nowadays generation is more influenced by the western culture so they are losing the values and beliefs	3.5	10
Human population	++	Due to advanced medication population will increase	7	80
Live stocking density	++	This will increase because of cultural beliefs Eg: With Hereros if you don't have livestock you are not considered worthy	7	30
Irrigation water	--	It will definitely decrease as we are one of the hot and dry countries	3	10
Drinking water	-	Will decrease due to water scarcity	4	20
Energy access	++	People are tending to develop so they will need high access to energy	7	30
Renewable energy (solar, wind, geothermal, etc.)	++	Will increase	7	30
Roads	+	Few lands for expansion, it will be hard	3.5	15

Communication (e.g., internet and mobile phone towers)	++	Due to technology the platform will increase	7	30
Labour availability	++	There will be high job demand so it will be very easy to get labourers	7	30
Conservancies	-	Will decrease due to human involvement destroying natural habitat for animals	3.5	15
Poverty	++	The richer become richer and the poor become worse	7	35
Safe, efficient, reliable, affordable transport	--	Will decrease due to urbanization, which leads to high expansion of informal dwellers	3.5	10
Government policies/ stricter environmental policies	--	Will definitely decrease due to corruption	3.5	40
National debt	++	This will be high, as the country depends on foreign loans	7	30
Asset capture	++	Due to NPM this will increase	7	30
Local market access	+	More people will be forced to sell/ go into business	4	20
International market access	0	People will not have access/ lack of knowledge on buying online. Won't be affording to travel	3	30
Invasive species	-	Drought, Human animal conflict	3	10
Participation and representation in decision making	++	More youth will be involved in day-to-day decision making Policies will be implemented	7	20
Fire regimes	-	More shacks will be built – more possibility for fire outbreaks Dry grass easy to catch fire – climate change	4	20
Tourism and recreation industry	--	Lack of green spaces + animals will not attract tourists Recreational places will be less – more informal settlements	1	40
Truck industry	+	Lack of office jobs + lack of skills in the country will push the working force in truck industry	4	40
Taxi industry	0	Lack of job availability will push the youth into taxi business Economy does not have money	0	25
Pastoralists	-	Drought Poor economy, won't be able to trade/ export	4	30

Farmers	--	No rain, drought/ climate change Farmers will sell/ consume their products/ produce	2	10
Petty traders	+	Urbanization – better jobs Starting small businesses	4	30
Foreign investments	+	Foreigners will want to have more share in local resources Government will need foreign money to expand (?)	40	20
In migration	++	Informal settlements will expand More people will flock to the city – better jobs	7	20
Outmigration	+	If more towns are developed, such as Walvis Bay, Rundu, again people will migrate – better jobs	4	30
Capacity building	+	More fix (?) used on different types of livelihoods National Training Authority will make more training available	7	20
Road safety	++	Awareness will be created on road safety Drought, meaning no pot holes caused by rain Attitudes of drivers will change	7	30
Railway collisions of wildlife	-	Due to decease in animals Also decrease in railway services / trains will fade out	4	30

Group 4: *Embracing Informality*

Keys identified drivers of change	**Parameter value**	**Why does this change happen?**	**Likely change in 5y time steps (%)**	**Degree of uncertainty (%)**
Land and habitat fragmentation	0	Expansion of informal settlement But will be well managed	3	10
Wildlife populations	++	Protected Economy is good enough	8	20
Water availability	-	Good governance But climate change + increasing population + increasing consumption	8	5
Water quality	-	Informality controlled High recycling rate	10	8
Education and rep in decision making	++	Investment of government Collaboration between government, NGO, private sector	10	25
Social cohesion	++	Green spaces and neighbourhood activities	7	15

		Investment in understanding all cultures		
Equality (between rich and poor)	+	Good governance But complex issues + informality there	3	60
Land speculation	-	Control regulations Stable economy	7	50
Industrialization and technological transfer	+	Investment in research Collaboration with international organizations	5	50
Urbanization	++	Drought and related struggles Not many other alternative cities	5.5	10
Gender and youth representation	++	Inclusive governance Bigger youth population	10	30
Vegetation and tree cover (shrubs, grasslands, etc)	-	Urbanization happening Good parks, protection	3	30
GDP per capita	++	Investment in CoW training More opportunities	1.5	20
Economic growth per annum	+	Investment, good governance Limitations of systems capacity	0.2	30
Income generation	++	More innovation and research Stable accessible loans	2	35
Employment opportunities	++	New business opportunities New governance projects	2.2	45
Trade	+	Well managed resources Good internal policies	3.5	50
Spatial planning and zoning	++	Planning + involvement of universities + communities Policies for informal settlements	2	30
Climate variability and change	++	Big international dynamics Slow implementation of policies	3	5
Flooding	++	Climate change Natural occurrence	1	5
Drought	++	Climate change Natural occurrence	1	5
Intense, erratic rainfall	++	Climate change Natural occurrence.	1	5

Extended dry seasons	++	Climate change Natural occurrence	1	5
Heat waves	++	Climate change Natural occurrence	1	50
Agricultural productivity	-	Drought But efficient use of water	2	30
Food security (accessibility, quality and availability)	+	Urban agriculture	3	60
Noise and air pollution	-	Community appreciation of cleaner, safer environments Less bars, more informal economic stability	20	40
Crime	-	Better policing, community cohesion + protection of green spaces	10	70
Transparent leadership	+	Communities seeking more accountability, especially youth, Election year	5	40
Corruption and lack of political good will	-	Collaboration across sectors will make corruption difficult Economic crisis makes more people accountable	10	20
Health facilities	++	Low cost mobile clinics Health awareness campaigns	30	40
Schools	+	Low cost preschool/ kindergartens, after school programme	10	40
Higher education institutions	+	Greater Collaboration with professionals and other stakeholders	4	50
Moral and social fabric/cultural behaviours /values	0	Awareness on anti-tribalism start – will take more years to take effect	0	3
Human-wildlife conflict	-	People use alternative energy rather than going to the bush	3	40
Land grabbing	-	Good governance + attitude to informal will increase urbanization	8	10
Encroachment of parks	+	Controlled by community policing	1	10
Corporate social responsibility	+	Increase in CBOs	15	40

Human population	+	Drought will cause urbanization (migration) Urban populations grow naturally	6	30
Live stocking density	-	Drought, livestock die, expensive to maintain	20	40
Irrigation water	+	Good governance and management of water sources for urban agriculture	5	40
Drinking water	-	Drought Reduction not too drastic due to good governance	2	30
Energy access	+	Alternative sources of energy explored	30	30
Renewable energy (solar, wind, geothermal, etc.)	+	Good governance + policy change allows for alternative energy / solutions	30	30
Roads	+	Local authority will recognize informal roads (names) and walking paths	40	25
Communication (e.g., internet and mobile phone towers)	+	Good governance will encourage open communication and youth will be more active	20	30
Labour availability	+	Vocational training will ensure workforce	20	30
Conservancies	+	Environments will be protected and policed Alternative sources of energy	10	30
Poverty	-	Tenure easier to acquire Informal settlement supported	5	30
Safe, efficient, reliable, affordable transport	+	Transport systems to be developed for the informal, existing to be expanded (public)	5	40
Government policies/ stricter environmental policies	++	Protection of natural environments Community appreciation of natural environments	40	10
National debt	0	Good governance will prevent debt growing	0	60

Asset capture	+	Tenure is easier to attain due to better policy Flexible financial systems	5	60
Local market access	++	More money available to people	5	25
International market access	+	Good inter links More unique products manufactured	2.5	50
Invasive species	-	More control More awareness	0.8	30
Participation and representation in decision making	++	Youth push for it Government opening up	3	40
Fire regimes	+	Hotter and drier Good response and prevention	2	30
Tourism and recreation industry	++	Investment to boom economy Stable, well maintained country attracts	3	35
Truck industry	0	Not much within Windhoek	0.1	10
Taxi industry	+	Pop growth But invest in public transport + alternatives	3.5	20
Pastoralists	--	Urbanization pressure Alternative income	5	15
Farmers	--	As above	11	1
Petty traders	++	More people More money around	2.5	20
Foreign investments	++	Attraction of international funding Economic and political stability	2	15
In migration	++	Creation of jobs from good governance Availability of land	9	20
Outmigration	-	Due to drought in Northern areas Job opportunities in cities	7	35
Capacity building	N/A	N/A	N/A	N/A
Road safety	++	Road rules and regulations Better policing Informal settlements will be recognized	40	10

Railway collisions of wildlife	0	Protection of wildlife No wildlife	0	0

Appendix 4 - Semi-quantification of land cover change

Group 1 - Shili Nawa – Good Life

Land cover classes	**Parameter value**	**Where?** (e.g., near roads, airports, waterbodies, park boundaries, settlements)	**What kind?** (e.g., coffee, macadamia nut, sisal)	**Why does this change happen?**	**Likely percentage change (%) in 5 y increments**	**Degree of uncertainty (%)**
Indigenous trees	++	All areas	(Acacia family) - Camel thorn - Shepherd tree	Increase of indigenous trees Planting of trees	3	20
Exotic trees	-	Streets	Sausage tree Jacaranda	Exotic trees that adapt to climate and “water less” trees Non-invasive	1	50
Small scale garden	+	Private residence Public spaces	Seasonal crops Succulent plant	Home grown/ garden Pop-up dry gardens	7	10
Commercial cropland	+	Dagbreek Brakwater Krumhuk	Irrigated Aquaponics	Plots on periphery/ boundary – krumhuk	1	30
Closed to open woody vegetation	+	Periphery	Indigenous trees mostly	Mixed development Ecological integration	3	50
Grassland and livestock grazing zones	+	Periphery and farm plots within boundary	More palatable grass (edible)	Good rainy season Water availability	1	60
Degraded land	+	River – water bodies Informal settlements Roads/ streets	Ground cover Any trees less water	Maintenance of rivers + slopes More trees planed	1	30

Settlements (formal)	++	Own erf + recreation areas Pavements and streets	Any – especially indigenous	Aesthetics Economic value	7	20
Settlements (informal)	+	Own erf Settlement Street	Any – especially indigenous	Aesthetics Beautify own property	4	20
Medicinal plants	+	Settlements Townships	Indigenous shrubs + plants	Awareness of indigenous plants + values	1	60
Ancestral and cultural sites	+	Cemeteries Traditional sites, heritage sites National botanic garden	Indigenous trees	Land reform By-laws/ regulations	3	10

Group 2: Zula for survival

Land cover classes	**Parameter value**	**Where?** (e.g., near roads, airports, waterbodies, park boundaries, settlements)	**What kind?** (e.g., coffee, macadamia nut, sisal)	**Why does this change happen?**	**Likely percentage change (%) in 5 y increments**	**Degree of uncertainty (%)**
Indigenous trees	-	On the periphery of settlements / closer to private farms	Camel thorn – Acacia (mostly indigenous – anything)	People's energy needs are not met through servicing – no access	20% - Daan Viljoen offers buffer, and also wood from farms in the North covering needs	5
Exotic trees	-	Since some are aggressive invasive species, they may come into riverbeds, also towards Brakwater	Prosopis + other invasive species	As above, but also for construction, and active removal as invasive species	15	5

Small scale garden	-	Personal home garden Perhaps communal gardens	Spinach, tomatoes, herbs, onions, melons, mangoes, lemons, guava, granadilla	Although people have access to land, there is water scarcity, soil becoming more eroded. More energy required to plant	5	5
Commercial cropland	-	Chinese vegetable garden, Downstream from Goreangab	Chinese vegetables	As above	15 – unviable unless aquaponics etc is adopted – unlikely in our scenario	15
Closed to open woody vegetation	-	Riverbeds, mountain areas, high and steep areas	Shrubs on mountains will be cleared, and riverbeds	As above, but forests becoming over utilized + inaccessible	50	5
Grassland and livestock grazing zones	-	Next to roads, riverbeds, dam, Daan Viljoen, on private farm boundaries	Grass for fodder	Drought has made fodder for animals very scarce	30	10
Degraded land	++	Nearby settled areas, Construction sites, eroded areas	Brown spaces	Land clearance for settlement + construction	50	5
Settlements (formal)	+	Low income/ affordable areas	Housing increase, but also factories Eg: Lafrenz	Need for affordable housing + employment in factories	20	5
Settlements (informal)	++	Havana, Moses garoeb, Tobias Hainyeko, Goreangab Dam, Goreangab	Most affordable area available	Formal part of city becomes too expensive	55	5
Medicinal plants	0	Goreangab	Aloe vera, tomato leaves,	Medicinal + income purposes	5	5

			marijuana (hidden)			
Ancestral and cultural sites	+	Closer to suburbs as COTA too far	Cultural, youth groups	Affordable sites closer to home; youth kept active + occupied	20	5

Group 3: Survival of the fittest

Land cover classes	**Parameter value**	**Where?** (e.g., near roads, airports, waterbodies, park boundaries, settlements)	**What kind?** (e.g., coffee, macadamia nut, sisal)	**Why does this change happen?**	**Likely percentage change (%) in 5 y increments**	**Degree of uncertainty (%)**
Indigenous trees	-	Towards Daan Viljoen	Aloe vera Acacia	Cutting for accommodation but keeping some for shade	0.9	45
Exotic trees	0	N/A	Eucalyptus	Only on private land already	0	30
Small scale garden	+	Small settlements Individuals Backyard gardens	Veggies Namibian maize	Food security (population increasing) Income	5	25
Commercial cropland	+	City boundary	Wheat Veggies	Population increasing, demand increasing	5	25
Closed to open woody vegetation	-	Towards east, north and south	Bush	City expansion, settlements	8	25
Grassland and livestock grazing zones	--	Farmers at the borders of the city	N/A	Climate change, drought, overexploitation	10	35
Degraded land	+	Unplanned land area	Bad soil	Land use change Increase in settlements	4	30
Settlements (formal)	+	North Windhoek	Houses	Formalization policy	7	25
Settlements (informal)	++	North Windhoek	Shacks	Increasing population Urbanization	10	20
Medicinal plants	0	N/A	Marula Devil's Claw	Growing happening outside Windhoek	0	50

Ancestral and cultural sites	0	N/A	Cemetary Museum Heroes' Acre	No interest Different priorities	0	30

Group 4: Embracing informality

Land cover classes	**Parameter value**	**Where?** (e.g., near roads, airports, waterbodies, park boundaries, settlements)	**What kind?** (e.g., coffee, macadamia nut, sisal)	**Why does this change happen?**	**Likely percentage change (%) in 5 y increments**	**Degree of uncertainty (%)**
Indigenous trees	0	In and around informal settlements Undeveloped areas	Acacia species	Alternative energy Drought = slow growth	0.8	40
Exotic trees	--	In and around Windhoek, wealthy neighbourhoods too	Eucalyptus and others	Not adapted to drought Eradication for firewood and medicine	10	40
Small scale garden	--	Around Windhoek, undeveloped areas	Millet Maize	Drought Alternative food sources	10	50
Commercial cropland	-	Around Windhoek	Green veg	Drought	5	50
Closed to open woody vegetation	0	In and around informal settlements, undeveloped areas	Acacia	Alternative energy Drought = no replenishment	0.8	40
Grassland and livestock grazing zones	-	Around Windhoek Undeveloped areas	grass	Drought Source of income	0.8	30
Degraded land	+	Riverbeds Open space	All	Alternative energy Better appreciation for nature	50	10

				Better policing Sanitation		
Settlements (formal)	+	Around Windhoek	Houses Domestic business	Informal being upgraded Tenure easier to acquire	8	40
Settlements (informal)	-	On Windhoek outskirts	Houses Domestic business	Informal settlements upgrade Flexible policy	60	50
Medicinal plants	+	In and around informal settlements	Eucalyptus Boscia	Better healthcare Protected environment	2	60
Ancestral and cultural sites	N/A	N/A	N/A	N/A	N/A	N/A

Appendix 5 - Semi-quantification of ecosystem services provision

Group 1

Ecosystem Service	**Parameter value in *Shili Nawa – The Good Life***	**Why would this change happen?**	**Where?**	**Likely percentage change (%)**	**Degree of uncertainty (%)**
Space for recreation	+	To allow more space for recreation and business opportunities Riverwalk and existing initiatives	All around Windhoek, especially around riverbeds	10	50
Tourism	+	Brings in revenue, and we a thriving economy and also we have urban design cause that incorporates better security environment	Southern parks of Windhoek Zoo park, Mandela park	3	30
Regulates erosion	++	We are planting indigenous trees and we have other places that are used for other purposes	Riverbeds all over city Sloped of hills	4	5
Air purification	++	Trees planted in the city will help with air purification Good governance in industrial pollution PPP implemented	Everywhere	6	20
Environmental education opportunities	++	Clearly zoned areas Better security high quality parks	Shady areas Soccer fields Water ways	8	50
Drinking/irrigation water	0	Increased drought but there is water harvesting and demand management	River channels Dams	0	80
Meeting and socialization space	++	Space provided for recreational spaces	All suburbs	50	50
Provision of firewood for cooking/heating	--	Everyone has access to affordable renewable energy	Informal settlements	10	60
Medicinal resources	+	Ecosystem services provides for medicinal resources	Townships Backyard gardens Green/ nursery	1	60

Ecosystem Service	**Parameter value in *Shili Nawa – The Good Life***	**Why would this change happen?**	**Where?**	**Likely percentage change (%)**	**Degree of uncertainty (%)**
Microclimate regulation (i.e., shade/cooling effect)	++	More trees planted Infiltration of ground water	Roads/streets House/erf Work place/ any	2	20
Breaking impact of flood waters	++	Stability + Protection + Planning Protection of riparian areas	Riverbanks Water bodies	2	20
Habitat for species	++	Diversity of habitat proper planning + integration of ecological perspectives Environmental planning	Along rivers, patches, parks, gardens, open spaces	3	20
Connectivity for humans and biodiversity	++	Environmental planning incorporated in plans of cities Proper open space infrastructure/network	Along rivers, roads, streets, open space, parks	3	20
Space for exercising	++	Safety and security	Parks/streets Natural areas of recreation - dams	4	20
Enhances soil water storage	+	Improvement of water management + agriculture Proper planning of EIA should be considered in all cases	Water bodies Roads Urban areas, rivers	3	30
Provides fish	+	Rainy – consistent rainfall Cleaning of river courses + storm water drainage in townships	Dams	1	60
Provision of tree pods for animal feed	+	Consistent rainfall More trees planted	Periphery Plots and farmlands	1	50
Beautification, aesthetics and inspiration	++	People will beautify their places and they go to these areas for sightseeing	All around Windhoek, esp. public spaces	3	50
Fruits and greens to increase food security (household consumption)	+	Urban agriculture encouraged	All households	2	80

Ecosystem Service	**Parameter value in *Shili Nawa – The Good Life***	**Why would this change happen?**	**Where?**	**Likely percentage change (%)**	**Degree of uncertainty (%)**
Raw material for livelihoods (traditional crafts including baskets, brooms, natural products)	-	Biodiversity protection Strict laws and regulations around resources	Everywhere	1	70
Captures wastewater, industrial and agricultural runoffs	+	Healthy ecosystems that protect itself from pollution and regulates itself	Riverbeds	2	20
Provision of building material (e.g., timber for frames)	-	Strict laws and regulations around protection of resources	Everywhere	1	80
Carbon capture and storage	++	Indigenous trees planted all around the city	Riverbeds Public open spaces	7	30
Nutrient cycling / decomposition	+	Healthy ecosystems More trees will help to keep the balance	Everywhere	5	20
Mental wellbeing, relaxation psychological comfort	+	People will start using open spaces for relaxation and mental well being	Open spaces Riverbeds Public parks	5	70
Community, and cultural, tribal identity	+	Socialization encouraged especially among young people	Recreational parks New parks/existing	2	60
Provision of grasses for animal feed	-	Provision of grasses from elsewhere, that all areas will be green	Farms, green spaces	3	40
Maintenance of soil fertility	++	The healthy ecosystem supports and provides soil regulation for healthy soils	Farms, suburbs	50	20

Ecosystem Service	**Parameter value in *Shili Nawa – The Good Life***	**Why would this change happen?**	**Where?**	**Likely percentage change (%)**	**Degree of uncertainty (%)**
Reduces water-related diseases (e.g., malaria, dengue, cholera)	++	Healthy ecology provides no opportunity for diseases to strive	Informal areas	7	20
Provides meat (e.g., bush meat, rodents, birds)	0	Provision of food security, thus bush meat is at commercial level from farms	Farms	2	20
Tubers for food security	0	Urban agriculture and farms provide communities with vegetables	Everywhere Agricultural land	20	10
Sacred sites, spiritual and religious value (e.g., churches, marriage)	0	Part of culture and tradition, therefore not much change will take place	Sacred sites, churches, marriage	1	60
Makes soil less hard	++	Limited use of non-paved surfaces- thus water can infiltrate, trees and animals contribute to healthy soil	Farm Green spaces Agricultural land	50	20
Capturing sediments in (storm) water runoff	++	The ecosystem provides of capturing sediments	-	50	20
Provision of tree pods for cooking/heating	++	Access to electricity therefore no need to use pods for cooking/heating	Farms Everywhere Green spaces Parks	70	20
Provision of wood carving materials	--	Regulations exist	Everywhere	2	40
Fruits and greens to increase food security (for sale)	+	Support of urban agriculture	Everywhere	7	30

Ecosystem Service	Parameter value in *Shili Nawa – The Good Life*	Why would this change happen?	Where?	Likely percentage change (%)	Degree of uncertainty (%)
Breaks down pollutants in the water	++	Regulation of pollutants	Riverbeds Rivers Dams	6	20
Provision for renewable energy	++	Provision of renewable energy	Open spaces	3	30
Regulates seasonal changes	++	Create microclimate	Everywhere	2	20

Group 2

Ecosystem Service	Parameter value in Zula for Survival	Why would this change happen?	Where?	Likely percentage change (%)	Degree of uncertainty (%)
Space for recreation	--	Open spaces sold for land demand, municipality can be bribed There's no political will to create and maintain recreational space	Open spaces in the city and also on the outskirts Eg: Braai areas near Goreangab Dam (e.g., Hilton used to be an open space) Rest not maintained	25	5
Tourism	-	Places like Avis Dam, Penduka, Kapana Stalls, Heroes' Acre – if managed by richer individuals they will be buffered from impact due to corruption. Businesses of informal residents will suffer due to water cuts Dry gardens by CoW Parks Division	Avis Dam, Penduka, Goreangab Recreation Area, Kapana Stalls, Heroes Acre	10	5
Regulates erosion	-	People worry more about houses being washed away- people will control with tires etc. At same time, removal of grass and trees will decrease top soil – CoW maintenance not good especially in poorer areas	Riverbeds all over city Sloped of hills	4	5

Ecosystem Service	Parameter value in Zula for Survival	Why would this change happen?	Where?	Likely percentage change (%)	Degree of uncertainty (%)
		Already people in poorer areas take care of it themselves			
Air purification	0	Although trees are cut in periphery people will also plant in their own home gardens	Public open space, private gardens	15	5
Environmental education opportunities	-	Education will be there, but ignorance and corruption will decrease the opportunities Agriculture and nature conservation are taught as subjects, but not practiced	School gardens (primary, secondary and tertiary), botanical gardens	35	5
Drinking/irrigation water	--	Low adaptation to drought leads to scarcity – no demand and supply management More evapotranspiration- less rainfall There's no irrigation water anyway, just potable	All over Windhoek	10	5
Meeting and socialization space	-	Community won't cut all trees, they will leave some Socialization space- people will manage privately, maybe start charging for entry	Communal trees (for meetings), just on outskirts	30	5
Provision of firewood for cooking/heating	--	Very difficult to fetch, people will walk a long way for wood Need other initiatives for cooking options Conflicts between residents of high/middle income suburbs vs lower income suburbs	Conflicts in riverbeds and on the street (rest will be degraded)	75	5
Medicinal resources	0	People value certain plants, they will make sure they are there and maintained	Marijuana (personal gardens), moringa tree, mint – for sale, tobacco - maybe	5	N/A
Microclimate regulation (i.e., shade/cooling effect)	--	Especially in public open space and areas sold/encroached for development – therefore heat increases. People may plant more trees in their own gardens, especially with tenure	Privately people may make more effort, CoW only concentrates in wealthy suburbs	70	N/A

Ecosystem Service	Parameter value in Zula for Survival	Why would this change happen?	Where?	Likely percentage change (%)	Degree of uncertainty (%)
Breaking impact of flood waters	-	People would try hard to maintain some vegetation to prevent water, but in high income areas CoW will remove in low income areas, people build right on riverbeds because they don't expect floods	Riverbeds	30	N/A
Habitat for species	-	High income areas – people will work hard to preserve BD areas, not so much in low income – less awareness, more pressing needs	Only places strictly protected by CoW (Parks) Farms around Windhoek	30	N/A
Connectivity for humans and biodiversity	-	Again, high income areas will maintain, and demand CoW to improve for them, but low income - neglected	Same as above	30	N/A
Space for exercising	-	Hilly areas can be used, but criminality becomes an issue An expanding city – space for exercise will be taken for other land uses	Hilly slopes	45	N/A
Enhances soil water storage	-	As land pressure increases, and as CoW may be corrupted, they may sell land in the South (above aquifer) for development	Aquifer south of Windhoek	11	N/A
Provides fish	0	Unhealthy to eat with increasing pollution of water sources	Dams – Avis, Goreangab Water bodies in farms	15	N/A
Provision of tree pods for animal feed	--	Trees are being cut for other energy needs, pods are not available anymore	Periphery of settlements	70	5
Beautification, aesthetics and inspiration	-	As things degrade in informal areas, richer areas will get more investment into beautification purposes	Investment in aesthetics in Klein, Eros, PioneersPark	10	5

Ecosystem Service	Parameter value in Zula for Survival	Why would this change happen?	Where?	Likely percentage change (%)	Degree of uncertainty (%)
Fruits and greens to increase food security (household consumption)	-	People may have other pressing issues, but secure tenure means that people will grow for themselves maybe	In private home gardens	25	5
Raw material for livelihoods (traditional crafts including baskets, brooms, natural products)	--	Raw materials will finish at fast pace as demand increases People have to fetch material from other regions	On outskirts of the city	60	5
Captures wastewater, industrial and agricultural runoffs	-	People will harvest grass+shrubs – nothing to capture wastewater There will be a lot of wastewater to capture	Empty riverbeds	30	5
Provision of building material (e.g., timber for frames)	--	No big trees left for building materials Trees in high income suburbs are protected by residents	Degraded land – no trees, maybe supply from elsewhere in the country	5	5
Carbon capture and storage	-	The reduction of the number of trees	Hotspot will be richer suburbs	20	5
Nutrient cycling / decomposition	--	As the number of trees decrease the nutrient cycling shuts down	Degraded, may continue near Avis, some places near Goreangab	15	5
Mental wellbeing, relaxation, psychological comfort	--	People may smoke more marijuana to distress, causing violence There are no enough relaxation spaces for stress	Informal areas, substance abuse will increase	7	5

Ecosystem Service	Parameter value in Zula for Survival	Why would this change happen?	Where?	Likely percentage change (%)	Degree of uncertainty (%)
Community, and cultural, tribal identity	0	Not used for any	-	-	-
Provision of grasses for animal feed	--	As it becomes drier, grasses will not grow People will be barred from entering riverbeds in richer suburbs	Within the boundary	60	5
Maintenance of soil fertility	--	Will severely degrade in an unequal manner, with informal settlements experiencing the worst Feed will be fetched from other regions	Slopes, riverbeds	40	5
Reduces water-related diseases (e.g., malaria, dengue, cholera)	-	More stagnant water caused by pollution	Drainage areas	10	5
Provides meat (e.g., bush meat, rodents, birds)	-	Rabbits, small mammals nearer to farms are eaten, but they will be overharvested	Outskirts of the boundary	5	5
Tubers for food security	N/A	People don't really plant tubers Some may resort to sweet potato but its hard to grow			
Sacred sites, spiritual and religious value (e.g., churches, marriage)	0	Because people migrated to Windhoek from other places, there are not many sacred sites – church areas may be last places to go as people depend on religion	Churches	2	5
Makes soil less hard	-	As trees are cut and land is degraded, soil will be washed away	Informal settlements	5	5
Capturing sediments in (storm) water runoff	--	Storm water, when it does occur, may be harvested more by CoW to be able to charge tariffs and rates, so they will actively clear river beds	River beds	80	5

Ecosystem Service	Parameter value in Zula for Survival	Why would this change happen?	Where?	Likely percentage change (%)	Degree of uncertainty (%)
Provision of tree pods for cooking/heating	--	May be supplied from other parts of the country, not from Windhoek anymore More people will lose their livelihoods	Informal settlements Surrounding farms	75	5
Provision of wood carving materials	0	People usually get materials for carving from Okahandja and beyond		0	0
Fruits and greens to increase food security (for sale)	--	People will not be able to grow the kind of volume needed for resale, soil not conducive	Informal settlements	10	5
Breaks down pollutants in the water	--	Vegetation will be cleared by storm water people	Informal settlements River beds	5	5
Provision for renewable energy	--	No connection	Within boundary	5	5
Regulates seasonal changes	-	Temperature will increase in summer, as trees are lost and shade is lost , Microclimatic changes	Informal settlements	75	5

Group 3

Ecosystem Service	Parameter value in Survival of the Fittest	Why would this change happen?	Where?	Likely percentage change (%)	Degree of uncertainty (%)
Space for recreation	-	Increase in informal settlements, but there would be initiatives to maintain the spaces available There would be provision for open spaces in new developed areas	New proclaimed areas	5	50
Tourism	-	Climate change, Crime rate increasing, drives tourism down, Influx of people flocking to the city, shifting nature away, pollution would increase, unpleasant environment	Within the boundaries	7	10
Regulates erosion	-	More people compacts the soil, more run off Convert soil structure allows for increased erosion	Informal settlements New development sites	4	30
Air purification	-	Due to less forests in the carbon sinks	Informal settlements due to fires	6	40

Ecosystem Service	Parameter value in Survival of the Fittest	Why would this change happen?	Where?	Likely percentage change (%)	Degree of uncertainty (%)
Environmental education opportunities	+	More initiatives to adopt to climate change and mitigation mechanisms	Within the boundaries but more specific to informal areas' schools and institutions	5	45
Drinking/irrigation water	--	Due to less rain, high water demand from increase in population Windhoek does not have a fixed (secured) water source except from aquifer (decrease in recharge due to decreased rainfall)	Within the boundaries	8	50
Meeting and socialization space	-	Space (available) will be used for residential space purposes Won't be provisions for new areas/ limited	In informal settlements and residential areas	6	30
Provision of firewood for cooking/heating	--	Due to high demand firewood cooking, heating	Informal settlements surrounding farm lands	8	30
Medicinal resources	-	Demand for medicinal use Health will be less affordable and people will turn to indigenous plants	Boundaries of informal settlements In green space of wealthy neighbourhoods	8	20
Microclimate regulation (i.e., shade/cooling effect)	-	Increase in demand for trees, so shade decline	All open and available green spaces in informal areas	9	15
Breaking impact of flood waters	-	People who will remove trees along the rivers, other natural boundaries as well	In informal areas	8.5	20
Habitat for species	-	Due to deforestation for animals to have habitat Expansion of informal settlements causes human-animal conflict, Also lose species	All over informal settlement In riverbeds	8.5	23

Ecosystem Service	Parameter value in Survival of the Fittest	Why would this change happen?	Where?	Likely percentage change (%)	Degree of uncertainty (%)
Connectivity for humans and biodiversity	-	People will over utilize resources such as sand mining and reeds in river beds	In riverbeds in the city	8	15
Space for exercising	--	People are not concerned with healthy and fit lifestyles – focused on poverty	Reduction of exercise spaces in informal areas	7.5	10
Enhances soil water storage	-	People will mine sand and deforestation reduces top soil, water decreases, climate change	In the riverbeds around the city	9.3	0.8
Provides fish	-	Overfishing by residents to provide alternative supplements and also economics Pollution	Will happen in dams north and south Goreangab and Avis	8.7	0.5
Provision of tree pods for animal feed	-	Reduction of provision supply. Early harvesting of pods due to economic needs	Green spaces in the city	6	20
Beautification, aesthetics and inspiration	--	There will be no space available for parks, recreational areas etc. Expansion of informal settlements	Outskirts of Windhoek Informal settlements	2	30
Fruits and greens to increase food security (household consumption)	-	Lack of water sources Lack of knowledge on other ways of farming	Informal settlements Groot-Aub, Dordabis	3	30
Raw material for livelihoods (traditional crafts including baskets, brooms, natural products)	+	Selling to the tourists Keeping up with traditional aspects	Informal sectors Northern part	7	15
Captures wastewater, industrial and	+	Greywater system, reducing bills on water	Informal settlements Otjimuise	7.5	5

Ecosystem Service	Parameter value in Survival of the Fittest	Why would this change happen?	Where?	Likely percentage change (%)	Degree of uncertainty (%)
agricultural runoffs					
Provision of building material (e.g., timber for frames)	-	Locals will not benefit/ only for the ones who are well connected	Informal settlements	2	30
Carbon capture and storage	-	Deforestation Increase in informal settlement areas	Outskirts of Windhoek	8.5	25
Nutrient cycling / decomposition	+	More dumping sites due to lack of toilets	Informal settlements	5	30
Mental wellbeing, relaxation, psychological comfort	-	More stress for people Socio-economic stress High crime rate	Informal areas	7.5	0.5
Community, and cultural, tribal identity	++	People will divide in cultural groups in order to survive Strong solidarity against current systems in place	Informal settlements	5	25
Provision of grasses for animal feed	-	Variability of rainfall	Within the boundary	50	40
Maintenance of soil fertility	-	Over utilization of soil due to limited space Costly to maintain soil fertility	Within boundary (private houses, backyards, gardens)	45	50
Reduces water-related diseases (e.g., malaria, dengue, cholera)	+	More campaigns (awareness) International organizations will pitch in and help	Within boundary	2	25
Provides meat (e.g., bush meat, rodents, birds)	-	Less vegetation to nurture them	Outskirts of the boundary	15	40
Tubers for food security	N/A	N/A	N/A	N/A	N/A

Ecosystem Service	Parameter value in Survival of the Fittest	Why would this change happen?	Where?	Likely percentage change (%)	Degree of uncertainty (%)
Sacred sites, spiritual and religious value (e.g., churches, marriage)	+	Churches are business areas (grounds of churches) Increase in death due to sicknesses, depression	Informal settlements	15	50
Makes soil less hard	--	Because there is less vegetation More people affects soil structure, causing dust	Informal settlements	4	30
Capturing sediments in (storm) water runoff	-	No vegetation on the river banks to capture sediment	River beds	15	40
Provision of tree pods for cooking/heating	N/A	N/A	N/A	N/A	N/A
Provision of wood carving materials	N/A	No plant species for wood carving within our boundaries	N/A	N/A	N/A
Fruits and greens to increase food security (for sale)	+	Due to food demand	Informal settlements, Schools, individual households	50%	50%
Breaks down pollutants in the water	-	Due to increase of dumping (waste)	Informal settlements River beds	60%	30%
Provision for renewable energy	+	Possible alternative right initiatives (sun) Affordable	Within boundary	50%	50
Regulates seasonal changes	N/A	N/A	N/A	N/A	N/A

Group 4

Ecosystem Service	**Parameter value in *Embracing Informality***	**Why would this change happen?**	**Where?**	**Likely percentage change (%)**	**Degree of uncertainty (%)**
Space for recreation	++	Climate resilience of green space People want increased wellbeing in neighbourhood and enjoy nature (walking, chilling, cycling)	Parks, riverbeds, dams, reserves, farms, football fields	35	50
Tourism	++	Boost economy + jobs Well managed spaces become attractive	Dams, riverbeds, parks, reserves, farms, gardens	20	40
Regulates erosion	+	Government wants to control floods Preserve quality of soil (farming, housing)	Riverbeds + steep areas + paths + roads	5	35
Air purification	++	To balance increasing traffic To balance pollution of industries	Trees around city, along roads etc	30	30
Environmental education opportunities	+	To change awareness of environment O help behaviour for adaptation and mitigation	Botanical garden, nurseries, dams, parks	10	50
Drinking/irrigation water	++	Trap and hold water in view of drought To filter and clean water	Gardens, riverbed	35	30
Meeting and socialization space	++	Foster inclusiveness and cohesion Space for kids to play and meet	Parks, riverbeds, garden, squares, etc	35	50
Provision of firewood for cooking/heating	-	Alternative forms of energy available Protection of trees	In and around city	8	20
Medicinal resources	+	Better health care facilities Protected environment	In and around informal settlements	2	60
Microclimate regulation (i.e., shade/cooling effect)	+	Alternative energy Better appreciation for the environment + better policing	In and around informal settlements, undeveloped areas	2	60
Breaking impact of flood waters	++	Resilience to flash floods Better environmental appreciation	Riverbeds	40	50

Ecosystem Service	**Parameter value in *Embracing Informality***	**Why would this change happen?**	**Where?**	**Likely percentage change (%)**	**Degree of uncertainty (%)**
Habitat for species	+	Better environmental approach	Riverbeds Green areas	30	60
Connectivity for humans and biodiversity	+	Environmental awareness	In and around informal settlements	20	50
Space for exercising	+	Proper urban planning Land use regulations Functional parks	Open areas in Windhoek	20	50
Enhances soil water storage	-	Drought Water harvesting	Informal settlements	8	60
Provides fish	+	Goreangab Dam natural ecosystem restored	Goreangab dam	5	60
Provision of tree pods for animal feed	0	N/A	Outskirts of Windhoek	0	60
Beautification, aesthetics and inspiration	++	Increase wellbeing of residents Increase property value	Parks + gardens	30	45
Fruits and greens to increase food security (household consumption)	+	Use of riverbeds + river water to farm Training and teaching	Riverbeds Veg gardens	10	20
Raw material for livelihoods (traditional crafts including baskets, brooms, natural products)	0	Doesn't happen much now in Windhoek, unlikely to change	Nowhere	0.1	1
Captures wastewater, industrial and agricultural runoffs	++	To restore and clean ecosystems To increase sustainability of industries	Around north and south industrial areas. Goreangab dam, riverbeds	30	40

Ecosystem Service	**Parameter value in *Embracing Informality***	**Why would this change happen?**	**Where?**	**Likely percentage change (%)**	**Degree of uncertainty (%)**
Provision of building material (e.g., timber for frames)	+	Use of traditional material in houses increases But materials sourced from other areas	Undeveloped areas	15	30
Carbon capture and storage	++	Not used for fire anymore Protection of trees	Everywhere	40	20
Nutrient cycling / decomposition	++	Protected ecosystems Active employment to clean areas	Everywhere	40	20
Mental wellbeing, relaxation, psychological comfort	++	Increase of green areas for urban equality % depends on management	Riverbeds, parks, gardens, dams	35	50
Community, and cultural, tribal identity	+	Marriages, meeting places Not too much as other buildings fulfil same function	Parks, gardens	30	30
Provision of grasses for animal feed	-	Drought killing animals	Around Windhoek	30	50
Maintenance of soil fertility	+	Urban agriculture	In and around informal settlements	5	60
Reduces water-related diseases (e.g., malaria, dengue, cholera)	+	Improvement water sanitation Health awareness Water treatment	Water catchment areas (dams)	40	60
Provides meat (e.g., bush meat, rodents, birds)	0	Wild animals	In and around informal settlements	0	50
Tubers for food security	+	Green urban	In and around informal settlements	5	60
Sacred sites, spiritual and	+	Population growth	Around Windhoek	8	50

Ecosystem Service	**Parameter value in *Embracing Informality***	**Why would this change happen?**	**Where?**	**Likely percentage change (%)**	**Degree of uncertainty (%)**
religious value (e.g., churches, marriage)					
Makes soil less hard	+	Urban agriculture	Around Windhoek	2	50
Capturing sediments in (storm) water runoff	+	Water harvesting Improved water infrastructure	From house roofs Riverbeds	30	40
Provision of tree pods for cooking/heating	0	Use of firewood	Informal settlements	0	50
Provision of wood carving materials	0	No suitable wood in Windhoek Does not happen	Nowhere	0	1
Fruits and greens to increase food security (for sale)	0	No space and water for that More household consumption but not enough for business	Household gardens Riverbeds	5	30
Breaks down pollutants in the water	+	Can help clean up If heavy pollution – might not be enough	Riverbeds Dams	15	35
Provision for renewable energy	0	Growth rate too sloe Not enough area	Not really anywhere	0.5	40
Regulates seasonal changes	+	Regulates humidity and “rainfall”	Everywhere there are plants	20	35