

Urban Land Management for a Better Microclimate

- the Case of Dar es Salaam, Tanzania

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Emil Ljung

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Urban Land Management for a Better Microclimate: the Case of Dar es Salaam, Tanzania

Urban planering för ett bättre mikroklimat i Dar es Salaam, Tanzania

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Abstract

The climate change will in the future cause major problems around the world. These problems will be particularly evident within urban areas due to the heat island effect and other features of the urban climate. The big number of residents in cities affected and the expectation of a continued trend of urbanization further stresses the importance of taking these problems into consideration. Especially cities in warm regions, where thermal discomfort already is common among the population, have to be planned for the arising problem. By considering microclimatic improvements, urban planning could help to create a more comfortable city for the residents.

The biggest city in Tanzania, Dar es Salaam, is situated along the Indian Ocean and characterized by a hot and humid climate. The residents of the city therefore experience thermal discomfort both day and night time almost all year around, which further highlights the problem.

This thesis aims to cover both a determination of legal possibilities to work with microclimate and an examination of the actual practical work being conducted for improvement of the microclimate in Dar es Salaam. Much of the data collection was made during a two month field study in Dar es Salaam where several interviews with people involved in the urban planning process were conducted.

When determining the legal possibilities to work with microclimate, four specific strategies, suitable for the situation in Dar es Salaam, were selected for detailed analysis. These four are: vegetation, ratio between height of buildings and width of street, arcades and buildings materials. The four strategies could be used to improve the thermal comfort, for example by giving shade and providing wind.

Provisions were found for all four strategies through the legal and policy framework. Most of the strategies could, at least partially, be regulated either through planning schemes or building permits and consequently be enforced by law.

The examination of the practical work shows that there are good intentions to work with microclimatic issues and that some measures for improving the microclimate are being done. However, microclimate is not the most prioritized question in a city facing other more pressing issues.

Sammanfattning

De pågående klimatförändringarna kommer i framtiden skapa stora problem runt om i världen. Framförallt kommer dessa problem bli kännbara inom urbana områden där bland annat fenomen som *heat-island-effect* bidrar till att förvärra situationen. Att denna problematik ska tas på allvar betonas av att stora delar av världsbefolkningen är bosatta i städer och att urbaniseringstrenden förväntas fortsätta. Det är framförallt städer i varmare regioner som måste börja planera för problemet, då den termiska diskomforten som uppvisas i flera av dessa städer redan är ett utbrett problem. Genom att använda urban planering kan mikroklimatet förbättras vilket skulle hjälpa till att skapa en mer komfortabel stad för invånarna.

Tanzanias största stad, Dar es Salaam, ligger vid Indiska Oceanen och karakteriseras av ett varmt och fuktigt klimat. Detta klimat leder till att stadens invånare upplever termisk diskomfort både dag- och nattetid under så gott som hela året, vilket belyser det ovan beskrivna problemet.

Denna uppsats syfte är att både fastställa vilka juridiska möjligheter som finns i den tanzaniska lagstiftningen att jobba med mikroklimatsfrågor och vilket hur det praktiska arbetet för att förbättra mikroklimatet i Dar es Salaam ser ut. En stor del av faktainsamlingen har skett under en tvåmånaders fältstudie i Dar es Salaam då bland annat ett flertal intervjuer med personer involverade i den urbana planeringsprocessen har genomförts.

För att avgränsa arbetet har fyra specifika strategier, lämpliga för att förbättra mikroklimatet i Dar es Salaam, valts ut för att studeras mer i detalj. Juridiska möjligheter att genom urban planering arbeta med dessa har sedan fastställts. De fyra föreslagna strategierna är: vegetation, förhållandet mellan byggnadshöjder och gatubredd, arkader och byggnadsmaterial. Alla fyra kan användas för att förbättra den termiska komforten i staden, till exempel genom att ge skuggning eller underlätta för vind.

Bestämmelser och riktlinjer hittades i både lagar och policys för samtliga strategier. Dessa visar att samtliga strategier huvudsakligen kan behandlas genom detaljplaneläggning eller bygglovsförfarandet.

En undersökning av det praktiska arbetet som görs med mikroklimat i åtanke i Dar es Salaam visar att det finns goda intentioner bland inblandade aktörer att arbeta med frågan. På grund av att staden står inför många andra frågor som anses viktigare är dessvärre mikroklimatet oftast en oprioriterad fråga.

Muhtasali

Mabadiliko ya hali ya hewa katika siku zijazo yatasababisha matatizo makubwa duniani kote. Matatizo haya yatakuwa dhahiri hasa ndani ya maeneo ya mijini kutokana na athari ya joto kisiwa na sifa nyingine zinazo endana ya hali ya hewa mijini. Idadi kubwa ya wakazi wa miji walioathirika wanasisitiza zaidi umuhimu wa kutilia maanani matatizo haya. Hasa katika miji ya mikoa ya joto, ambapo shinikizo la fukuto ni jambo la kawaida kwenye jamii, inatakiwa mipango kuepusha matatizo yatakayojitokeza. Kwa kuzingatia maboresho ya hali ya hewa katika eneo husika, mipango miji wanaweza kusaidia kujenga mji vizuri zaidi kwa wakazi.

Mji mkubwa wa Tanzania, Dar es Salaam, upo kandokando ya Bahari ya Hindi na una sifa ya hali ya hewa ya joto na unyevunyevu. Kwa hiyo wakazi wa mji wanapatwa na shinikizo la fukuto wakati wa usiku na mchana karibu mwaka wote, ambapo ndipo panaonekana tatizo.

Tasnifu hii ina lengo la kuonyesha uwezekano wa sheria zilizopo wa kuweka mkazo katika kushughulikia hali ya hewa ya eneo husika na pia uchunguzi wa uhalisia wa kinachofanyika kwa ajili ya kuboresha hali ya hewa ya Dar es Salaam. Ukusanyaji wa takwimu zilizonyingi ulifanyika wakati wa miezi miwili ya utafiti wa kimasomo katika jiji la Dar es Salaam ambapo mahojiano mbalimbali na watu wanaohusika katika mchakato wa mipango miji zilifanyika.

Wakati wa kuamua kuhusu uwezekano wa kisheria wa kushughulika na hali ya hewa ya eneo, mikakati minne maalum, inayofaa kwa ajili ya hali ya Dar es Salaam, ilichaguliwa kwa uchambuzi wa kina. Mikakati hiyo ni: mimea na miti, uwiano kati ya urefu wa majengo na upana wa mitaa, ujenzi wa aina ya baraza na vifaa vya ujenzi. Mikakati hii minne inaweza kutumika kuboresha kupoa kwa fukuto, kwa mfano kutumika kama kivuli na kupitisha upepo.

Mikakati yote minne imeonekana kulindwa na sheria kupitia mfumo wa kisheria na sera ambapo mikakati iliyomingi inaweza , angalau sehemu, kurekebisha ama kwa njia ya mipango endelevu au vibali vya ujenzi.

Uchunguzi wa uhalisia uliofanyika unaonyesha kuwa kuna nia nzuri ya kufanya kazi na masuala ya hali ya hewa ya eneo husika na kwamba baadhi ya hatua kwa ajili ya kuboresha hali hiyo zinachukuliwa. Hata hivyo, ukweli ni kwamba hali ya hewa ya eneo halikuwa swala la kipaumbele hasa katika mji unaokabiliwa na masuala mengine makubwa zaidi.

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We would also like to take the opportunity to thank all the teachers at the department of Real Estate Science, Lund University for preparing us for life after school.

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Lund, 2014-06-05

Jim Alexandersson

Emil Ljung

Abbreviations

CBD – Central Business District

EMA – Environmental Management Act

EPM – Environmental Planning and Management

GDP – Gross Domestic Product

H/W ratio – ratio between Height of buildings and Width of street

HDM – Department of Housing Development Management, LTH, Lund University

LGA – Local Government Authority

LTH – Faculty of Engineering, Lund University

MLHHSD – Ministry of Lands, Housing and Human Settlements Development

Sida – Swedish International Development Cooperation Agency

SDP – Sustainable Dar es Salaam Project

SUDP – Strategic Urban Development Plan

UCL – Urban Canopy Layer

UN-Habitat – United Nations Human Settlements Programme

UPA – Urban Planning Act

Definitions

Antropogenic heat – refers to the heat generated by cars, air conditioners, industrial facilities, and a variety of other manmade sources (EPA 2008).

Density (building density) – refers to the floor space index, indicating the ratio between the total floor area, including thickness of walls, and the total area of a plot (Acioly & Davidson 1996).

Landholder – means a holder of granted right of occupancy or customary right of occupancy or derivative right of occupancy (UPA 2007).

Long-wave radiation – is heat reemitted from any surface on the earth. It is characterized by a low content of energy (Givoni 1998).

Short-wave radiation – is heat radiation emitted from the sun. The radiation has wavelengths mainly in the range of visible light and contains a high level of energy (Givoni 1998).

Thermal admittance – is a measure of the ability of a material to transfer heat in the presence of a temperature difference. Hence, materials with a high thermal admittance both absorb and release heat more easily (Erell, Pearlmutter & Williamson 2011).

Urban design – is the process of designing and shaping urban spaces such as streets and parks, it also includes the allocation, form and size of separate buildings (Erell et al. 2011).

Urban land management – refers to the process of managing the use as well as the development of urban areas (Mwiga 2011).

Urban planning – will in this thesis refer to the planning for development of urban areas.

Urban structure – is a wide term to describe the physical character of a city. It will in this thesis include the underlying topography, the system of roads and sidewalks as well as the range of buildings and open spaces and their form and appearance.

Convective heat loss – is heat transfer by fluid motion (in most cases air) (Givoni 1998)

Relative humidity – is the ratio of the current absolute humidity (mass of vapor divided by the mass of dry air) to the highest possible absolute humidity (Ingersholl, Koenigsberger, Mayhew, Szokolay 1973).

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1 Introduction

1.1 Background

Dar es Salaam, which is the biggest city of Tanzania, is located on the coast of the Indian Ocean. Since many years the city of Dar es Salaam is experiencing a rapid growth of population. Today more than four million people live in the city and within the next decade the population is almost expected to be doubled (NBSMF 2013). Many challenges originate from this growth. To address these challenges it is of great importance that the city is governed and planned in a well-considered and responsible way.

Dar es Salaam has a climate which is both hot and humid all year around. This makes everyday life uncomfortable and leads to an increased occurrence of heat-related diseases as well as an increased use of energy, due to for example air-conditioning. With the ongoing climate change these problems will become even more apparent in the future. The above stated problems are related to urban climate where microclimate is included. Microclimate is a term to describe the climate within a narrow area, for instance along a street. Microclimate plays an important role for the citizens and the urban life within the city. One instrument used to improve the microclimate in cities is urban land management.

The European planning laws, introduced during the colonial times, are still in use in many African countries and have in many of them only been marginally revised. The urban planning regulations are often poorly adapted both to the local culture and climate (Watson 2009). In 2013, at a conference on *Challenges of Urbanisation and Development in Africa in Context of Climate Change*, the Vice President of Tanzania, Dr. Bilal, addressed the issues above. He stated that urban planning plays a critical role in the quest to reverse climate change challenges and its impact at the city level (Nkwame 2013).

The project *Efficient use of land and energy in Dar es Salaam, Tanzania – Urban planning and climate adaptation* lead by Researcher Erik Johansson is treating the issues above. More specific, this project will propose urban planning principles leading to more efficient use of land and energy in Dar es Salaam. In order to achieve this, the principles will focus on how the local climate can be utilized and how the microclimate within different parts of the city can be modified.

This thesis can be seen as a part of his project. It endeavors to study whether the principles from the project can be implemented through the force of law or not. In other words, would it be possible through the use of planning schemes, building permits or other urban land management instruments to regulate these principles? If so, the relevant legal support will be presented along with the process of regulating that matter.

In addition, research will be performed on how these principles, or other measures beneficial for the microclimate, are being handled practically. It is plausible, due to the amount of other pressing issues, that microclimate has been given very little concern in the urban planning process in Dar es Salaam.

1.2 Purpose

The purpose of this study is to determine the legal possibilities to achieve an improved microclimate. Furthermore, the purpose is also to examine the actual practical work performed in Dar es Salaam where microclimate is considered.

1.3 Research Questions

The following questions will be answered to achieve the main purpose of the study.

- What is microclimate?
- What characterizes microclimates in Dar es Salaam?
- What principles can be used to improve microclimate in Dar es Salaam?
- How is the planning system in Tanzania structured?
- What legal possibilities are given to work with microclimate through urban land management?
- How is microclimate practically being considered through urban land management in Dar es Salaam?

1.4 Limitations

The focus of this thesis is on how urban land management can be used to improve the microclimate in Dar es Salaam. In order to make this focus more manageable and comprehensible, only four strategies for improving the microclimate have been selected for a detailed legal analysis. The four strategies are vegetation, ratio between height of buildings and width of street, arcades and building materials. The four strategies have been chosen after consultation with researcher Erik Johansson and due to their relevancy to the purpose of the thesis.

The field presentation of microclimates in Dar es Salaam has been limited to only a handful of areas. The aim of this part is to provide the reader with a general understanding of the differences prevailing within Dar es Salaam and the difficulties to address microclimate generally. Although, the microclimate basically differs from one block to another the five areas selected are thought to represent these differences fairly well.

1.5 Method

The main information collected, which forms the basis of this thesis, comes from a two month field study in Dar es Salaam, Tanzania. The field studies were conducted during the months of February and March, 2014. To ensure a successful field study onsite, preparations started months before the field work by collecting available information and finding valuable contacts relevant for the purpose of the thesis. Furthermore, to improve the knowledge about microclimate and related issues, the course “*Climate smart architecture and urban design*”, given the fourth year in the Architecture program at LTH, was a valuable source.

The objective during the field study was to achieve a comprehensive understanding of microclimatic questions and the urban planning system in Tanzania in general.

The main method used during the field studies was interviews. Semi-structured interviews were held with different people from several of the key players involved in urban planning in Dar es Salaam, see the list of interview objects below. The different roles of these key players gave a wide perspective of urban planning in the city. Furthermore, relevant data that would help this thesis forward was collected. The collected data consist of a mixture of documents and planning schemes, ranging from legal acts and PhD dissertations to redevelopment schemes.

The two months of field studies contributed to a deeper understanding of the microclimatic situation and the problem this is causing within the city. The microclimatic situation in different parts of the city was both experienced in person and ocularly analyzed when visiting these places.

Collected information from the field study has been compiled, analyzed and discussed in this document.

People interviewed:

Chagula, Benjamin. Town Planner, Ilala Municipal Council
Bahati, Ayubu, Road Engineer, Ilala Municipal Council
Kapinga, Tommy, Town Planner, Physical Master Planning, MLHHSD
Kibassa, Deusdedit, PhD, Ardhi University
Kweka Msale, Clara, PhD student, Ardhi University
Laiser, Levilal, Town Planner, Physical Development Control, MLHHSD
Laurian, Revelian. Town Planner, Ilala Municipal Council
Lulu, Dawi. Town Planner, Ilala Municipal Council
Mafuru, Charles, Asst. Director, Housing Finance, MLHHSD
Mkupasi, Martha, PhD, Ardhi University; Town Planner, Dar es Salaam City Council
Mwakyusa, Philip H., City Planner, Dar es Salaam City Council
Nkondola, Daniel, Principle Environmental Officer, Ministry of Environment
Nnko, Walter, Town Planner, Physical Development Control, MLHHSD

Ole-Mungaya, Michael Moses. Assistant Administrative Secretary, Regional Administration and Local Government

Pangawi, George, Town Planner, Physical Master Planning, MLHHS

Tesha, Anna. Town Planner, Kinondoni Municipal Council

1.6 Sources of Error

When conducting interviews there is always a possibility that misinterpretations and misunderstandings can occur. This is especially the case when interviews are held in another language than the mother tongue of the interview object and the interviewer. There is also a risk that the result of an interview is more based on one person's personal opinions rather than on pure fact. To minimize the risk for sources of error regarding interviews, plenty of interviews have been conducted at different levels of the urban planning system to confirm given information.

Other sources of errors include the climatic condition prevailing in Dar es Salaam at the time of the field study and the selection of five areas described under section 6.1.3. The climatic conditions at the time for the field study were characterized by an unusually early rain period. Although, temperatures and other climatic features in Dar es Salaam are fairly stable over the year these conditions might have had an impact on the analysis made of the microclimate in the city. Furthermore, the five described areas were picked by the authors to represent the differences in urban structure and microclimate appearing in Dar es Salaam. Whether these areas are the most representative for Dar es Salaam when it comes to the mentioned differences could probably be further discussed.

Last but not least, the limited amount of material could also be a source of error. Due to difficulties to get a hold of, for example planning schemes, conclusions are in some cases made on only a few schemes or after only getting a brief look at the schemes. Moreover, the new, still not approved, Dar es Salaam Master Plan is used in the thesis to discuss how microclimate is considered when preparing a general planning scheme today. An eventual approval of the Master Plan is in the current situation uncertain.

1.7 Disposition

This thesis is structured in order to give the reader an introduction to both microclimate and urban planning in Tanzania. Thereafter, these two parts will be combined and the results will be presented. In more detail, the thesis comprises the following chapters:

Chapter 1 gives an introduction to the thesis. The background and the objectives as well as the methodology and the limitations of the thesis are presented.

Chapter 2 and 3 will briefly introduce Tanzania and Dar es Salaam.

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Chapter 4 describes the urban land management system in Tanzania in general. It should provide an understanding of relevant key players, laws and policies as well as tools for managing land.

Chapter 5 gives an overview of the field of urban climate and microclimate. Different strategies for improving the microclimate in hot humid climates such as Dar es Salaam will be explained.

Chapter 6 contains the result of the thesis. Apart from a description of the microclimate in different areas of Dar es Salaam the chapter will interweave the information from the previous chapters. Thus, it will present the legal possibilities to improve the microclimate in accordance with some of the strategies presented in chapter 5. It will also present if these possibilities are being utilized or if the microclimate is practically being considered in any other way.

Chapter 7 is a final discussion based on the result of the thesis.

2 Tanzania

Outside Africa, Tanzania might probably be best known for its famous national parks, the highest mountain in Africa, Kilimanjaro, and the paradise island Zanzibar. Additional information will be presented in this chapter to briefly introduce Tanzania.

Tanzania originates from the two states Tanganyika and Zanzibar. Tanganyika, which became a sovereign state in 1961 and Zanzibar, which became independent in 1963, formed the United Republic of Tanzania in 1964. Like most African countries, the country did also experience colonialism. In the beginning of the 16th century most of the East African coast, Tanzania included, was controlled by the Portuguese. Four hundred years later, in the end of the 19th century, Tanganyika – Tanzania's mainland today – was under German domination while Zanzibar, since 200 years back was governed by Omani Arabs. The German reign lasted only about 30 years before Great Britain got mandate over Tanganyika. Eventually, after years of struggle for liberty both Tanganyika and Zanzibar got independency and the United Republic of Tanzania, with Julius Nyerere as president, was formed the 26th of April 1964 (Tanzania e-Government Agency (TeGA) 2014).



Figure 2.1 Map over Tanzania (Google Maps 2014)

Tanzania has an area of 947,300 km² which makes it the biggest country in East Africa, see Figure 2.1 (CIA 2014). The country consists of three different physiographic regions. In the first one, located along the Indian Ocean, the Islands and the coastal plains are to be found. The second one is the inland saucer-shaped plateau, located in the central parts of Tanzania, and last one is the highlands. The highlands are situated in both the southern and the northern parts of the country where Kilimanjaro is located on the latter (TeGA 2014). Kilimanjaro, which is one of only

two mountains on the African continent with a glacier, forms an important landmark for Tanzania and attracts several of adventure seeking tourists from all over the world. Furthermore, Tanzania is also characterized by three of Africa's largest lakes surrounding the country, Lake Victoria in the northwest, Lake Tanganyika in the west and Lake Malawi in the south. Lake Victoria is the largest lake on the continent while Lake Tanganyika is the second deepest lake in the entire world (CIA 2014). Another landmark, contributing to the scenic view of the country, is the Great Rift Valley stretching through the central parts of Tanzania (TeGA 2014).

The climate conditions in Tanzania vary between the coastline, the inland and the highlands. The coastline is characterized by a hot and humid climate, the inland by a hot but dryer climate while the highlands often presents colder temperatures, especially compared to the other two where temperatures below 20°C are rarely displayed (Utrikespolitiska Institutet 2014).

The total population in Tanzania is about 44.9 million (NBSMF 2013). Almost 27 percent of the population lives within urban areas. With an annual urbanization rate of 4.77 percent the number of people living in urban areas is rapidly increasing which in result creates a variety of challenges (CIA 2014).

The majority of the population in Tanzania is Bantu and belongs to one of the more than 120 tribes (UI 2014). Official languages are Swahili and English. Due to all different tribe languages spoken around the country, Swahili is seen as the unifying language for the Tanzanians while English is the official language of education, administration and business (TeGA 2014). Religious views differ distinctly from the mainland and Zanzibar. At Zanzibar, heavily embossed by its history with Arabic influences, 99 percent of the population is Muslims. The mainland on the other hand displays a mixture of religious beliefs where 30 percent belongs to Christianity, 35 percent to Islam and 35 percent profess to indigenous beliefs (CIA 2014).

Poverty is a widespread problem among the Tanzanian population where almost 90 percent lives under the international poverty definition, 1.25 US Dollars per day. Combined with a population growth rate of 2.8 percent, the actual number of people living in poverty is steadily increasing (CIA 2014). There are several reasons causing the poverty. Environmental destruction and fluctuation in precipitation has a major negative impact on agriculture. Agriculture, which is in fact the largest sector of employment, employs two thirds of the working labor in the country. As for most of the people employed in agriculture, the majority of the Tanzanian population is employed in the informal sector, which often results in an uncertain source of income. Formal businesses in the cities are heavily dominated by the Indian minority even though they only represent one percent of the country's population (Sida n.d.).

Despite decades of international aid and loans, Tanzania as a country is still seen as one of the poorest countries in the world (Utrikespolitiska Institutet 2014). This fact is also confirmed by the World Bank's classification of Tanzania as a low-income economy. Tanzania has a dept of 10 billion US Dollars and the international aid

amounts about 1.8 billion US Dollars a year. The annual aid forms 30 percent of the total state budget (Swedish Embassy Tanzania 2014). Moreover, corruption is a widespread problem in the country where Tanzania ranks 111 out of 177 countries ranked on the corruption perception index (Transparency International 2014).

However, with an abundance of natural resources, Tanzania has great potential to meet a bright future. The country has, for instance, a big inventory of minerals, where the exploitation of gold started in 2001 and is, as of today, one of the fastest growing businesses in the country. Furthermore, the tourism attracted by the wildlife and beaches will continue to be an important source of income (Utrikespolitiska Institutet 2014). In fact, Tanzania has generally displayed a high rate of growth for several years. In 2013, the GDP growth was seven percent (CIA 2014). This, combined with the fact that Tanzania, compared to other African states, is a politically peaceful and stable country, gives hope for a continued positive development in the future.

3 Dar es Salaam

Dar es Salaam was established as late as 1862 as a port and trading center to support new caravan routes opening to the interior of Africa. The founder was the sultan of Zanzibar, Seyyid Majid. It is popularly believed that he gave Dar es Salaam its name. The name is thought to mean “*Harbor of Peace*”, stemming from the Persian-Arabic expression Bandar-ul-Salaam (City Council 2004).

Since its founding, the city has experienced a rapid growth. It became the national capital already in 1891. The city was also one of the first to achieve both municipality status (1949) and city status (1961). Even though the status as the official capital was lost to Dodoma in 1973 due to decentralizing powers, it still remains the economic and administrative center of Tanzania. Since 2000, the city is divided into three different municipalities – Ilala, Temeke and Kinondoni (Kithakye, Mutashu-birwa & Kayani 2009a). The growth and success of Dar es Salaam could be a result of its strategic location along the Tanzanian coastline, close to Zanzibar and between the two deltas of Mpiji and Mzinga River.

As of today, Dar es Salaam is inhabited by around 4,400,000 people. It has experienced an average annual growth rate of 5.6 percent during the last ten years (NBSMF 2013). The alarmingly high rate of urbanization is expected to continue. Until 2020 the population will increase to approximately 5.12 million people, making Dar es Salaam one of the ten fastest growing cities in the world (Citymayors 2014).

The population growth greatly depends on an influx of unemployed youth from rural areas looking for better opportunities. It is expected that around 16 percent of the population of Dar es Salaam migrated to the city within the last six years. Another main reason to the population growth is due to high birth rates. A majority of the residents are in fertile ages, hence birth rates can be expected to remain relatively high (Kinabo 2003). It should however be mentioned that fertility rates are on the decline and that the average household size of 4.0 is one of the lowest in all over Tanzania (NBSMF 2013). This probably depends on rising ages at first marriage and greater awareness of family planning (Kinabo 2003).

Due to the low rates of employment and low rates of income, a household of four people is still a significant burden. Based on statistics from 2002, 53.5 percent of the population was employed. This figure should however be used gently. It is estimated that 95 percent of these 53.5 percent are employed in the informal sector, which makes statistic impractical and unreliable (City Council 2004). The informal sector most commonly comprises professions such as street vendors and other small business operators (Kinabo 2003).

Informality is not only an issue among the labor force. It has been estimated that over 70 percent of Dar es Salaam’s population live in informal settlements (World Bank 2002). These are unplanned settlements, often with unclear landholdership conditions and out of governmental control. Both residents and authorities usually lack resources

to pay for any services or infrastructure, resulting in very poor health and environmental conditions. It has been shown that more than half of the residents of Dar es Salaam's informal settlement live on an average income of 1 US Dollar per day. In these areas, rates of unemployment or underemployment are about 75 percent. A big part of the residents in these areas are estimated to be migrants from other parts of Tanzania (World Bank 2002). It shall however be mentioned that the informal settlements in Dar es Salaam displays a great variety of people from all kind of social groups. In general, variety is something characteristic for all of Dar es Salaam. It is a multicultural city, with well-established groups of Indians and Europeans. It is also a city with major economic inequalities.

With the high rate of urbanization other problems occur as well. Dar es Salaam hosts more than 50 percent of all vehicles in Tanzania. The city has a traffic density growth rate of over 6.3 percent per year (World Bank n.d.). The limited transportation capacity is already being more than fully utilized and emissions are increasingly polluting the air. Furthermore, the quality of the environment has become adversely affected. With, for instance, an underdeveloped waste collection system, illegal logging for timber and charcoal, and squatters encroaching on public open spaces, the environment is under high pressure and changes are urgent (Kithakye et al. 2009a).

In accordance with what is already presented, it is obvious that the city of Dar es Salaam faces some major challenges. Nevertheless, the growth and strength of the city does not only have to be seen as something negative. As introduced, Dar es Salaam is the major commercial, administrative and industrial center of Tanzania. It is the core for Tanzania's banking activity as well as the holder of the country's major port. It has experienced longtime political stability and is known for favorable fiscal policies. As a result, it is seen as a highly attractive investment destination, contributing largely to the GDP growth of Tanzania (City Council 2004).

Moreover, the city has attracted a lot of attention, both nationally and internationally in the quest for a more sustainable future. Several groundbreaking programs has been undertaken in order to achieve betterment. The city was among the first to adapt the *Environmental Planning and Management* (EPM) process, established by the United Nations. EPM can be seen as a strategic approach where public participation is vital to achieve a better urban environment. Other grand projects are, for instance, the *Bus Rapid Transit Project* aiming to facilitate for public transportation within Dar es Salaam or the *Solid Waste Management Program* which has more than ten folded the amount of collected waste during a period of ten years (City Council 2004).

4 Urban land management in Tanzania

The main objective of urban land management is to enable the guidance and control of urban environments. Urban land management concerns both the growth of cities and their efficient functioning with provision of necessary urban services, housing and other facilities (Mwiga 2011). This chapter is an introduction to the urban land management system in Tanzania. The information on urban planning authorities is however focused on Dar es Salaam. The chapter endeavors to present the most fundamental parts of urban land management. This includes a presentation of the relevant regulatory framework and a presentation of the authorities involved in urban land management. Moreover, different planning schemes used to govern urban land will be presented.

4.1 Urban planning authorities

Tanzania has a two-tier system of government with a central government as well as local governments. Local governments are either urban authorities (city, municipal or town councils) or rural authorities (district councils). The central government through ministries creates policies while the local governments supervises and implements these at the local level (Kithakye, Mutashubirwa & Kayani 2009b). Regional Secretariats are located in between local and central governments to facilitate administration and interaction. Wards are basically an administrative zoning of municipalities. However, since some authority is located at the ward level they will also be introduced (Kuusi 2009). The structure of urban planning authorities can be seen in Figure 4.1.

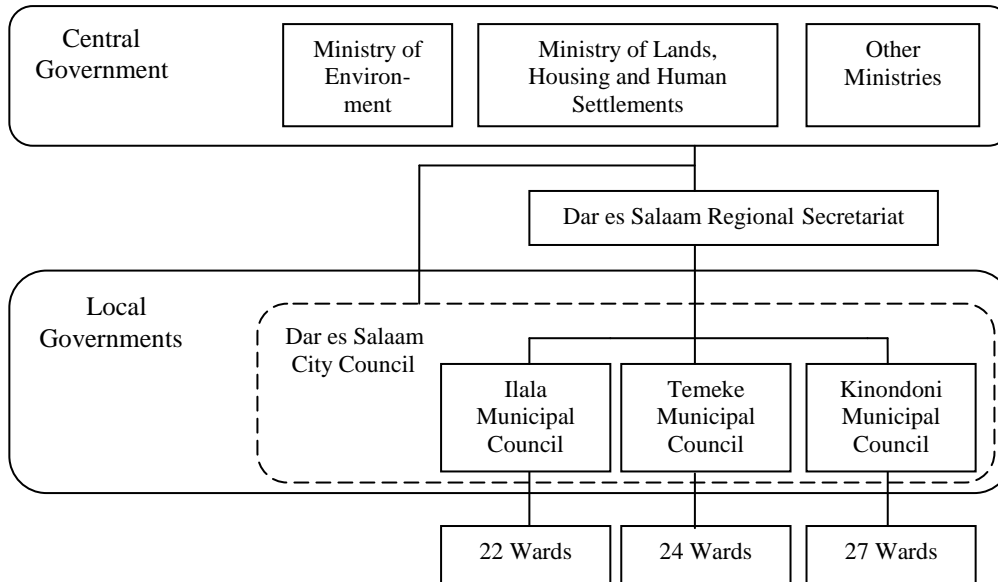


Figure 4.1 The main features of the institutional set-up regarding urban planning in Dar es Salaam.

The following is a brief description of the role of these different authorities, all having a major impact on the urban land management procedure in Tanzania. Other actors involved in this process, for instance private investors, constructors and developers, also have the opportunity to influence, but their impact is seen as secondary compared to the authorities that will be presented.

4.1.1 Ministry of Lands, Housing and Human Settlements Development

Ministry of Lands, Housing and Human Settlements Development (MLHSD) is the responsible ministry for questions such as land development and urban planning. The ministry is headed by the Minister for Lands, Housing and Human Settlements Development. This is currently being Hon. Prof. Anna Tibaijuka who formerly was the Executive Director of the UN-Habitat. Under her responsibility, a number of different divisions and units are to be found. These are among others, Surveys and Mapping Division, Physical Planning Division, Property Values Unit and Registration of Titles Unit. In charge of each of the different departments is a Director (President's Office 2011). The Director will further on, in this thesis, refer to the Director of the Physical Planning Division.

As a central government, the MLHSD's most important liability is to lay principles and guidelines for the local governments to follow. According to the Urban Planning Act, the Director shall for instance; initiate research into matters concerning town planning, issue guidelines to planning authorities both concerning the preparation and declaration of planning schemes as well as on the content of these plans (UPA 2007).

MLHSD allocates resources to local governments. They can make resources available for specific projects at the municipal authorities. They can also choose to take direct action on a central level themselves. This is for instance the case for the drawing of the new master plan for Dar es Salaam (UN-Habitat 2010). Furthermore, MLHSD has the responsibility to approve all planning schemes (UPA 2007).

4.1.2 Ministry of Environment

The Ministry of Environment is a central government authority responsible for the environment in Tanzania. Their vision is in short "*a strong union and a safe, healthy and sustainable environment*" (VPO 2010). Their role is to monitor environmental issues, and coordinate environmental management in Tanzania. In similarity to the MLHSD they also formulate guidelines and policies (Nkondola 2014).

The ministry also plays an important role in the urban planning process. First of all, policies and guidelines from the Ministry of Environment should be considered through all plans, programs, constructions etc. The ministry is available as an advisor on environmental issues through these processes. Furthermore, the Ministry of Environment could disapprove a planning scheme if environmental issues have not been considered and there is a risk of negative impact on the environment (Nkondola 2014).

The Ministry of Environment usually requires a Strategic Environmental Assessment from the planning authority when plans are expected to have an impact on the environment (Nkondola 2014). This document will ensure that environmental effects from the plan are identified, assessed, mitigated, communicated to decision-makers, monitored and that opportunities for public involvement are provided.

4.1.3 Regional Secretariats

The Regional Secretariats have a role in between the central and the local governments. There is one Regional Secretariat in each region of Tanzania. They are supposed to support the Local Government Authorities by giving advice, coordinate and supervise (Ole-Mungaya 2014). This is done in a variety of different sectors such as administration, social services, finance, human resources, infrastructure and urban planning (President's office 2007). In the case of Dar es Salaam, there is one Regional Secretariat to coordinate the activities of the City Council and the three municipal councils.

The Regional Secretariats work in two ways; first of all they should execute the functions of the central government within its region. For instance all guidelines, policies and laws shall go through the Regional Secretariat before being implemented at the local level. On the other hand, documents from the local authorities to the central government also pass through the Regional Secretariats (Ole-Mungaya 2014). The latter is for example the case for detailed planning schemes, where the Regional Secretariat shall scrutinize the plan before it can be sent to the Ministry of Lands, Housing and Human Settlements Development for final approval (UPA 2007).

4.1.4 The Local Authorities of Dar es Salaam

According to the Local Government (Urban Authorities) Act (LGUAA) (1982) it is the Minister responsible for local governments that should establish an appropriate authority in any area of Tanzania. Furthermore, he has the power to establish such number and types of authorities as he may deem necessary (UPA 2007). This being said, the situation in Dar es Salaam is somehow unique for Tanzania. Until the year of 2000 Dar es Salaam had one local government authority, namely the City Council. In accordance with the decentralizing reforms that had been taken place during the 1990s, the City Council's operations were decentralized and three municipalities – Ilala, Temeke and Kinondoni – were given full policy and implementation authority (Kithakye et al. 2009a). The City Council was however not abolished. Instead it remained as an executive power at the same level as the three municipal councils (Mkupasi 2014).

In accordance with the Urban Planning Act every “*city council, municipality council, town council and township authority shall each become a planning authority in respect of its area of jurisdiction*” (UPA 2007, 7.1). With the role as a planning authority follows obligations such as to prepare general as well as detailed planning schemes, adopt planning space standards, regulate the height, design, appearance and sitting of buildings, grant planning consent, secure orderly and environmentally

sustainable development (UPA 2007). In order to separate the responsibilities of the City Council and the municipal councils – all being planning authorities – the City Council remained in charge of some departments while the rest was decentralized to the municipal councils (Kithakye et al. 2009a).

4.1.4.1 City Council

Dar es Salaam's City Council coordinates and supervises the planning that is taking place in the three municipalities of Dar es Salaam. The City Council is, as already mentioned, not an authority on top of the municipalities, but rather a local authority on the same level but with other responsibilities. Under their responsibility lies citywide issues, or at least issues regarding more than one municipality, such as roads, transportation, waste management and markets (UN-Habitat 2010). Moreover the City Council is responsible for creating the strategic city framework and for formulating city legislation (Kithakye et al. 2009a).

4.1.4.2 Municipal Councils

Dar es Salaam is divided into three municipalities, Ilala, Kinondoni and Temeke. Each municipality has their own municipal council headed by an Executive Director and a Mayor (Kithakye et al. 2009a). Below these are usually a number of Heads of Department, heading departments such as; personnel and administration, health and social welfare, finance, urban planning and so forth (Kuusi 2009). Each municipality in Dar es Salaam has their own urban planning department. These departments handle the urban planning issues within each municipality. The municipality councils draw detailed planning schemes and provide building permits (UPA 2007). With these two tools, they have the possibility and responsibility to govern the urban environment within the municipality.

Municipal councils are also, according to the Local Government (Urban Authorities) Act, responsible both to provide and maintain parks and other open spaces within the city. Furthermore, the three municipal councils have the responsibility to design the layout of streets, including planting trees along any street (LGUAA 1982).

4.1.5 Wards and Subwards

Every municipality is divided into wards. A ward is basically an administrative area. Each ward is headed by a Ward Committee (Kuusi 2009). Broadly speaking the Ward Committee shall do any lawful act that would ensure the welfare and the well-being of the ward. They can undertake own tasks but they also have some functions of implementing decisions, policies and plans from the local authorities (LGUAA 1982).

This being said, it is the responsibility of each Ward Committee to follow up planning schemes and building permits within its area. In order to do this the Ward Committees should employ their own town planners and building inspectors but due to financing problems this is rarely being done (Mkupasi 2014).

Each ward is further divided into different subwards, also called mitaa (mtaa in singular). Each mtaa has an Mtaa Committee. This committee should strengthen the

local governance and facilitate public participation in different matters. Within the field of urban planning the committee only has an advisory role, passing on information, concerns or opinions from the mtaa level to wards and councils (Kuusi 2009).

4.2 Regulatory framework for urban land management in Tanzania

Policies and legislations regarding urban land management in Tanzania, which are relevant for the purpose of this thesis, are presented below. Each framework is described both generally and, when possible, focused on the perspective of the purpose of this thesis.

4.2.1 Policy framework

There is a wide range of policy documents in Tanzania. Seen over the last two decades, policies have been produced both at a macro level, such as the Tanzania Development Vision 2025, but most of all at a sectoral level, with policies such as the National Land Policy 1995, the National Human Settlements Development Policy 2000 and the National Environmental Policy 1997. A policy is not an act of enforcement. Nevertheless, the rigorous policy framework still has an impact on urban land management in Tanzania. First of all, many of these documents were written in order to be a guide in the preparation of new laws (Mwiga 2011). Secondly, these policies should guide the practical work being carried out at different institutions on an everyday basis (Kapinga 2014). As an example, planning schemes are to be approved by the same authority, the Ministry of Lands, Housing and Human Settlements Development, that produced the National Land Policy and the National Human Settlements Development Policy. Hence, they have the possibility to assure that these policies are being implemented (UPA 2007).

4.2.1.1 Tanzania Development Vision 2025

This document lays out the future path for development in Tanzania. According to the vision, by 2025 Tanzania has; achieved quality and good life for all; good governance and the rule of law; and built a strong and resilient economy that can effectively withstand global competition (Tanzania Development Vision 2000).

The document outlines basic pillars for the establishment of a sustainable society. Taking up matters such as “*treasuring a competitive mindset and nurturing a self-reliance culture*” (Tanzania Development Vision 2000, p.4), the vision is in many ways not easy to implement. It shall rather be seen as a guide for further law- and policymaking. However, some suggestions are offered, among others a reform of the existing laws and institutional structures. Such a reform should ensure that the laws and institutions will be able to implement the objectives of the vision. Also suggested in the vision is better public participation when plans are prepared and implemented. In order to achieve this, the strategy is to give more resources to local governments and communities and to promote grassroots participation (Tanzania Development Vision 2000).

4.2.1.2 National Land Policy of 1995

In the end of the 1980s, Tanzania still relied on a system of land tenure and land management that was a product of the colonial era. Since independence, only fragments of the legislation had been changed. But with a country in rapid change, both concerning demographic, economic and social factors, it was clear that the legislation needed to be reviewed with a holistic approach (NLP 1997). The government of Tanzania set up a commission in 1991 and almost two years later they submitted their report. The report proposed a national land policy to be written. This policy should then be used as a backbone for the formulation of new legislation (Kironde 2009).

The aim of the National Land Policy was stipulated to:

“promote and ensure a secure land tenure system, to encourage the optimal use of land resources, and to facilitate broad-based social and economic development without upsetting or endangering the ecological balance of the environment”

(NLP 1997, 2.0).

The policy is written as an articulation of fundamental land principles on a wide range of land matters such as land tenure, land administration, surveys and mapping, land information, urban and rural land use planning etc. The first part concerns land tenure, wherein four basic tenets are written, these are:

”all land in Tanzania is public land vested in the President as trustee on behalf of the citizens; land has value; the rights and interest of citizens in land shall not be taken without due process of law; full, fair and prompt compensation shall be paid when land is acquired”

(NLP 1997, 4.1.1 (ii)).

More specific principles on urban land management are to be found in the chapter on urban and rural land use planning. It is stated that urban planning should steer towards vertical development and more compact environments. Open spaces and other urban land for public use is however recognized as important and shall be protected from encroachment (NLP 1997). The policy also recognizes master plans to be inflexible and expensive tools for controlling the urban development. Instead it emphasizes the use of less costly methods such as strategic planning and the use of detailed land use plans. This would, according to the policy, simplify land and environmental management and strengthen public participation (NLP 1997).

4.2.1.3 National Human Settlements Development Policy 2000

This policy outlines the future development for human settlements in Tanzania. Human settlements are not only the built environment or the physical structure of a city, town or village; it is also a combination of all human activity processes, whether residential, work, education, health, culture, leisure etc. (NHSDP 2000). At the time, it was argued that the human settlements of Tanzania did not combine socio-

economic development with environmental conservation and protection, which eventually would lead to an unsustainable situation.

The policy has two main goals, namely; “*to promote a sustainable development of human settlements and to facilitate the provisions of adequate and affordable shelter to all income groups in Tanzania*” (NHSDP 2000, 3.1). This policy is divided into different subsections addressing different issues, some of which are more or less a reiteration of the National Land Policy. Nevertheless, this policy covers a wider range of urban issues, some listed below.

- The existing building regulations are inflexible and unaffordable. The existing regulations should be revised so that they become more functional and performance based.
- There is a lack of public awareness about the existence and use of public land. The government shall promote such awareness.
- Raw and locally available materials such as sand, cement blocks, burnt bricks, timber etc. should be available in large quantities and at affordable prices to encourage housing construction. In connection to this, there is a recognition of inappropriate standards that reduces the range of approved materials.
- Since there is a need of fuel-wood and charcoal, which are the main sources of energy in human settlements, harvesting of trees and woodlands is a problem. Therefore, tree planting should be encouraged and environmental planning in general should be empathized (NHSDP 2000).

4.2.1.4 National Environment Policy 1997

The first objective of the National Environmental Policy is “*to ensure sustainability, security, and equitable use of resources for meeting the basic needs of the present and the future generations without degrading the environment or risking health or safety*”, a tenet that could and should be applicable through all processes and decisions in Tanzania (NEP 1997, 18. (a)). Due to the importance of environmental questions and the necessity to never ignore them, this policy addresses a very broad range of issues that involves many sectors.

Despite the extent of the policy, it still covers specific issues and situations. Notable is, above all, the chapter on human settlements, where it is recognized that the environmental quality in many urban centers are declining and that the urban services are inadequate. As a part of addressing these issues the policy proposes

“development of gardens, parks and open spaces in urban centers for public use; greenbelts with pollution tolerant species; and more generally, planting of shade-giving and fruit-bearing as well as ornamental trees along urban roads...”

(NEP 1997, 55. (iii)).

4.2.2 Legal framework

4.2.2.1 Land Act 1999

The Land Act No. 4 1999 replaced the colonial Land Ordinance Chapter 113 from 1923. After the National Land Policy was approved, consultants presented a draft of the new land tenure legislation which was later modified by the Ministry of Lands, Housing and Human Settlements Development and the Attorney General. This draft eventually resulted in two land laws, the Land Act and the Village Land Act (Kironde 2009).

The Land Act is the chief legislation which covers fundamental principles from the National Land Policy. The act deals with land rights on general land, where urban land is included. The Village Land Act, however, strictly deals with land within village areas. Matters covered in the Land Act are, for instance, classifications of land, issues of mortgage and ownership between husband and wife as well as definition of certain terms used in the two land acts. Furthermore, the two land acts give provisions about the rights held by individuals and groups either under statutory or customary tenure for land in both rural and urban areas (Kironde 2009).

4.2.2.2 Urban Planning Act 2007

Since 2007 land use planning and management in urban areas are regulated by the Urban Planning Act. To govern land use planning and management, the act includes provision for orderly and sustainable development of land in urban areas. Furthermore, it also provides for the grant of consent to develop land, powers of control over the use of land as well as other matters related to urban land management (UPA 2007).

The act is divided into seven different parts, for instance the policy framework, the institutional framework and the planning process. These are followed by four schedules, having the character of appendices. These schedules include, among other things, detailed description on what matters that can be regulated in different planning schemes (UPA 2007).

When the Urban Planning Act was approved and implemented in the Tanzanian legal system in 2007 it replaced the Town and Country Planning Act Chapter 378 from 1956 as the legal document governing land use planning and management within urban areas. Compared to the previous act the Urban Planning Act has incorporated provisions which make public consultation an important part of the process when preparing a planning scheme. Another difference is that the Urban Planning Act states that all approved schemes shall be available for the public (Kironde 2009). The act is meant to give effect to the fundamental principles expressed in the National Land Policy and the Human Settlements Development Policy (UPA 2007).

The broad coverage of the Urban Planning Act has made a system of sub-laws under the act necessary. Already in 1958 such sub-laws were written under the, by that time valid, Town and Country Planning Act. These sub-laws include a wide spectrum of specific matters, too detailed to be a part of the act. These are for instance space

standards (plot coverage, setbacks, recommended width of streets etc.) or guidelines for rat prevention. Since 1958 almost no revision has been performed, and accordingly their applicability is limited. However, since the adoption of the Urban Planning Act in 2007, it has been seen as a necessity to rewrite these sub-laws and adapt them to the new act. A draft has been developed and is expected to be approved by the Parliament in June 2014 (Kapinga 2014). The draft is basically a list of several new or rewritten sub-laws, commonly referred to as the Urban Planning Regulations. Some of them, for instance the Planning Space Standards 2012, have already been approved. Nevertheless, most of them, for example Buildings Regulations or Zoning of Land Use Regulations, await approval (Kapinga 2014).

4.2.2.3 Environmental Management Act 2004

The first national Environmental Management Act (EMA) in Tanzania was enacted in 1983 to implement the Stockholm Declaration from *the United Nations Conference on the Human Environment* in Stockholm, Sweden, eleven years earlier. The conference was giving principles to inspire and guide preservation and enhancement of the human environment (UNEP 2014). The 1983 Act was repealed in October 2004 when the Parliament of Tanzania enacted the new Environmental Management Act No. 20. The act is a comprehensive act governing all environmental aspects in Tanzania (Pallangyo 2007).

The EMA provides for a legal and institutional framework for, for example, sustainable management of the environment, environmental quality standards, public participation and environmental compliance and enforcement (NEMC 2011).

The EMA allocates the local authority to be the executive agency regarding implementation of environmental policies and regulations (Pallangyo 2007).

4.3 Instruments for urban land management

There are two types of planning schemes used for urban planning in Tanzania – general planning schemes and detailed planning schemes. The two different plans will be further described below. Furthermore, the use and procedure of building permits will be presented.

4.3.1 General planning schemes

4.3.1.1 General information and purpose of general planning schemes

According to the Urban Planning Act a general planning scheme is prepared to:

“coordinate sustainable development of the area to which it relates in order to promote health, safety, good order, amenity, convenience and general welfare of such area as well as efficiency and economy in the process of such development”.

(UPA 2007, 9.1)

Furthermore, the same section also states that:

“the purpose of a general planning scheme shall be to improve the land and provide for the proper physical development of such land, and to secure suitable provision for transportation, public purposes, utilities and services, commercial, industrial, residential and recreational areas, including parks, open spaces, agriculture and reserves and for the making of suitable provision for the use of land for building or other purposes.”

(UPA 2007, 9.2)

A general planning scheme shall, compared to a detailed planning scheme which is enforced by law, be a guide to all persons involved in town planning under the Urban Planning Act (UPA 2007).

Ever since 1948, when the first master plan of Dar es Salaam was ready, the spatial growth and development of the city has been formally guided by these plans (Armstrong 1986). In total, Dar es Salaam has had three master plans, the first one, just mentioned, prepared in 1948, second one prepared in 1968 and the latest master plan was approved and adopted for implementation in 1979. This said, the latest master plan's timeframe of 20 years has already expired. Despite this, the 1979 Master Plan is still the official framework for urban development in Dar es Salaam (Kohlert 2007). However, the new master plan for the city has been a work in progress for many years and in 2013 a final draft was presented by the Italian consultants contracted for the task. The Ministry of Lands, Housing and Human Settlement Development was not satisfied with the result and did therefore not approve the final draft. The proceeding of the new master plan is hence uncertain at the moment.

Although, there has been no updated master plan the last years, a Strategic Urban Development Plan (SUDP), which was introduced in 1992, has been functioning as a general planning scheme. The SUDP controlled the urban development of Dar es Salaam until 2007 when it was repealed (Pangawi 2014). This plan was introduced during the UN-Habitat lead *Sustainable Dar es Salaam Project* (SDP) (MLHSD 2007).

4.3.1.2 History of general planning schemes in Dar es Salaam

It is known that the first planning scheme in Dar es Salaam was created already 1891 by the German colonial authorities. This planning scheme was made when the Germans were transferring the capital to Dar es Salaam from Bagamoyo (Kohlert 2007).

Each one of the three master plans produced during the 20th century was due to an important or transitional phase in Tanzania's post war development. The 1948 master plan came at the end of the colonial period. In 1968, the master plan came just after the major policy shift due to the Arusha Declaration, which was a re-orientation towards socialist policies. The latest master plan, 1979, was made in the midst of a

growing economic crisis and during the war with Uganda. Furthermore, between each master plan the conditions in the city changed dramatically, for example the size of the population, which made it a challenge to keep the valid master plan usable (Armstrong 1986).

It has been discussed how much influence external institutions have exerted on the planning of Dar es Salaam since all three master plans in the 20th century have been both funded and prepared by foreign governments and consultants. Some people mean that it is clear that western planning values and concepts in general had a very strong impact on each one of the three master plans (Armstrong 1986).

The 1948 Dar es Salaam Master Plan

This first actual master plan of Dar es Salaam was prepared by a consultancy firm from London. The plan gave a foundation to a rational pattern for the city's growth so that the city would be able to meet the functions needed to be a major administrative, commercial and transportation hub in the country. Besides making the master plan, the appointed firm did also design a new Town Planning Ordinance. At the same time they were also responsible to set up a Town Planning Division (Armstrong 1986).

Of obvious reasons the plan was made with the same concerns which dominated British planning during this period – those were primarily health and aesthetics, but also open space provision, urban sprawl and conservation. Open spaces were mostly not for recreational reasons but rather for health reasons especially in the event of a tropical disease outburst. To improve the air ventilation in the city, so called breeze lanes were created. As already introduced by the Germans in 1912, this master plan did also divide the city in three different racial zones, one for Europeans, one for Asians and one for Africans. Between these three different areas were open spaces that would make sure the division was clear. Some of the planned breeze lanes worked as separators between the different residential zones. As mentioned before, these were ventilation funnels, open space corridors from the coast aligned in the direction of the wind to bring fresh air into the built-up city (Armstrong 1986).

Since the European population, by the time this master plan was produced, only comprised 2.5 percent of the total city population and the African population comprised 73 percent, the master plan was taking a disproportionately big concern about the low density residential zones while not too much attention was dedicated to the much denser African residential zones. For instance, the African district Ilala, with 14,000 residents, was dismissed in the master plan with the words “*insufficient information*” (Armstrong 1986).

The 1968 Dar es Salaam Master Plan

The second master plan of Dar es Salaam, funded by Canadians, was made in 1968 by the Canadian Consultancy firm, Project Planning Associates Ltd. Apart from the coming 20 years the master plan was supposed to cover, the 1968 Master Plan did also include a long range scenario – Plan 2000 (Armstrong 1986).

One of the most important measures being taken in the new master plan was its aim of breaking down the exclusive racial and income barriers of the past. This was made by trying to create a diversity of properties and housing to attract people from different income groups in each and every residential zone. Practically, this was to be achieved by increasing the densities in the former European low density zones and, vice versa, decrease the density in the African high density zones. However, the differences between infrastructural developments between different residential zones remained the same and were even validated by the new master plan. Instead of using the “racial” factor as in the previous master plan the new master plan used the “standard” factor to distinguish different residential zones (Banyikwa n.d.).

Like the breeze lanes from the 1948-plan the 1968 Master Plan was working with landscape corridors starting at the ocean and crossing through the city. These corridors created undeveloped buffers and open green spaces between different land use zones (Armstrong 1986).

The problem of informal settlements within the city was also raised in the new plan. This master plan describes the problem of squatters as a serious threat towards a healthy development of the city. By giving five proposals on how to deal with this problem the plan’s long range scenario shows that all informal settlements should be eradicated by 1990 (Armstrong 1986).

Compared to the first master plan, the 1968-plan was widely criticized. Partly because of the choice of a 6 percent projected population growth rate for the city when there was already a 9 percent growth occurring. This showed the consultants’ ignorance to the demographic pressure. Also of great criticism, was that the wider concept and specific proposals in the master plan were overambitious. To implement the plan the funding, manpower and administrative capacities was not even close to enough. This was the major reason why the 1968 Master Plan had a relatively insignificant impact in shaping Dar es Salaam (Armstrong 1986).

The 1979 Master Plan

By the time the 1979 Dar es Salaam Master Plan was prepared, the city was facing challenges with an undiminished population influx, a proliferation of informal settlements and stagnation in employment. These issues, combined with an economic crisis in the country as well as the damaging impact of the war with Uganda made the conditions for the new master plan a bit different than the conditions for the time of the previous two (Armstrong 1986).

The plan, funded by Swedish aid, was developed by the Canadian consultancy firm Marshall Macklin Monaghan Ltd. Compared to the ambitious 1969 Master Plan the new master plan was a more down-to-earth document and more concentrated on the pressing and detailed concerns of urban management. The new master plan was also flexible in a far greater extent than its predecessors. Instead of attempting to forecast how the population would grow over the years, which had not been to successful in the earlier plans, the 1979 Master Plan worked with three stages of development not depending on actual years but to approximate population targets. When the

population of Dar es Salaam would reach 1.2, 1.5 and 2.4 million respectively, the plan had outlined areas to be developed and programs to be implemented to ensure the city was able to accommodate its residents. Overall, the 1979 Master Plan is characterized by the consultants' redefinition of a master plan as "*planning under uncertainty with variables increasing as the time horizon expands*" (Armstrong 1986).

Some of the main features in the 1979 Master Plan were to integrate the former strictly segregated functional zoning for different uses by encouraging industries to locate throughout the urban area. This would both give more job opportunities for the growing labor force and at the same time reduce travel time and distance. Secondly the plan was, unlike its predecessors, working towards conservation and gradual improvement of the informal settlements while still trying to ensure that most new development occurred on allocated and surveyed plots. Thirdly, with lesson taken from the 1969 Master Plan, the consultants made an effort to incorporate participation in the making of the new master plan. By involving politicians, administrators and representatives of relevant national and city agencies the consultants' objective was to overcome previous difficulties with poor coordination and implementation (Armstrong 1986).

Just like in the former master plans, a few features reappeared in the new plan. For example the issue about residential densities was still a major factor while the consideration and provision of open spaces once again was overlooked (Armstrong 1986).

During the 20 years the 1979 Master Plan was supposed to cover it was not being revised at all and to a large extent the plan was not implemented as planned due to lack of funds (Kiunsi 2013).

The Strategic Urban Development Plan 1992

The government of Tanzania saw the need to revise the 1979 Master Plan in 1990. At the same time the UN-Habitat, United Nations Environment Programme and the World Bank started the *Sustainable Cities Programme*. This was an urban management program which would work towards an economically and environmentally sustainable city by using, what is called, *Environmental Planning and Management*. In 1992 the *Sustainable Dar es Salaam Project* (SDP) became the program's pilot project. The project was thought to be an appropriate way to address the environmental and growth problems the city of Dar es Salaam was experiencing. An important part of the SDP was the drawing of a Strategic Urban Development Plan (SUDP). During the preparation of the SUDP a three days consultation was held where stakeholders had the opportunity to review and comment on the new plan (Nnkya 2004).

The SUDP, which was ready in 1999, was planned to supersede the old master plan from 1979. However, the SUDP never legally superseded the 1979 Master Plan and in 2007 it was repealed. Nevertheless, the SUDP has been and is still being considered

when preparing and scrutinizing new detailed planning schemes. (Ole-Mungaya 2014; Pangwani 2014)

4.3.1.3 Process of preparation – general planning scheme

The first step in the process of drawing a new general planning scheme is to declare the relevant area to be a planning area. This is done by the Minister publishing an order in *The Gazette*, a Tanzanian governmental magazine. A copy of this order, together with a map defining the boundaries of the scheme, also has to be posted at public spaces within the planning area. However, this order cannot be published in *The Gazette* unless preceded by;

“a) favourable response at public hearing or public hearings in the area conducted by the planning authority; (b) resolution by planning authority recommending declaration of planning area; and (c) positive recommendation by the Regional Secretariat of the respective region”

(UPA 2007, 8.3. (a))

To get a favorable response from the affected parties at such an early stage of the process is often one of the most difficult and controversial stages of the preparation process. This first step of the process is also applicable for preparation of detailed planning schemes. Since 1992 all of Dar es Salaam is declared a planning area so this initial step is however not necessary in Dar es Salaam (Lulu, Laurian & Chagula 2014).

Given a positive outcome from the procedure described above, the responsible local government authority, which in the case of Dar es Salaam would be the City Council, can initiate the work with the preparation of the general planning scheme. First of all they have to pass a resolution of the preparation of the general planning scheme and publish this in *The Gazette*. After the publication the planning authority has a period of six months to prepare a draft for the general planning scheme. During these six months the planning authority shall carry out surveys within the planning area as well as do an inventory of the planning resources available for the implementation of the scheme. The results should be presented in a report together with maps and other descriptive matters. These results shall thereafter be submitted to a meeting with all stakeholders as a draft. According to the Urban Planning Act, stakeholders are all landholders, public and private institutions, Community Based Organizations and Non-Governmental Organizations within the planning area. If this meeting results in a positive resolution the planning authority shall submit the draft for the general planning scheme to the Regional Secretariat within two months. Thereafter, the Regional Secretariat has another two months to either reject or submit the draft to the Director at the MLHSD together with recommendations and comments (UPA 2007).

The Director is supposed to make sure that the draft is available for the public. This is done by publication in at least one local newspaper and by any other means. Within three months after such a publication the planning authority shall conduct a public

hearing to get opinions from the public. The proceedings of the public hearing shall be recorded and submitted to the Director (UPA 2007).

The Director should take the views and opinions from both the Regional Secretariat and the public into account and make alterations in the draft in accordance with these. When he is satisfied he should submit the draft to the Minister who, upon receipt, should order the general planning scheme to be published in *The Gazette*, whereby the preparation process is finished (UPA 2007).

4.3.2 Detailed planning schemes

4.3.2.1 General information and purpose

Just like general planning schemes, the use and making of a detailed planning scheme is being regulated in the Urban Planning Act. Unlike the general planning scheme an approved detailed planning scheme have the force of law.

Detailed planning schemes are instruments for local government authorities to coordinate all development activities, to control the use and development of land including intensive use of urban land and, in particular, vertical and compact urban development. Their initiation shall be demand driven. When preparing a detailed planning scheme the general planning scheme serves as a guideline for how the land should be planned. However, it is possible to get an approval from the Ministry of Lands, Housing and Human Settlements Development for a detailed planning scheme contrary to the master plan (UPA 2007).

There are several ways a detailed planning scheme can be used. It could be as a long-term or short-term physical development scheme as well as a redevelopment scheme for an area (UPA 2007). Redevelopment schemes, sometimes referred to as redevelopment plans, can only be drawn on areas where there has already been a detailed planning scheme (Lulu et al. 2014). For central parts of Dar es Salaam, redevelopment plans have been a well-used instrument during the two last decades. Redevelopment plans have been drawn for entire neighborhoods in order to manage the high-pace development.

As stated in the Urban Planning Act a detailed planning scheme shall consist of “*a survey in respect of the area to which the scheme relates and carried out in a manner as may be prescribed and maps and descriptions as may be necessary*” (UPA 2007,16.3. (a)). Provisions that can be made when preparing a detailed planning scheme are being listed in the second and third schedules in the Urban Planning Act.

4.3.2.2 Process of preparation – detailed planning scheme

In order to draw a detailed planning scheme the relevant area has to be declared to be a planning area. The procedure for this is as described in the beginning of section 4.3.1.3.

A detailed planning scheme can be prepared either by a planning authority or by the landholder himself. Regardless of who is preparing the scheme, it is the obligation of

the Minister, the Director and the Regional Secretariat to give assistance during the process. Also worth noticing is that a detailed planning scheme can be prepared even though a general planning scheme has not been prepared for the area. The only requisite is, as mentioned, that the relevant area has been declared a planning area. However, if there is a general planning scheme valid for the area, the planning authority or the landholder should take that scheme into account when preparing the detailed planning scheme (UPA 2007).

The preparation of a detailed planning scheme by a planning authority is a multistage process, clearly laid out in the Urban Planning Act section 19. Many of the stages are similar to the procedure of preparing a general planning scheme. Firstly, the process has to be initiated by the passing of a resolution where the municipality should state its intention to prepare a detailed planning scheme for the relevant area. Following this is a meeting with all stakeholders, including affected landholders, public and private institutions, Community Based Organizations and Non-Governmental Organizations in the area. The planning authority is supposed to present its proposal of how the relevant land should be planned. Without a positive resolution by the meeting the preparation cannot continue. On the other hand, given a positive resolution, the planning authority shall proceed to prepare the detailed planning scheme (UPA 2007).

When the work with the detailed planning scheme is finished, the planning authority shall conduct a public hearing within three months. Any results from the hearing shall be taken into account and may lead to alterations in the scheme. When this is done the scheme can be submitted for approval. First step of approval is, as for the process of preparing a general planning scheme, at the Regional Secretariat. The Regional Secretariat can approve the scheme either with, or without changes that is found necessary. The scheme can also be disapproved in which case the planning authority will be directed to prepare a new scheme (UPA 2007). The latter is the case for around 50 percent of the detailed planning schemes that are being submitted to the Regional Secretariat in Dar es Salaam. The main reason for disapproval is that too little considerations have been given to public requirements such as infrastructure and open spaces (Ole-Mungaya 2014).

Second step of approval is at the MLHHS D where the Director shall, upon receipt, make a decision within 30 days. If the Director disapproves the scheme, he shall send it back to the planning authority with written grounds for revision. If there has been a positive outcome from both stages of approval the planning authority should publish the detailed planning scheme in *The Gazette* within 30 days. The detailed planning scheme takes effect seven days after the publication at which time it also will have the force of law (UPA 2007).

As mentioned above, a detailed planning scheme can also be prepared by a landholder on his own land. The procedure of this is in many regards the same as the one described above. The landholder prepares the detailed planning scheme and submits the plan to the planning authority for approval. Upon approval from the municipal

council the planning scheme still has to be approved both by the Regional Secretariat and the Director. The difference in the preparation of detailed planning schemes by landholders and planning authorities is the amount of public participation. This is due to the fact that detailed planning schemes prepared by landholders only concern his/her private land (UPA 2007).

If any person would be aggrieved by the detailed planning scheme, he or she can within 45 days from the date of publication appeal to the District Land and Housing Tribunal (UPA 2007).

It is argued that this procedure, as well as the procedure of preparing a general planning scheme, is too long and complicated for the local conditions. Even during the most optimistic circumstances, a detailed planning scheme will not be drawn in less than two years. In total, there will be at least seven years from the identification of an area suitable for a detailed planning scheme to the time when surveys have been performed and approved (Kironde 2005).

4.3.3 Building permit

Construction and reconstruction within planned areas is governed through the use of building permits (planning consents). According to the Urban Planning Act “*No person shall develop any land within a planning area without planning consent granted by the planning authority or otherwise than in accordance with planning consent and any conditions specified therein*” (UPA 2007, 29.1.).

An application for a building permit to develop any land shall be submitted to the planning authority, in the case of Dar es Salaam this would be the municipal councils (UPA 2007). The application consists of three copies of building plans/drawings together with a filled up application form and a title deed showing ownership. At the municipality level the building plans have to be scrutinized by several different desks, namely; an architect, an engineer, a town planner, a land officer, a health officer, the fire section and finally the sanitation section. The application is thereafter sent to the Urban Planning Committee within the planning authority for granting of the building permit (Mwiga 2011).

The planning authority has a total amount of 60 days to process the application, and to either approve or deny it. In dealing with the application, the planning authority shall use and work in conformity with the provisions of relevant planning schemes. Regardless whether the application is denied or approved, the planning authority should give reasons for its decision. An approval can be given unconditionally or subject to such conditions as the authority may find necessary.

If any person would be aggrieved by the planning consent, he has the right to appeal to the District Land and Housing Tribunal within 45 days from the date of publication of the decision (UPA 2007)

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According to information collected by the World Bank Group, the process of receiving a building permit usually takes a little bit more than 100 days and costs about 1.5 million Tanzanian Shillings (680 US Dollars) (World Bank 2014). Kironde on the other hand argues that this procedure normally takes more than a year. Hence, it could be argued to be a lengthy and costly procedure which results in that most development is performed without building permit (Kironde 2005).

The granted development should be completed within three years upon receipt of the building permit. If this is not done, the permit shall lapse unless the planning authority finds it necessary to renew the permit (UPA 2007).

5 Urban climate

5.1 Urban climate

The climate in urban areas are usually distinctly distinguished from the climate in surrounding rural areas, hence the concept urban climate. Some general characteristics of the urban climate, the urban heat island and urban wind – which are both greatly influencing the urban climate –will be more described in this section.

5.1.1 Urban Heat Island

The elevation of air temperature in cities compared to their surroundings is commonly defined as the urban heat island, see Figure 5.1 (Givoni 1998). The surrounding rural areas with lower temperatures represent the “*cool sea*” and the urban area thereby forms the “*warm island*”. Basically, urban heat island and in particular the heat island intensity, which is the maximum temperature difference between urban/rural areas, are nocturnal phenomena (Givoni 1998). It is not uncommon with differences between rural and urban temperature of 6°C during nighttime in the centers of major cities (Oke 1987 cited in Johansson 2006). Depending on a few factors, like season, surrounding weather conditions and properties of urban surfaces, the heat island effect is generally more pronounced after sunset and displays a weaker effect during late mornings and throughout the day. Furthermore, this depends on the capacity of buildings, roads and other urban infrastructure to absorb and release heat. It also depends on a restricted cooling effect due to canyons created along streets and between the buildings, often referred to as a high H/W ratio. The bigger the city is, the more evident is usually the heat island effect. However, smaller cities and towns will display urban heat island as well, even if the effect will decrease with the size of the city (EPA 2008).

Urban climate, and in result the urban heat island, is influenced by meteorological and anthropogenic factors as well as urban structure. More specifically, the reason behind the occurrence of urban heat island is an interaction of these factors, some of them presented in the following. The heat release from industries and other buildings, partly from the absorbed heat in the building materials is one of the reasons. Other heavy materials within the city like concrete and asphalt also has the ability to store heat during the day and release it in the evening/night time when the temperature is lower. Furthermore, clouds and smog from car and industry emissions tends to trap radiation which increases air temperature. Also, the absence of water due to removal of vegetation and high impervious surface covers within urban areas are proven to increase the temperature since less energy is used for evapotranspiration. The significance of these factors is heavily dependent on the urban structure. For instance, low building density, that is low H/W ratios, and an appropriate alignment of streets could ensure better ventilation and increase cooling at night (Met Office 2011).

The urban heat island’s effect on urban climate might in cold regions be a welcoming element during cold winter days. It would both help to reduce energy needed for

heating and to melt snow and ice on roads. This shows that there are also positive effects coming out of the phenomenon (EPA 2008). Although, for this thesis, where the hot and humid climate of Dar es Salaam is in question, the heat island's impacts on energy consumption, environmental quality and human health and productivity are seen as problematic.



Figure 5.1 Temperature differences between urban and rural areas (EPA 2008)

5.1.2 Urban wind

The urban atmosphere consists of two main layers, the urban boundary layer and the urban canopy layer, see Figure 5.2. Usually, studies on urban heat island have been focused on the latter. The urban canopy layer extends from the ground up to the top of buildings, trees or other roughness elements. These roughness elements decrease the wind speed when the air flows into the urban canopy layer. Due to the friction from buildings and trees the air usually displays a much higher turbulence within the urban canopy layer. Hence, compared to the airflow over rural, open country, the urban wind field presents lower wind speed in general, but also a higher rate of turbulence. Right above the building roofs, a distinct increase in wind speed can be measured, the speed increases with the height until it reaches the speed it has in the open country. The zone created with these features ranging from the ground up to the undisturbed wind flowing above the urban air dome is the urban boundary layer (Givoni 1998).

Regional wind is the most important climate factor influencing the ventilation of urban areas. The wind is generated by the differences in the atmospheric pressure and flows undisturbed several hundred meters above the ground. Most of the time on these heights, the wind has an even speed, only marginally increasing with height. However, as written before, when experiencing friction from roughness elements both a higher variety of wind speeds and turbulence occurs, typical for urban wind. In fact, the wind speed in cities are often between 25-50 percent lower than the surrounding rural wind. What is said makes it clear that incoming initial regional wind speed plays an important role for the air velocity and turbulence conditions in the city. Nevertheless, the importance of urban design and planning should not be underestimated. As shown later in this chapter, the form of buildings as well as the pattern and orientation of streets and open spaces can greatly affect the urban wind (Givoni 1998).

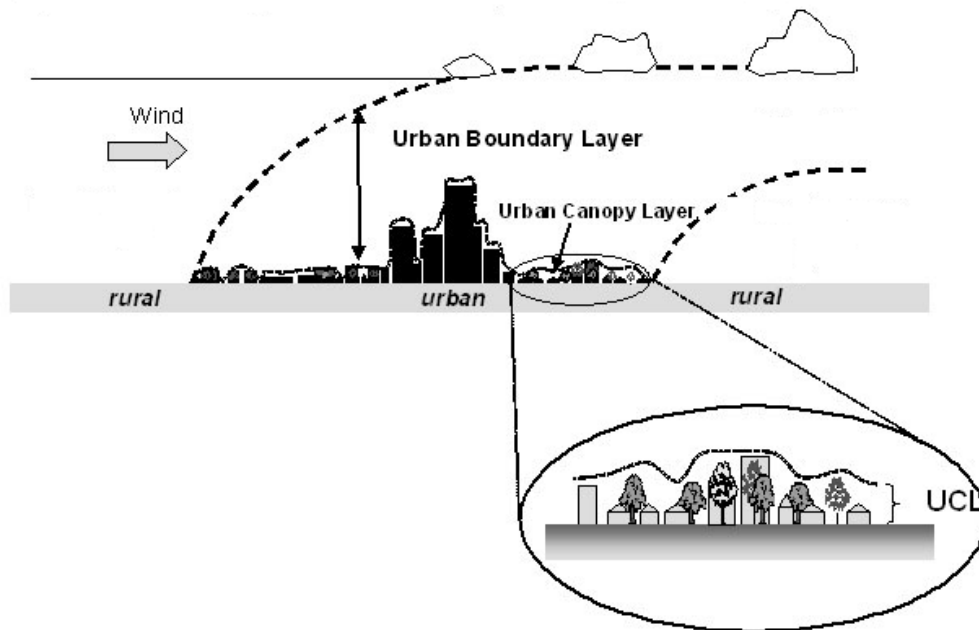


Figure 5.2 Two different wind layers within the city: urban boundary layer and urban canopy layer (modified from AIBS 2014)

5.2 Thermal comfort

Thermal comfort is a term describing the mental condition that expresses satisfaction with the thermal environment (Ndetto & Matzarakis 2013). With other words it describes someone's state of mind in terms of whether he or she feels comfortable or not. Thermal comfort does not only depend on the climatic features, such as air temperature, humidity, wind speed and radiation, but also on personal variables such as clothing and activities (Erell et al. 2011). When air temperature increases, the convective heat loss from the body decreases, which is problematic especially in hot regions. Likewise, when the air temperature exceeds the temperature of the surface of a bare or clothed body the body will be exposed for a heat gain. The exposure to radiation differs distinctly between indoor and outdoor spaces. Outdoors, the human body is exposed to a great variety of radiation, including short-wave radiation as well as long-wave radiation emitted from façades and ground materials. Analogically with temperatures, radiation could also cause the human body to gain heat. Humidity influences the ability of the body to cool down through evaporation by sweating, which is an important mechanism in maintaining comfort. Generally, high air humidity causes a sticky and sweatiest heat, often experienced as uncomfortable. Air movements lead to increased heat loss through convection which is clearly an advantage in hot and humid climates while, mostly, vice versa in colder climates. However, even wind in hot climates can be seen as disturbing and annoying for people moving around in the city if too strong (Johansson 2006).

Compared to indoor thermal comfort, occurring in a more controlled environment which could be easily modified by a heat- or cooling system, the work with outdoor thermal comfort is more complex (Givoni 1998). To determine the thermal comfort level there are several different measurements with several different indices available. Which one to use depends on what factors the measurements are focused on (Johansson 2006).

When the thermal comfort levels are exceeded, thermal discomfort is experienced. When the discomfort reaches a certain level it is referred to as thermal stress, also called heat stress. Thermal discomfort has a negative effect on both productivity and human health (McIntyre 1980 cited in Johansson & Ouahrani 2009). Desirable is thereby to find a comfort zone that would satisfy as many people as possible and minimize the risk for thermal discomfort (Givoni 1992).

5.3 Microclimate

Microclimate is a distinctive climate of a small-scale area. The area could for example be a garden, a park, a part of a city or a valley. The area is not defined by a certain size, but rather by the characteristic climatic conditions prevailing within that area. These weather conditions, such as temperature, rainfall, wind or humidity, may be just subtly different from those in the surrounding area. Hence, by definition, all land could be divided into different microclimatic zones (Met Office 2011).

Microclimates are of varying nature and due to this very little can be said about them in general. Nevertheless, they are of great importance for the thermal comfort within a city. It is the mixture of different microclimates that creates the climate of a town or a city. It is also at the microclimatic scale that the climatic conditions within a town can be addressed most readily. Whereas the task to change the urban climate is accompanied with great difficulties, several strategies have been developed in order to create or modify microclimates (Erell et al. 2011).

5.3.1 Why work with microclimate?

Many factors have to be taken into account in the process of urban land management. These include economic, social and ecological factors. Climatic considerations can easily become less prioritized in this process but as will be argued, such considerations can be beneficial for all of these factors. Erell et al. (2011) give an exhaustive list of applications of microclimatology. In general, these could be divided into two main categories; the effect on humans and human activity in public spaces and the effect on performance of buildings.

The possibilities to improve the performance of buildings are principally aimed at reducing energy consumption. Favorable climatic conditions should be utilized, and non-favorable should be foreclosed, in order to reduce costs for heating, cooling and ventilation. As an example, in hot humid climates it is often desirable to lower the air temperatures indoors. Otherwise productivity will drop and the heat will cause discomfort and poor rest. The temperature is commonly reduced with air

conditioning. This is however not only costly, but will also lower the humidity and thereby increase discomfort for those accustomed to a higher and more stable humidity. The use of air conditioning will also heat the outdoor air, contributing to a more uncomfortable urban climate in general (De Schiller & Evans 1998). Hence, it would be beneficial from many aspects if the indoor temperatures could be lowered with other tools than air conditioning, for instance by natural ventilation and shadowing. In hot humid climates, many buildings are in fact operated without any input of energy, especially in developing countries. In such cases, the applications of microclimatology will have a direct impact on the indoor climate, and the buildings will be reliant on such applications (Erell et al. 2011).

The city consists not only of buildings but also of open spaces. As argued by Gehl (1986 cited in Erell et al. 2011) it is between the buildings that much of the human interaction within a city takes place. Everyday activities of all kinds of purposes are dependent on a well-functioning public arena. The spaces and places of this arena are accordingly of special social, cultural and even economic significance. Given a good environmental quality in outdoor spaces, people will be more enhanced to stay outdoors. This would in turn have a positive effect on public health as well as on the local economy (Erell et al. 2011). In hot humid regions, open spaces and their well-functioning are of considerable importance. The high temperatures prevailing over all seasons result in much of the everyday activities to take place outdoors. Streets within such regions are rarely just for transportation but rather a place for basically all human activities, including social interaction, commerce, employment, recreation, dining etc. Unlike in colder climates, these activities are not just being performed outdoors on a complementary basis, but constantly. This situation is however nothing unfavorable. Outdoor activities should be encouraged. It shall only be emphasized that, since so many activities are performed outdoors, it is of great importance to achieve a comfortable urban environment.

The concept of thermal comfort is one of the main reasons to work with microclimate. It is well known that mental and physical performances are being impaired at high temperatures. Hence, the productivity and well-being of all urban inhabitants could be reduced if there are no comfortable spaces available. When the temperatures are very high, thermal stress might lead to heat related diseases (McIntyre 1980 cited in Johansson & Ouahrani 2009). These are for instance, respiratory difficulties, heat cramps and exhaustion, strokes and even heat-related mortality. An American study estimated that during a period of 23 years, excessive heat exposure contributed to more than 8,000 premature deaths in the United States. When compared to other weather conditions, it could be seen that this figure exceeded the number of mortalities resulting from hurricanes, lightning, tornadoes, floods and earthquakes combined (EPA 2013). These numbers indicate that heat and heat related diseases are an evident problem.

Outdoor spaces, experienced as comfortable, will encourage urban inhabitants to stay outside. Fewer people indoors would result in less energy needed for air conditioning and lightning of buildings. The comfort provided could also reduce the reliance on

fuel-driven vehicles as more people would find it acceptable to walk or bicycle (Erell et al. 2011). This would help to reduce the level of air pollutants harmful to human health and greenhouse gas emission contributing to global climate change (EPA 2013). Microclimatology can also be used directly to reduce the impact of pollutants on urban inhabitants. By increasing ventilation, emissions from cars and other sources can be removed faster (De Schiller & Evans 1998).

In summary, working with microclimate has many advantages. They are united by their contribution to a sustainable development.

5.3.2 How to improve the microclimate

This section summarizes the main strategies for improving the microclimate in hot humid cities such as Dar es Salaam. The information should provide an understanding of what theoretically can be done through urban land management within the field of microclimate. The strategies presented in this section represent the basis for forthcoming chapters. Legal possibilities and the practical implementations of these strategies form the main purpose of this thesis.

The main objective for the design and planning principles presented is to control undesirable thermal discomfort, thus contributing to a comfortable and energy efficient environment. Incorporating this objective in urban planning is however not an easy task. It could be argued that the climate in hot humid regions is characterized by few annual variations. Hence, measures taken will, more or less, be applicable throughout all seasons. Nevertheless, hot humid climates still present a special challenge for urban planners and architects. The combination of high temperatures and high relative humidity, creating a thermal environment often above the comfort limit, requires reflection. The situation could be mitigated through more shade and more ventilation. However, promoting one of them would often disfavor the other. For instance, wider roads not only improve ventilation but also increase the exposure to solar radiation (De Schiller & Evans 1998). There are however possibilities to avoid such pitfalls. Presented below are proposals from several studies performed within this field. The proposals could be argued to be rather vague, since they are neither definitive nor quantitative. On the other hand, as they must be adjusted to local climates and conditions, this might not be so unexpected (Johansson 2006).

Before any specific strategies are to be given it is of importance to realize that different strategies must be approached at different levels of urban planning. Some strategies can only be controlled through comprehensive town planning, including matters such as density, urban form, street layout etc. Others strategies are rather related to urban design, for instance, choice of building form and size and design of outdoor spaces. Finally, some strategies are to be implemented through specific construction details, among other things, building materials or building installations (De Schiller & Evans 1998). The following recommendations will be given from general to detailed level.

5.3.2.1 Location and urban layout

The location of a city, or for that matter a district within a city, is probably the most important factor affecting the urban climate. Even if the climate within the urban area differs from surrounding rural areas, there is still a strong correlation between these two. The climatic aspects of a city are also greatly affected by its physical surroundings such as mountains, open fields or oceans. Moreover, the location may have the most permanent effect on the urban climate and the comfort of the inhabitants. Land usage and urban design are changeable matters, but the geographical location of a town will remain (Givoni 1998). Due to this permanent nature, this factor can hardly be affected by urban land management, thus it will not be further described.

The urban layout in this context refers to the allocation and orientation of streets and open spaces. A well-functioning urban layout could enhance natural breezes, provide shading and encourage cooling (De Schiller & Evans 1998).

The main objective, concerning climate for the system of streets in a hot humid climate should be to provide for good ventilation. In particular, this is the case in densely built urban areas where ventilation is scarce. Providing for good ventilation is most effectively done by a system of streets oriented parallel to the direction of the wind prevailing in the afternoon, when temperatures are at maximum. Such a layout would enable the wind to penetrate through the urban area and not only provide for a better thermal comfort, but also reduce the amount of particles and exhaust (Givoni 1998). Good ventilation would still be possible if streets were oriented in an oblique angle (between 30 and 60 degrees) to the prevailing wind. This orientation would allow both more wind at intersecting streets and for better ventilation of buildings. The latter occurs as the buildings within this orientation would be exposed to different air pressures on their front and back façades (Givoni 1998).

Street allocation is not the only tool used to direct the wind into and through a city. Breeze lanes or ventilation funnels could be described as corridors of open spaces aligned in the direction of the prevailing wind. Characteristically, these corridors stretch from windier locations, such as coastlines, towards inner parts of an urban area. They could be parks, riverbeds, power lines or suchlike, and their main objective is not necessary to increase airflow. Nevertheless, they can have a significant impact on the wind conditions within an urban area (Armstrong 1986).

Belts of vegetation and water could also be used in a more general sense as a microclimate modifier. Wind passing over open spaces of water or low vegetation leads to lower air temperatures and higher wind speeds. It is argued that it is especially important to locate such areas around densely built zones. Thereby, the airflow would be made cooler and faster before entering and after leaving these zones (De Schiller & Evans 1998).

5.3.2.2 Urban density and building heights

The building density is one of the major factors which determine the ventilation conditions and affect the strength of the heat island within an urban area. Generally speaking, higher densities ensue less ventilation and a stronger heat island effect (Givoni 1998). In accordance with this, an open city plan with adequate space between buildings and generous provision of outdoor open spaces would be recommended (De Schiller & Evans 1998). It is nonetheless a complex question. Higher densities are desirable in other aspects, for instance to improve shading, reduce transportation needs and meet land demands. It is hence more reasonable to discuss how to improve the microclimate given a certain density than to change the density (Givoni 1998).

For high density areas such as central business districts, the buildings should be of varying heights, and especially high-rise buildings or skyscrapers should be staggered (De Schiller & Evans 1998). Aynsley and Gulson (1999) recommend a distance between high rise buildings of at least six times the width of one of these buildings. Givoni (1992) argues that climate conditions will be optimized if high narrow buildings are spaced as far apart from each other as is consistent with the given density. Such a configuration will reduce the impact on the airflow, and, if planned correctly, could even create better ventilation conditions than among closely spaced low buildings.

As wind reaches individual buildings rising high above those around them, air turbulence will occur in the area. This depends mostly on the fact that high rise buildings are exposed to stronger winds occurring higher up in the urban canopy layer. As these winds encounter the façade they have to change direction, which causes a strong downward current, often referred to as downwind. This downwind allows fresh air and increases ventilation at the street level. This phenomenon can create winds noticeable up to the same horizontal distance as the building is tall. Occasionally, the turbulence caused by the downwind could even result in annoyingly high wind speeds around the building (Givoni 1998).

Medium rise buildings, such as multistory apartment buildings, also require distance and scattered locations (De Schiller & Evans 1998). As such complexes have a tendency to be built more outstretched than high rise buildings, their alignment are of more importance. They should not be positioned in long rows, perpendicular to the prevailing wind, especially not on the windward side of a city, as this “shields” the area behind them (Givoni 1992).

5.3.2.3 Ratio between height of buildings and width of street

To facilitate airflow, wide streets should be encouraged. As the streets are wider, the airflow encounters less resistance from buildings along them, thus improving the general urban ventilation. The ratio between height of buildings and width of street (H/W ratio), also referred to as the sky view factor, could be used as an indirect term to compare urban building densities. A 20 meters wide street surrounded with buildings of 10 meters height would for instance have the H/W ratio of 0.5. It has

been shown that higher ratios correlate to the significance of the heat island (Oke 1987 cited in Erell et al. 2011). Thus, an appropriate strategy would be to give preference to lower ratios. No quantitative number can be suggested. Nevertheless, where streets are not aligned in the direction of the breeze, spaces between buildings less than four times the height of surrounding buildings have little prospect for breeze penetration (Aynsley & Gulson 1999)

This strategy could however conflict to the objective of providing shade along sidewalks. If such a conflict would occur, the ventilation aspect may be more important in hot humid regions, although, in most cases the different objectives could be combined. For example, a wide street could still be provided with trees or other design details for shading (Givoni 1998).

5.3.2.4 Vegetation

Vegetation, both in form of green areas, such as public parks or private gardens, as well as isolated greeneries like trees along streets or vines on walls and fences, can have a significant effect on many aspects of urban quality. This includes a marked effect on the urban climate and the microclimate (Givoni 1991). Vegetation as a tool for improving the comfort conditions can be used at different scales of urban planning. As already treated, the location and orientation of larger green areas must be considered from a citywide perspective.

The effect of parks in urban areas has been the subject of several studies. Givoni performed measurements already in 1972 where he observed that air temperatures were a couple of degrees lower in a small urban park in Haifa, Israel, compared to a built-up area only 150 meter away from the park (Givoni, 1998). Other studies show that air temperatures in moderate to large parks may be substantially lower than those in surrounding built-up areas. These results have been given name to a phenomenon, the *park cool island*, the converse of the urban heat island (Erell et al. 2011). Apart from their presented ability to increase urban ventilation, parks and greeneries can obviously be used as a tool for lowering the temperature in certain areas as well. It shall however be reminded that the influence of parks and open spaces are limited to the areas themselves and their absolute proximity. It seems that the impact from a park is independent of the size of that park, at least beyond a certain limit. Hence, it would be recommendable to have more, but smaller parks rather than less but larger parks (Givoni 1992).

The objectives for planning and designing urban open green areas should be multiple. From a climatic point of view it is important that parks provide shade for users, minimize blockage of wind within the open space and improve ventilation conditions in the surrounding built-up areas (Givoni 1991). Trees could be used as a way to achieve shading. For hot humid climates trees should however be planted carefully. The absorbed solar radiation by leaves is mainly used to evaporate water. The evaporation cools the leaves and thus the air, but also increases the humidity of the air. Thereeto, trees could contribute to the blockage of wind (Givoni 1991).

A recommended design of public parks is to plant trees sparsely, only at spots where their shade will be utilized, such as near benches and playgrounds or along walkways. Preferably, these trees should have a high trunk and a wide canopy, to allow airflow under their tree tops (Givoni 1991). High shrubs or trees with short trunks should be avoided, unless they are used to channel wind towards specific spots such as intensively used outdoor spaces (De Schiller & Evans 1998).

The given recommendations are not only applicable to public spaces but also to private gardens and other private spaces. The design of private gardens will have a significant impact on the urban life as well (Givoni 1991).

Trees and greeneries can and should not only be a tool in parks, but also in paved and molded areas. As argued, the ratio between building heights and the street width should be low. Taken in combination with high sun angles, shading has to be provided from specific details, for instance trees. Once again, species should be chosen that provide shade without interrupting low-level breezes, in other words, trees with high trunks and wide canopies (De Schiller & Evans 1998).

The shading provided from trees or other greeneries in built-up areas cannot only be utilized by humans, but also by buildings and ground materials (Erell et al. 2011). Givoni (1991) presents studies where the temperature of walls shaded by trees was reduced by 13.5-15.5°C. If shaded by climbing vines the temperatures were between 10 and 12°C lower. Such findings could be used to lower the energy consumption for cooling, but also to improve the microclimate along sidewalks or at open spaces. Shaded walls or ground materials will be sources of coolness rather than heat (Aynsley & Gulson 1999).

5.3.2.5 Shading devices

Shading can be provided not only from trees but also from specific details in the built-up area. Well known examples are integral parts of buildings such as arcades or overhanging balconies. Also separate design elements can be used like pergolas or shading canopies. All examples could, if correctly implemented, be used advantageously to improve the microclimate.

The thermal comfort of pedestrians in outdoor spaces depends as much on the exposure to radiation as on the temperature of the air. While the possibilities to control the air temperature are rather limited, radiation could be controlled fairly simple. The examples in the previous paragraph can be implemented at specific locations and does not require comprehensive strategies. Their concept is very intuitive and their effect will be long-lasting (Erell et al. 2011). As argued, improved ventilation conditions should be of highest priority in hot humid regions. Nonetheless, tools for shading should be seen as a valuable, and sometimes more realistic tool, especially along streets or at places where airflow is unreliable or compromised (Emmanuel 1993 cited in Aynsley & Gulson 1999).

Different design approaches for buildings can be chosen to provide sun (and rain) protection along streets. A separate part of the building, projecting away from the wall over the sidewalk, is one option. Another would be to have a setback on the ground floor with some of the upper floors “hanging over” the sidewalk. The setback could also be utilized with all upper floors projecting into the street, requiring support from a colonnade or arcade. In order to still promote good wind condition, Givoni (1998) recommends the latter of these three.

The advantages of these kinds of shading devices in comparison with trees are multiple. Among others, they will provide a reasonable continuity of shading (Erell et al. 2011). They will neither be dependent on climate conditions nor economic decisions for maintenance. On the other hand, these devices are often related to higher initial costs and are not as flexible as vegetation would be.

5.3.2.6 Surface materials

The materials in an urban area have great influence on the thermal conditions. The thermal admittance of a surface affects its temperature and as a result the temperature of the surrounding air. However, the surface temperature also determines the radiant exchange with pedestrians, creating a complex situation where few specific recommendations can be given (Erell et al. 2011).

The complexity of the situation above can best be described with an example. In the selection between different paving materials, asphalt becomes warmer than light colored concrete in the presence of sunshine. The higher temperature results in a more uncomfortable situation for pedestrians as they are exposed to both far greater emission of long-wave radiation and higher air temperatures. But as the higher thermal storage capacity of concrete will result in lower temperatures daytime, it will also result in a slower cooling process and higher temperatures at night. Moreover, the lighter surface-color of concrete will lead to increased reflection of short-wave radiation, causing an uncomfortable thermal and visual environment, the latter due to glare (Erell et al. 2011). In a microclimatic sense, dirt roads could be a superior alternative as they will absorb and store less heat and thus be cooler at night. Obviously, dirt roads are not a long-term solution as they perform negatively from many other aspects. This only further displays the intricacy of these issues.

In building design, the same dilemma exists. Kibassa (2014) emphasizes the use of low absorbing materials, as they will reduce the strength of the urban heat island but reckon it to be an intricate issue. Givoni (1998) recommends insulated buildings with heavier and more absorbing façade materials. The insulation should ensure that the heat, when released during nighttime, is directed outdoors. Such a building would also need to be equipped with a fan to increase air movements during the night. Which material to use could depend on the area of focus. Whereas heavier materials, if correctly implemented, might be better from an indoor-comfort point of view, they will also contribute to a higher extent to the urban heat island (Erell et al. 2011). Hence, in areas where the urban heat island effect will be most significant, especially in densely built zones, heavy materials should be used carefully if possible.

6 Towards an improved microclimate in Dar es Salaam

6.1 Microclimates in Dar es Salaam

6.1.1 Climatic conditions

Dar es Salaam is situated on lowland at the coast of the Indian Ocean and just south of the equator. These are both reasons for the hot and humid climate the city of Dar es Salaam is experiencing all year around.

Dar es Salaam is annually experiencing two rain seasons and the precipitation is more than 1,000 mm per year. The rain is mostly distributed during the long rain season (Masika), which starts in the midst of March and goes until the end of May, and the shorter rain season (Vuli) from mid-October to late December (City Council 2004). Between the two rain periods the climate is also heavily impacted by the northeast monsoon which prevails after Masika until Vuli starts and the southeast monsoon prevailing between the end of Vuli and the beginning of Masika. The monsoons occur partly in response to the movement of the Intertropical Convergence Zone, whose movements are the reason for the rain periods in Dar es Salaam (Ndetto & Matzarakis 2013).

Dar es Salaam has a mean annual temperature of approximately 27°C, a daily sunshine duration of about 7-9 hours and an average relative humidity about 80 percent, see Figure 6.1-2 (Meteotest 1990). Studies of Dar es Salaam have shown that people in the city experience thermal discomfort during day time all months of the year. Thermal discomfort during night time is experienced eight months of the year with only the months of June to September perceived as comfortable (Ndetto & Matzarakis 2013). Wind, which is an important feature to, at least help to prevent the thermal discomfort in Dar es Salaam mostly comes from the south east throughout the year. For more specific climatic data, see

Temperature

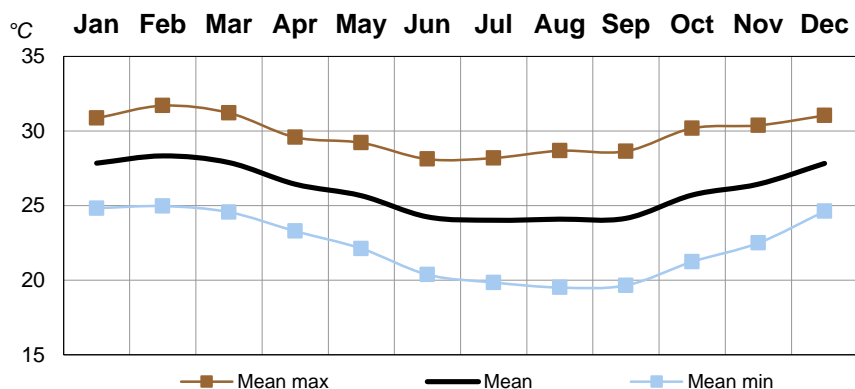


Figure 6.1 Annual variation in temperature, Dar es Salaam. Data from 1960-1990 (Meteotest 1990)

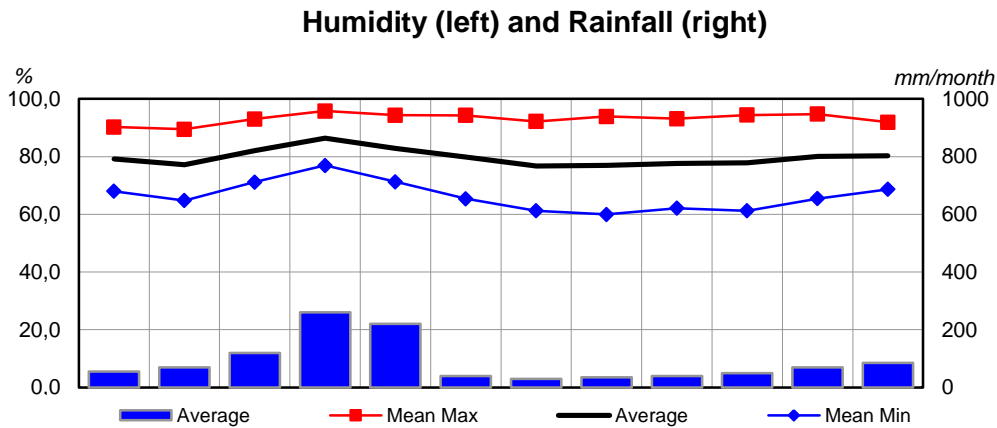


Figure 6.2 Annual variations in humidity and rainfall, Dar es Salaam. Data collected between 1960-1990 (Meteotest 1990)

6.1.2 Microclimatic conditions

The microclimate experienced in Dar es Salaam differs distinctly between different parts of the city. This is, for example, due to where the area is located in the city, surrounding areas, building density, height and design of buildings, street pattern and street layout. Put in more general terms the urban environment for each area is the major factor of the microclimate experienced in that specific place. In many cases, the differences in the urban environment, hence microclimate, depend on the historical planning of that specific area. As already written, Dar es Salaam was divided into three different racial/density/standard (the word used depending on which master plan being studied) zones. These areas did not only differ in density but also in planning effort in general where little concern was given to the African/more dense areas. Microclimates in Dar es Salaam are also heavily influenced by the city’s location next to the ocean due to surface temperatures of the water and breezes coming into the city from the sea (Ndetto & Matzarakis 2013).

6.1.3 Area Description

To cover the major characters of microclimates in Dar es Salaam five different areas with separate physical attributes and planning history will be presented. These include the hectic and crowded central areas; the Central Business District (CBD) and Kariakoo. Contrasting these two, more peaceful and greener areas of Masaki and the Embassy District will be presented. Finally, a characteristic informal settlement situated five kilometers west of the city center, Mburahati settlement, is described as well. The presentation is based on the author’s own field observations. For the location of each chosen area, see Figure 6.3.

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Figure 6.3 The location of the different areas to be presented. 1, Central Business District 2, The Embassy District 3, Kariakoo 4, Masaki 5, Mburahati settlement (Google Maps 2014)

6.1.3.1 Central Business District

The Central Business District (CBD) is the administrative and economic center, not only for Dar es Salaam, but also for the rest of Tanzania. Traditionally, it was an Indian zone and although some of this character remains, a century of rapid development has redesigned the area. As a result, the area is today more like other central business districts around the world.

The CBD, as described in this chapter, is circled by Bibi Titi Mohammed Street in west and north, and by Ohio Street in east. It is a densely built zone with a lot of traffic and movement. As such an area, there is a high risk for poor ventilation and a

strong heat island effect and consequently a high risk for thermal discomfort (Givoni 1992). Nevertheless, this district also has a lot of potential to reduce the impact of these risks. For instance, the district has a strategic location along the coastline and a well-oriented system of streets.

The CBD has the potential to utilize the cooling breezes from the ocean. As argued it would be optimal to have a system of streets where the main avenues are parallel to the prevailing wind direction and lower buildings along the coast to avoid wind barriers (Givoni 1992). Intentionally or unintentionally, both of these strategies have been, and are being implemented. Main streets – such as Morogoro Road and Maktaba Street – are located in a southeast to northwest direction. Furthermore, very few high-rise buildings will be found along the coastline, see Figure 6.4. Due to these two circumstances, the Central Business District has decent wind conditions. This is despite the fact that a higher density usually implies poorer ventilation (Givoni 1992).

Another characteristic wind feature of this area is the downwind found by some high-rise buildings. The incoming wind is partly blocked by the high towers of the Central Business District and forced downwards, creating a turbulent zone at the street level on the windward side of these buildings. As argued, depending on the strength of this turbulence, it can have a positive or a negative impact on the microclimate. Givoni (1992) however recommends an urban profile where high towers exist, but are dispersed among lower buildings – a profile similar to the situation in this district.



Figure 6.4 View over parts of the CBD. Notice the canyon allowing more airflow into the city (Munneke 2012)



Figure 6.5 Intersection, Samora Avenue and Railway Street with surrounding arcades (Padraig 2007)

Very few parks and no other open spaces of significance are located within this district. The existing parks are of limited size and can barely be used for recreational purposes. The climatic influence of city parks and open spaces are limited to the areas themselves and their absolute proximity. Hence, as the few existing parks are unsuitable for public use, their contribution toward a more comfortable urban environment is limited.

The CBD lacks not only parks, but greenery in general. Very few of the streets within this district have been provided with trees. On the other hand shading is partly provided through a developed system of arcades, see Figure 6.5.

In conclusion, the CBD is an area of great importance whose microclimatic circumstances affect many people. The ongoing process of densification could result in devastating consequences. It is therefore important that the identified strengths – above all decent wind conditions – are protected and that open spaces and greeneries are enhanced.

6.1.3.2 The Embassy District

The Embassy district is principally for administrative purposes. It is first of all a governmental seat, accommodating the President's and the Vice President's Offices as well as several ministries. Some foreign embassies and other institutions are also located here. Historically this area was nothing else than a park but during the last century it has been increasingly forfeited by the administrative functions mentioned (Kohlert 2007). Nevertheless, the green character remains. It is one of few areas in Dar es Salaam with a system of alleys and public parks.

The Embassy district is not an administrative zone. However, in this case the area is presented separately, due to the fact that its microclimatic qualities are remarkably different from other parts of Dar es Salaam, see Figure 6.6.



Figure 6.6 An overview where the distinct difference between the denser CBD to the right and the greener Embassy District to the left is evident (Wikipedia 2012)

The Embassy District can be described as the green lung of Dar es Salaam. The buildings are located on large plots surrounded by big private gardens. Thereto, the district accommodates large areas of open green spaces, for instance the Botanical Garden and the Gymkhana Golf Course. Green areas in general have a cooling effect on the urban climate (Givoni 1991). An effect that is notable within parts of this district as well. However, the reason why the area is perceived as cooler might also depend on the rich access of shading. It is a rule rather than an exception that trees have been planted along the roads within the area, creating a pleasant urban environment, see Figure 6.7.



Figure 6.7
Samora Avenue, one of many tree-lined streets within the Embassy District (Africa Travel Resource 2014)

An abundance of trees could however hinder natural ventilation. The location along the coast together with the low-density structure, where rather big complexes are dispersed in a bed of urban greenery, are on the other hand promoting wind. In account for both of these observations, the overall feeling is that wind is present.

To sum up, the Embassy District can be seen as a role model for what is possible to accomplish within the field of microclimate. Although the underlying climatic conditions of the city are unfavorable, this district gives a very pleasant impression. The district provides for an example of what can be accomplished but it shall be remembered that the premises of each district are different and that examples cannot be transferred without reflection.

6.1.3.3 Masaki

Masaki is mainly a residential area. It is historically recognized as one of the European zones. As such, it has been given a lot of attention through the urban planning history of the city. This attention has been very influenced by European norms and standards. Consequently, this area has been and still is one of lowest density areas in all of Dar es Salaam (Armstrong 1986). The area is characterized by a large-scale approach in general, with not only big plots, houses and other complexes but also wide roads and roadsides as well as high fences. These attributes in turn affects the microclimate of the area.

The issues of street orientation and width are of minor importance in low density areas such as Masaki. The system of detached family houses and other complexes surrounded by private open spaces enables the wind to flow between and around the buildings (Givoni 1992). In accordance with this and due to the location on a peninsula the area experiences a good airflow.

Also of minor importance for the microclimate in low-density areas is the choice of building materials. With an abundance of open spaces there is little risk that the heat

from the city will be retained, in other words, the urban heat island effect will be weak. Furthermore, as few buildings are located along streets or in connection to other open spaces, the chosen building material will have limited impact on the public space. However, what could have greater impact on the public space is the selection of surface material on streets and roads. Within the area, pedestrians are exposed to excessive heat and long-wave radiation from the paved road. Because the urban heat island effect is limited, it would be possible to design streets with materials of greater heat storage capacity such as concrete.



Figure 6.8 The lack of shading is apparent along Haile Selassie Road (Isae 2009)

The major microclimatic concern within this district is the lack of shading. The dispersed character not only enables airflow, but also allows more impact from the sun. Solar radiation is difficult to avoid for pedestrians. Even though the area is seemingly green, most of the greenery is located on private land. Some public tree plantation exists but these trees are planted for aesthetical rather than practical reasons. They are not to be found in direct connection to the streets, to which the pedestrians are consigned. Instead they are planted in between the streets and the plots – creating further distance between private and public land rather than contributing to a more comfortable urban environment, see Figure 6.8.

rather than people have been in focus. However, the area has potential to improve its microclimatic situation. Above all, the wide roadsides could be used for more and better adapted tree planting.

The description above supports the impression of an area planned with western standards, where cars

6.1.3.4 Kariakoo

Kariakoo is a ward within the municipality of Ilala. It is a well-known commercial and residential area located west of the Central Business District (CBD) and resides about 13,780 inhabitants (NBSMF 2013). The area is a high-density area, referred to as the African zone in the 1948 Dar es Salaam Master Plan (Armstrong 1986).

Kariakoo market is spread out in the neighborhood around the Kariakoo Shimoni, a big market building located in the middle of Kariakoo. It is not only the largest market in Tanzania but also in East Africa (Bell 2013). Consequently, the character of

Kariakoo is greatly influenced by the daily market, taking place at the streets around Kariakoo Shimoni. Since Kariakoo is the major commercial center in Dar es Salaam a lot of people are attracted to the area every day, which makes it a busy and vivid area, see Figure 6.9.

The microclimate in Kariakoo is heavily impacted by the high density of buildings and people, the street structure and the location in the city. The narrow streets, perceived even smaller due to vendors spreading out, combined with the densely built-up area results in poor airflow. Furthermore, the high buildings, constructed in mostly heavy heat absorbing materials, tend to give a strong heat island effect. In fact, Kariakoo has been measured to be the area with the highest temperatures in Dar es Salaam (Kibassa 2014).

Vegetation, green belts or open spaces within Kariakoo are limited, strictly due to the fact that there are no free spaces since most of the area is built-up. This means, among other things, that trees, creating shades along the streets, are absent. Furthermore, other shading objects, like arcades, are not as commonly used in Kariakoo as in the CBD. Another problem is that vendors, spreading out their goods, forces people to walk in the middle of the streets. This exposes the pedestrians for the sun and gives them no chance of getting shadow from the buildings which would mitigate the uncomfortable microclimate experienced.



Figure 6.9 Shopping street in Kariakoo (Kariakoo 2014)

6.1.3.5 Mburahati

More than 70 percent of the population in Dar es Salaam lives in informal settlements. This makes Tanzania one of the countries with the highest proportion of its urban population living in informal settlements in Sub-Saharan Africa. From 1985 to 2003 the number of informal settlements in Dar es Salaam increased from approximately 40 to over 150 (Kombe 2005).

Since informal settlements are developed in an unplanned way they have poor infrastructure, for instance water and electricity connections or connections to road network and sewerage system (World Bank 2002).

Informal settlements in Dar es Salaam are typically distinguished by single storey houses and a random pattern of narrow streets. Usually a mixture of middle and low income families employed both in the formal and informal sector, can be found in the, often highly dense, settlements (Rasmussen 2012).

Mburahati settlement, situated along a power line and a small river, five kilometers from the city center is a typical high density informal settlement. The area is characterized by the specific informal settlement features mentioned above. The area consists mostly of dwellings but also a few shops and restaurants. Even a primary school is found centered in the area, next to the soccer field, see Figure 6.10.

A few observations about how the attributes of this area impact the perceived microclimate will be presented below. First of all, the dense settlement and tangled street pattern hampers most of the air ventilation within Mburahati. Although, the green belt along the power line/river and an open space for sports, in the middle of the settlement, make a little airflow possible. Unfortunately, this is of minor significance for people not living in the absolute proximity of these open spaces since the wind diminish almost immediately along the narrow streets.



Figure 6.10 Informal settlement in Mburahati (Google maps 2014)

Further, greenery within the residential area consists of a few trees, most of them around the sports field, giving shade for the audience enjoying a soccer game in the afternoon. For the rest of Mburahati, except the green belt, vegetation is minimal. In general, there is a lack of protection from the sun within the area. Neither arcades nor buildings high enough to give good shades are present. This combined with the commonly used heavy and heat absorbing building materials makes the people in Mburahati experience thermal discomfort more or less daily.

6.2 Legal possibilities to improve the microclimate

6.2.1 Introduction

There are several ways to improve the microclimate in hot humid cities such as Dar es Salaam. What strategies to choose greatly depend on local conditions and circumstances. These does not only vary from one city to another but rather from one specific spot to another. The previous section, aimed to give a presentation on different microclimatic features in Dar es Salaam.

In accordance with the purpose of this thesis, this section will present the legal possibilities for planning authorities to work with microclimatic questions. It will be based on the information given in chapter 4. In particular, the focus will be on the legislation. Nevertheless, relevant policies will also be considered.

In section 5.3.2 different strategies to improve the microclimate were presented. In order to delimit this presentation, four suitable strategies have been selected from that section. The strategies have been selected in response to the presented area description and are proven to be useful in hot and humid regions. The selected strategies are:

- Vegetation
- Ratio between height of buildings and width of street
- Arcades
- Building materials

These four strategies are believed to be applicable and useful in many areas of Dar es Salaam and, if correctly implemented, will most certainly help to improve the microclimate.

6.2.2 Vegetation

Vegetation is a topic referred to in plenty of policies and legislations. The legal possibilities to work with vegetation are primarily feasible through the planning instrument, this including both general and detailed planning schemes. By drawing up a general planning scheme the overall functions of the city is laid out.

“...the purpose of a general planning scheme shall be to improve the land and provide for the proper physical development of such land, and to secure suitable provision for transportation, public purposes, utilities and services, commercial, industrial, residential and recreational areas, including parks, open spaces, agriculture and reserves and for the making of suitable provision for the use of land for building or other purposes.”

(UPA 2007, 9.1.)

As seen in the provision from the Urban Planning Act a general planning scheme is supposed to provide for a proper physical development. This includes the opportunity for the responsible authority to plan for parks, open spaces and other green areas, which would in fact be beneficial for the microclimate. Although, the general planning scheme does not have legal force as a detailed planning scheme it still works as a blueprint to all actors involved in urban planning (UPA 2007). It is also stated in the Urban Planning Act that planning authorities and landholders are obliged to take the general planning scheme into account when preparing a detailed planning scheme (UPA 2007). Guidance is given both on a map and as a descriptive document.

The most effective and certain way to control vegetation is, however, by using detailed planning schemes. When approved, the detailed planning scheme has the force of law (UPA 2007).

In the third schedule of the Urban Planning Act, provisions are set out that may be made in both general as well as detailed planning schemes, see Appendix 2 (UPA 2007). The third schedule expresses different ways for the responsible planning authority to provide the planning area with vegetation. First of all it is stated that reservations can be made in the plan for different land uses, including for instance parks, open spaces and other greeneries. Furthermore, authority is also given to the planning authorities to restrict and control design and construction of new roads (UPA 2007; Bahati 2014).

However, when it comes to parks, green areas along roads or other greeneries the planning schemes does not have the power to decide about the specific design. That means that it is not possible to, for example, extort tree planting along a road through a planning scheme. Nevertheless, the municipal councils are still having the authority to design public places as they found most suitable. This is regulated in the Local Government (Urban Authorities) Act. This act stresses that the municipal councils have the power to provide for “*establishment, management, layout, planting, improvement, maintenance and regulation of parks, gardens...*” (LGUAA 1982, 59. (b)). Moreover, the act confirms that local authorities shall have the power to design street layouts, including tree planting along these streets (LGUAA 1982). Nevertheless, this is as mentioned not done through the use of any urban planning instruments but rather through direct authority.

Additionally, the issue about urban vegetation is raised in a few policies. Both the National Land Policy (NLP) and the National Human Settlements Development Policy deems that the government shall ensure that public open spaces and other recreational areas are protected from encroachment by developers and that the area is strictly used for the intended purpose. To make sure the intended purpose is secured, one of the statements in NLP proposes that “*public open spaces and other sites for public uses will be surveyed to determine their boundaries*” and that “*all sites for public activities in towns shall be licensed to appropriate authorities...*” (NLP 1997, 6.6.1 (ii)). These measures will complicate for private developers to abuse and invade public spaces.

Vegetation is also promoted through the National Environmental Policy. The policy proposes both tree planting and construction of green spaces for public use.

“The following policy objectives shall be pursued: development of gardens, parks, open spaces in urban centres for public use; greenbelts with pollution tolerant species; and more generally, planting of shade-giving and fruitbearing as well as ornamental trees along urban roads, school compounds, hospitals, government and private office building compounds, peripheries of play grounds, water bodies, places of worship, assemblies, markets, etc”

(NEP 1997, 55. (iii))

6.2.3 Ratio between building heights and street widths

As explained in section 5.3.2, the ratio between building heights and street width (H/W ratio) plays a crucial role both when it comes to air ventilation through the city as well as the occurrence of urban heat islands.

The Urban Planning Act gives each planning authority the power to “*control the use of land, development of land and buildings in the interests of proper and orderly development of the planning area*” (UPA 2007, 28. (a)).

Legal possibilities to regulate building height are to be found in the Urban Planning Act section 38.

“Each planning authority shall have power to determine planning space standards, density of buildings on land, height, design, and appearance and sitting of buildings, manner of access to land and buildings in its area of jurisdiction in accordance with set of national standards.”

This section lies under the subchapter *Control of Development of Land and Consent for Development*, which gives possibility for the planning authority to regulate building height through building permits. Moreover, it is relevant with the possibility to regulate the positioning of buildings to make sure the distance between buildings is enough for air flow to ventilate. This issue is also ensured through space standard regulations, which, among others, helps to control minimum spaces between and setback standards for buildings.

It is also possible to regulate height of buildings through detailed planning schemes (Ole-Mungaya 2014). Stated in the third schedule in the Urban Planning Act, provisions can be set out to control and regulate design, external appearance and materials of buildings and fences (UPA 2007). Building height regulations is here included in external appearance. It is specified in the Act that the objective of every detailed planning scheme shall be to coordinate all development activities. This

includes control use and development of land, in particular vertical and compact urban development (UPA 2007).

When it comes to street widths there are regulations in the third schedule of the Urban Planning Act (UPA 2007). According to section 27 in UPA both general and detailed planning schemes shall make provisions in relation to matters set out in this schedule. It states that provision may be made about matters regarding: *“Regulating the line, width, level and general dimensions and character of roads, whether new or existing.”*

Hence, if considering H/W ratio, planning authorities have the power to regulate street width. Recommendations of street widths are however also given in the Planning Space Standards 2012. These recommendations vary depending on both what area the street is located within and the expected traffic load.

In summary, it can be determined that planning authorities have legal support to work with the H/W ratio by controlling both building heights and street widths.

6.2.4 Arcades

Arcades are instruments mainly to be used in densely built-up areas. The use of arcades can strongly reduce the amount of solar radiation and thus improve the thermal comfort within a city.

Arcades are usually not located on private plots but instead impinge on public spaces. This makes the legal situation a little bit different in comparison with the other strategies. The existence of arcades may be of greater importance to the public than to the owner of the private plot. This creates a situation where public and private sectors need to collaborate.

The fundamental concept for buildings abutting a street is that no part of them should overhang the street or the sidewalk (MLHHSD 2012). Since the local governments have the responsibility to layout, maintain and regulate open spaces such as sidewalks, this concept might not be so strange.

Yet, it is possible for the planning authority in specific cases to permit different variations of projections or overhangs. The legal situation is depicted in the Urban Planning (Buildings) Regulations, likely to be approved in June 2014:

- “39. (2) No part of, or fixture attached to, any building abutting on a street shall overhang or project into such a street.*
- (3) Notwithstanding the provisions of sub-regulation (2) the Authority may permit on such term in each case as it may think fit –*
 - (b) the owner building or plot to build an arcade over the portion of a street or footpath adjoining such building and every such arcade shall –*
 - (i) specially approved by the Authority and full drawings shall be submitted for its approval; and*

(ii) built of burnt brick, stone, concrete, or other durable material for the first storey and shall not contain woodwork.”

(MLHHS 2012, p.24)

Thus, these regulations enable exceptions to be made for the construction of arcades. As given, the permit is dependent on the assessment of the authority from case to case. The assessment could however be facilitated if a uniform approach were to be given already in the detailed planning scheme. This is possible, the third schedule of the Urban Planning Act clarifies that a planning scheme can regulate “*object which may be affixed to buildings*” (UPA 2007, 3rd Sch. C.1 (b)). In accordance with what has been said, this tool could be used in both ways, either to encourage or to obstruct the construction of new arcades.

6.2.5 Building Materials

The chosen building material can have a significant impact on the microclimate, especially in denser urban areas. The authorities in Tanzania are however equipped with several tools to regulate this matter. The selection of building materials can be controlled both through the use of planning schemes as well as through the use of building permits.

In subsection C of the third schedule, see Appendix 2, it is listed in what ways buildings and structures can be regulated through planning schemes.

“Regulating and controlling either generally or in any particular area all or any of the following matters –

(e) design, external appearance and materials of buildings and fences”

(UPA 2007, 3rd Sch. C.1 (e))

Hence, it is clear that the planning authority has the possibility to regulate the materials of buildings. The third schedule is however applicable for both general and detailed planning schemes. The schedule comprises “*matters in respect of which provision may be made in any scheme*”. Given this, it is important to remember that general planning schemes lack the force of law. Even though it would be possible to regulate the selection of material in a general planning scheme, this would not be more than a guide. As such, it could be very useful, but in order to extort a specific material, this provision should be specified in a detailed planning scheme.

Interestingly, it is not only possible to use planning schemes to regulate the matter of building materials. Building permits (planning consents) would be another option (Lulu et al. 2014; Ole-Mungaya 2014). Obtaining a building permit is a basic condition for all development of land:

“...no person shall develop any land within a planning area without planning consent granted by the planning authority or otherwise than in accordance with planning consent and any conditions specified therein.”

(UPA 2007, 29.1)

There is a vague clarification about the conditions to be specified within the building permit, stating that the planning authority can approve an application “*either unconditionally or subject to such conditions as may be necessary*” (UPA 2007, 32.3). Apart from this, the Act entails no information about these conditions. The planning authorities obviously have a flexible tool for steering the development, and with this tool follow the possibility to regulate building materials (Lulu et al. 2014; Ole-Mungaya 2014).

It must be noted that even though the planning authorities are equipped with several tools for controlling building materials, the use of these tools are guided by principles and policies. In accordance with the National Human Settlements Development Policy, low cost building materials should be emphasized. Raw materials should be available in large quantities and at affordable prices. According to the policy, the high cost of building materials contributes largely to the high cost of housing construction. The policy reckons inappropriate standards that reduce the range of approved materials to be a part of this problem (NHSDP 2000). Consequently, the planning authorities might have other priorities than microclimatic when regulating building materials.

6.3 Microclimatic considerations in urban land management in Dar es Salaam

Internationally, microclimate can hardly be considered as a prioritized question within the field of urban planning. Urban planning is a complex procedure with many different issues to consider, many of them seen as more pressing than microclimate. Frequent issues confronted by urban planners might also be contradictory to each other, which make the planning process even more complex. This might for example be the contradictory interest of preserving open spaces and at the same time try to meet land demand for a growing urban population without allowing too much urban sprawl.

Tanzania, and in particular Dar es Salaam, is no exception from what is said above. With many people in the city living in poor conditions, with a lack of basic infrastructure, like water, sewerage, electricity and decent roads, microclimate comes far down the list of prioritized urban planning issues. Even though there seems to be an awareness of the problem and the possibilities to address it, it has been unanimously argued that these questions fall short in the competition among other pressing issues.

However, some measures beneficial for the microclimate both has been and is being implemented, as seen in the presentation of the five different areas in Dar es Salaam, see section 6.1. Whether these measures have been done with microclimatic consideration in mind or not is in many cases uncertain. Other factors, like aesthetic, may have had a major impact when planning for, for example, trees in the Embassy area. Meanwhile it is clear that some of the old master plans have had a distinct

microclimatic consideration when planning for wind funnels starting from the ocean to bring fresh air into the city.

Regardless of what the legislation demands and suggests, this section will describe the actual considerations being taken concerning microclimate in Dar es Salaam. The focus is on the four strategies presented but other considerations will be included as well. The information is mostly based on interviews with people involved in urban land management from different planning institutions in Dar es Salaam. It is also based on reviews of several detailed planning schemes, in particular four redevelopment plans from different areas. Information has as well been taken from a draft for the coming Dar es Salaam Master Plan.

In the city of Dar es Salaam, only 1.8 percent of the existing land use is reserved for recreational purposes. These purposes include green spaces like public parks, playgrounds, golf courses, forests and beaches. To improve this situation, the intention, when new detailed planning schemes are drawn, is to plan for 20 percent of the area to be green. This to make sure every neighborhood gets an open space and to improve the green structure in the entire city. Fact is that as much as 50 percent of the prepared detailed planning schemes sent to Regional Secretariat for scrutiny are sent back to the planning authority at respective municipal council for revision. This is mostly due to the lack of open spaces, infrastructure and other public requirements in the plan (Ole-Mungaya 2014). Of the five reviewed detailed planning schemes, no scheme fulfilled the aim of 20 percent green space. Four of them contained less than ten percent while one had as much as 19 percent green space. Nevertheless, these schemes have still all been approved.

Zoning of green areas (open spaces and recreation), zoning of beach areas and river valleys (buffer zones) are considered as important components in the planning schemes (Mwakyusa 2014). Therefore, the city is trying to preserve buffer zones, for instance Msimbazi valley, seen as valuable green areas. However, in many places informal settlements has popped up along the valley and its purpose as a green area diminish simultaneously as the inhabitants in these settlements take over (Kibassa 2014).

Existing parks, where Ilala municipality are responsible, for example the botanical garden, has due to economic reasons a deferred maintenance. Although, from a microclimatic perspective the standard of a park may not be of major importance, an inviting park attracting the city's residents would be preferable. There is also a risk that green areas that are in poor condition and therefore not frequently used could be taken over by squatters and lose the functions and qualities it would have as a green space (Kibassa 2014). Fortunately the municipalities are not the only ones responsible to construct and maintain parks throughout the city. With opportunity to advertise within a green area/park, companies from the private sector can get responsibility to construct and maintain this area. This would ensure that planned parks and green spaces in a detailed planning scheme are implemented (Mkupasi 2014). Several green areas around the city are managed by companies from the private sector. An example

is the park located along Kivukoni Road next to the ocean managed by the bank NBC Limited, see figure 6.11.

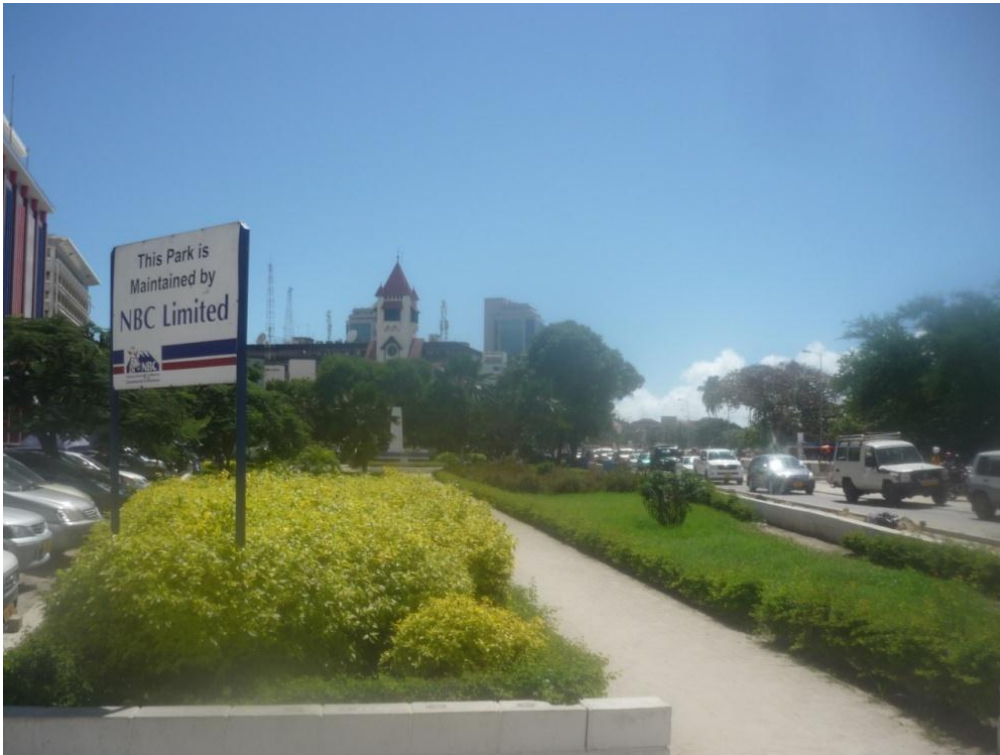


Figure 6.11 Park along Kivukoni Road in Dar es Salaam maintained by NBC Limited

Analogously, as a service in return for getting to put up advertisement along roads, private sector pays and is responsible for the design and layout along roads. Included in this responsibility might for instance be planting trees, putting up streetlights etc. (Bahati 2014).

Tree planting seems to be an objective in most of the reviewed redevelopment plans. In a plan over the area of Upanga, it is acknowledged that the presence of trees improve the microclimate. More importantly, one of twelve different main objectives of the plan actually is to: *“improve the microclimate of public outdoor spaces by planting appropriate trees and creating outdoor furniture”* (MLHSD 2011a, p.6). The plan suggests that the width of carriageways is reduced and that the extra space is instead destined to be planted with trees. Similar suggestions are found in several redevelopment plans. The Kariakoo redevelopment plan also aims to *“improve the environmental quality of Kariakoo through planting trees along major designated pedestrian routes”* (MLHSD 2002, p.3). Finally, in the redevelopment plan for Oysterbay and Masaki the following is stated:

“Provision of opportunities for both active and passive recreation and ensuring tree planting for beautification and control of wind and provision of shade especially in beach area must be given high priority”
(MLHHS 2011b, p.57)

To implement this, the same document states that it is important to:

“Create urban forest for conservation of soils, flora and fauna, and for beautification, shade, supply of flowers and fruits and also control of microclimate
- Encourage developers to plant trees on their plots for shade and fruits.
- Encourage developers to establish live fences instead of stones, bricks or concrete.”

(MLHHS 2011b, p.58)

The latter excerpt touches several interesting matters. First of all, it is one of few examples found where surface materials have been considered. Secondly, it emphasizes private tree planting as a favorable strategy. Such a strategy could actually be enforced from the planning authority. When a private developer applies for a land hold title, the authority could condition the title with tree planting on the same land (Tesha 2014).

Closely connected, a tree planting project is taking place in Dar es Salaam one week every year. It is initiated by the three municipalities for environmental purposes and implemented at ward level (Mkupasi 2014). It should in this context be mentioned that tree planting is accompanied with some difficulties. A common sight is empty slots, intended for and once planted with trees. Due to the drought occurring in between the rain periods, each year trees and greeneries reduce (Bahati 2014). This could however also depend on poor management, too small slots or illegal logging for timber and charcoal.



Figure 6.12 Kigogo Road was once aligned with trees

The redevelopment plan for the central area of Dar es Salaam suggests microclimatic beneficial measures, such as preservation and restoration of existing green areas and protection of trees along certain roads and along the seafront (MLHSD 2000).

Apart from vegetation and greenery, enhancement of wind seems to be the most common microclimatic concern. Planning standards and regulations, recommending for example width of streets, heights of buildings, plot sizes, setbacks for buildings and plot coverage, have a major impact when it comes to promoting air ventilation into the city (MLHSD 2000). Depending on the importance of a street and its location in the city, certain sizes are recommended. Major straight streets often have a width where they not only function as important transportation roads but also as breeze lanes. Two examples would be Morogoro and Ali Hassan Mwinyi/Bagamoyo Road. As mentioned before, microclimate may not be of highest priority when using these standards since there are many other factors to take into consideration as well. Nevertheless the effect on the microclimate will be there regardless why the standards were used.

A measure, in particular to promote the air ventilation into the city, is to keep high rise buildings off the absolute proximity of the shoreline. This measure facilitates for the sea breeze to ventilate the city. In a redevelopment plan from 2000 over Dar es Salaam central area, regulations about building heights along the coast prohibit high rise buildings. One factor for the regulations presented in the plan is “*consideration for wind circulation to permit penetration of the sea breeze to all part of the city centre*” (MLHSD 2000). The idea of controlling building heights in order to promote better wind conditions is common in several plans. As an example, both the Masaki and the Kariakoo redevelopment plan aim to have lower buildings along their boundaries. The heights of the buildings are thereafter supposed to rise gently towards the center of respective area (MLHSD 2002; MLHSD 2011b). Despite this, two buildings, widely exceeding building heights regulations are being constructed along the coastline in the city center. This indicates that plans and regulations are not always considered and respected (Lulu et al. 2014).

Finally, something should be said about the draft of the new Dar es Salaam Master Plan (MLHSD 2013). As a draft it cannot be argued to be of the same importance as what is already presented, nevertheless it gives an updated insight to how microclimate is being considered. Hence, some features from the draft will be presented. The draft was prepared by Italian consultants and displays several measures that would clearly benefit the microclimate. The document addresses, for example, the need of buffer zones. Main focus with this measure is to make space between air pollution sources and sensitive receptors. However, at the same time air flow will be promoted through the buffer zones, hence, the microclimate will benefit. Furthermore, the draft also displays priority actions to be implemented to fulfill the master plan. Connected to the one just mentioned, two actions are presented to facilitate for air ventilation. First one is to consider the alignment of streets in relation to prevailing winds. The second one is about avoiding street canyons where building heights on both sides of the road are more than the width of the road. Both these

actions are made to ensure that wind gets into the city. Moreover, the master plan draft plans to act on increasing the system of green areas, whereas existing parks should be preserved, increased and improved. However, it should be clarified that this master plan draft has not yet been endorsed by the parliament and it is still uncertain if and when this will be done (MLHHS 2013).

From the presented information it could seem as microclimatology is quite commonly implemented in the urban land management process of Dar es Salaam. It is however important to remember that many of the found considerations have been made through “soft” guidance. In other words, they are included in descriptive texts only and not made through the legal provision presented in section 6.2. The implementation of such texts could be argued to be uncertain. This dilemma has been highlighted in several interviews. Although the good intentions exist, the actual results are scarce.

In conclusion, the identified measures to improve the microclimate are few but still present. Seen in relationship to the legal possibilities presented earlier, it could be commented that few of them are utilized. No examples on the controlling of building materials or arcades have been found or expressed, neither through detailed planning schemes nor through building permits. The zoning of land use and in particular the allocation of green spaces is however used frequently, and so is the control of street widths. Building height has only been identified to be regulated in redevelopment schemes, thus in no other detailed planning schemes. In general, no specific provisions have been found where the aim is to subdue the H/W ratio.

As repeated several times microclimatic issues are not prioritized when it comes to urban planning. In Dar es Salaam both interviews with people at the planning authorities and different planning schemes has shown that there are few cases where measures have been implemented specifically with the vision to improve the microclimate. Fortunately, various measures being planned for in planning schemes with other objectives than microclimate in mind also support the microclimate. With climate change as an emerging problem around the world microclimate eventually has to be a more prioritized question.

7 Discussion

This thesis describes the urban planning system in Tanzania. It is focused on the legal possibilities to improve the microclimate, but it also covers how microclimatic issues are being handled practically. The results of the thesis have already been presented. Following is a summary of these findings and a general discussion about them.

The prevailing climate conditions in Dar es Salaam are heavily impacted by the Indian Ocean and the city's proximity to the equator, these causing high temperatures and high humidity all year around. As a result, thermal discomfort is a common problem among the citizens of Dar es Salaam. With the ongoing climate change, these conditions will become even worse. Temperatures can be expected to rise and extreme weather conditions in general will be more common. In addition, Dar es Salaam is experiencing a high rate of urbanization. Currently, the population increases with 5.6 percent per year. Hence, more and more people will be dependent on the climatic conditions prevailing within the city. The urbanization will also make it more difficult and less plausible for improvements of microclimate to be implemented. This is due to the fact that other urban planning issues are seen as more pressing and also due to the merge of informal settlements. Both of these issues, the climate change and the urbanization, stresses the need to consider microclimate.

An advantage compared to many other countries, or even other cities in Tanzania, where different seasons are more distinct, is that the climate in Dar es Salaam is characterized by few annual variations. Although, there is a fluctuation in temperature between rain and dry season in Dar es Salaam the difference is not as evident as in, for example, the highlands of Tanzania. These conditions facilitate for implementation of microclimatic strategies. For areas experiencing both warm and cold climate, planning for microclimate is more complex. Measures taken to improve the microclimate during the cold season may not be applicable for the warm season. This is, as mentioned, not an issue for Dar es Salaam where the climate is classified as hot and humid all year around.

The legal possibilities to work with microclimate have been presented in section 6.1. In general, the legal system provides good provisions for implementing strategies beneficial for the microclimate. Many of the strategies could be regulated through the use of planning schemes or buildings permits. It is for instance possible, through the use of detailed planning schemes to regulate the width of streets and the height of buildings, thereby achieving a suitable H/W ratio. The planning authorities have for some other measures, according to legislation, the authority to decide about different matters, even if the instruments to regulate these issues are not given through planning schemes or building permits. As an example, planning authorities should decide on the design of streets, including matters such as planting trees along sidewalks. Because the decision is not made through any scheme or permit it does not allow for public opinion and insight.

The paragraph above touches a delicate dilemma. A rigorous legal framework allows for better control and insight but it also results in more expensive and longer processes. The optimal solution is not obvious. What is clear is that Tanzania has a comprehensive system of laws, regulations and policies. It is based on remains from the colonial era and thus displays many similarities to the legal systems in Great Britain and other European countries. It is a system that provides planning authorities with many instruments, for instance to improve the microclimate. However, the existing system could be argued to be both bureaucratic and unnecessarily costly. As mentioned, achieving a building permit usually takes over a year and the drawing of detailed planning schemes often take several years. The most extreme case could be the making of the new Dar es Salaam Master Plan. The plan has been a work in progress for more than five years and it is still not certain if, and if so, when, the plan will be approved. It could as well be denied in which case the process needs to start over from the beginning.

The bureaucratic situation is characterized and further complicated by the comprehensive system of key players. Processes for drawing detailed planning schemes are for instance reliant on approval from both central and local authorities as well as from the Regional Secretariat. Each approval could be expected to delay the process. At least in the drawing of a planning scheme, the institutional arrangement is clear. In other cases, such as regarding cross-cutting issues, interviews have shown that the authority of different key players is uncertain and overlapping. In the case of Dar es Salaam, the City Council is responsible for coordination and supervision of the planning at the municipal councils. However, part of this responsibility lies on the Regional Secretariat as well, resulting in confusion, double work and difficulties for the different institutions to perform their liabilities. The City Council can for example hardly handle cross cutting issues when they have not been given mandate to participate in the drawing of the planning schemes.

The complicated institutional set-up and the rigorous legal framework has been claimed to be one of the main causes to the formation of informal settlements. As the process of drawing detailed planning schemes or achieving building permits in accordance with laws and regulations rarely can be funded by authorities and individuals, they are reliant on informal solutions instead. The fact that more than 70 percent of Dar es Salaam's population lives in informally built-up areas indicates that the legal system is not adapted to the local conditions. In this situation it would be narrow-minded to suggest an expansion of the legal framework. Perhaps it is better if certain matters, such as the design of parks and streets, remain under the direct authority of the planning authority and are not dependent on the approval of planning schemes. In general, the urban planning process could be made faster and less expensive if other issues could be regulated through direct authority as well. If so, concern has to be given not to undermine public participation and opinion.

So far, the discussion has mainly treated the legal possibilities to improve the microclimate. Although the design of the legal system could be protractedly discussed, it could in short be argued to provide for good opportunities. However, this

thesis also examines the practical work being performed at central, as well as at local governments, to improve the microclimate in Dar es Salaam. Given the legal opportunities presented, it is hence of great interest to discuss different obstacles for the implementation of these opportunities, or, in general, obstacles for any work beneficial for the microclimate. Such obstacles could be of varying kind and nature. It could be due to varying physical conditions. The formation of informal societies where laws and regulations are breached, definitely have an impact. Furthermore, economy most certainly plays an important role. In close relation, corruption cannot be ignored. These matters will be discussed in more depth in the following.

Economy plays an essential role on microclimate and urban planning in general. First of all it should be mentioned that the allocated resources for urban planning is limited and often not enough to implement desired projects. Furthermore, the allocation of resources among key players in urban planning has often been questioned in interviews. The distorted allocation is partly shown by the lack of both funds and manpower at the local government authorities. Due to this several plans and projects are never implemented. The issue is also visible at the ward level. As discussed earlier each ward is supposed to employ their own town planners and building inspectors. However, problem of financing these employments makes it very unusual to find these employers at the ward level. The problem of resource allocation is further displayed by the fact that the Ministry of Lands, Housing and Human Settlements Development (MLHSD) took over the responsibility of making the new Dar es Salaam Master Plan from the local government authorities (LGA). Both sides agree that the LGAs did not have enough resources or manpower to carry through the process of making a new master plan. Although, it could be argued that the MLHSD should have had the responsibility to ensure that the capacity of the LGAs were enough in the first place.

Desirable is also a clarification of what role each key player has in urban planning. As of today and already briefly discussed, there is an uncertainty about what tasks come upon which key player. This uncertainty leads to both inefficiency and ineffectiveness in the urban planning process as well as in the economic system. The uncertainty can be derived back to the change of local government where the City Council previously made all the work being done at the municipal councils today. Also, the MLHSD intruding in the local authorities business more than necessary is another reason creating uncertainty.

Concerning funds earmarked for microclimate, the amount in Tanzanian Shillings will most likely be small. With a city facing many other problems, such as traffic congestion, informal squatting and flooding, seen as more pressing than microclimate, the funds will simply not be enough. It could however be argued that some of the strategies proposed to improve the microclimate does not have to be too expensive. With the economically beneficial effects, like less energy needed for cooling and healthier and more productive people, coming out of a more comfortable microclimate, the invested money could even more than regenerate.

Closely connected to economy and other questions that have already been raised is the issue of corruption. Currently, the corruption is strongly rooted within the society as an approach to solve, speed up or get around different situations. Urban planning issues are certainly not spared from the problem of corruption. In contrary, with the words used above to describe the legal framework for urban planning – bureaucratic and unnecessarily costly – the corruption can be seen as an indicator on a system that is not always well functioning. Although the corruption may help the individual to satisfy his needs, whether it is to speed up the process of getting a building permit or to conduct a cadastral procedure in conflict with the valid detailed planning scheme, it also complicates for the planning authorities to fulfill their objectives. Corruption, thereby, creates areas that are more or less unregulated and where the planning authorities have lost their power. Especially planning measures for the microclimate and other public considerations could be seen as unnecessary to landholders who instead use corruption to bypass the provisions.

One of the most important aspects concerning the interaction between the legal framework and everyday based decision is a correct interpretation of the legal possibilities. If the legal framework is not orderly used, the presented possibilities will have little relevance. As an example, it has been observed that redevelopment schemes are used more as guiding documents than acts of law. Redevelopment schemes are detailed planning schemes for already built-up and planned areas. As such, provision given through them should have the force of law. Nevertheless, it is repeatedly underlined in the reviewed redevelopment schemes that they shall only be used as guidance for further development. The presented possibilities are mostly applicable in areas of redevelopment, hence the use of these schemes are of great importance. Their importance is however reduced if they are not used in accordance with their capability. In result, the importance of the presented possibilities will be reduced as well.

Finally, Dar es Salaam consists of many diverse areas. There are differences both between informal and formal settlements as well as between the planned settlements. Those differences involve among other things both standards of infrastructure and public spaces as well as building density. Many of these differences derive from the colonial period, where areas with certain people were more prioritized than others. The three master plans of Dar es Salaam, building on from the colonial thoughts, have, furthermore, been implementing the differences. These differences naturally create an uneven basis to plan for microclimatic measures. Some area's conditions facilitate while others complicate for microclimatic planning. An example is densely built-up areas such as Kariakoo, where open spaces that could be used for construction of parks are hard to find. In contrary, Masaki, located on the peninsula, provides plenty of free spaces that could easily be used for this purpose. These varying conditions make it a challenge for planning authorities to work with microclimate, especially for areas like Kariakoo.

Informal settlements are areas of certain interest, but also of certain difficulties. As mentioned, these areas are widely spread out over the city and are inhabited by more

than 70 percent of the Dar es Salaam population. This indicates that, for the major part of the city, no planning to guide the development in general is available. In fact, the informal settlements are more or less completely out of control for planning authorities to conduct any kind of urban planning, microclimatic planning included. Hence, the major issue is not whether the legal framework and the urban planning system in general are functioning good enough or not. The big problem is rather that they are being implemented and used only for the planned part of the city. Unfortunately, not even that is true. As discussed, corruption prevents for urban planning and, in some ways, makes the efforts of the planning authorities pointless.

Given the topics of discussion presented – economy, corruption, other more pressing issues, varying physical conditions and so forth – it is obvious that implementation of the legal possibilities might not be that easy. In general, very little practical consideration of microclimate can be expected. Thereby, it is of great interest to observe that considerations actually have been taken place. As presented in section 6.3, some of the reviewed documents include an aim to improve climatic conditions. Both approved redevelopment schemes and the draft for the new Master Plan underlines the importance to encourage good microclimatic conditions. Protection from sun and enhancement of wind seems to be the most common objectives. Whether these objectives are implemented or not is another question. It may be easy to address these issues in a written document, enclosed to a planning scheme. However, due to the different topics discussed, it may be more difficult to implement them in reality. This dilemma has been highlighted in several interviews. Even though the good intentions exist, the results are scarce.

Practical implementation of the observed objectives would of course be more likely if the objectives were to affect the actual planning scheme, and hence get the force of law. As has been argued, there are good provisions to enforce microclimatic matters through planning schemes or other planning instruments. As for some of the strategies – allocation of parks and controlling of H/W ratio – this has been done. Given the legal framework it would however be possible to use these instruments more. If so, the link between the objectives of the plans and the practical implementation could be strengthened.

In conclusion, the city of Dar es Salaam will encounter many challenges; thermal discomfort will be one of them. Fortunately, it has been shown that it is theoretically possible as well as practically desirable to improve the microclimate within the city. In combination, this enables a development where microclimatic considerations are an integrated part of the urban land management process, resulting in a more pleasant climate for the inhabitants of Dar es Salaam.

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Figures

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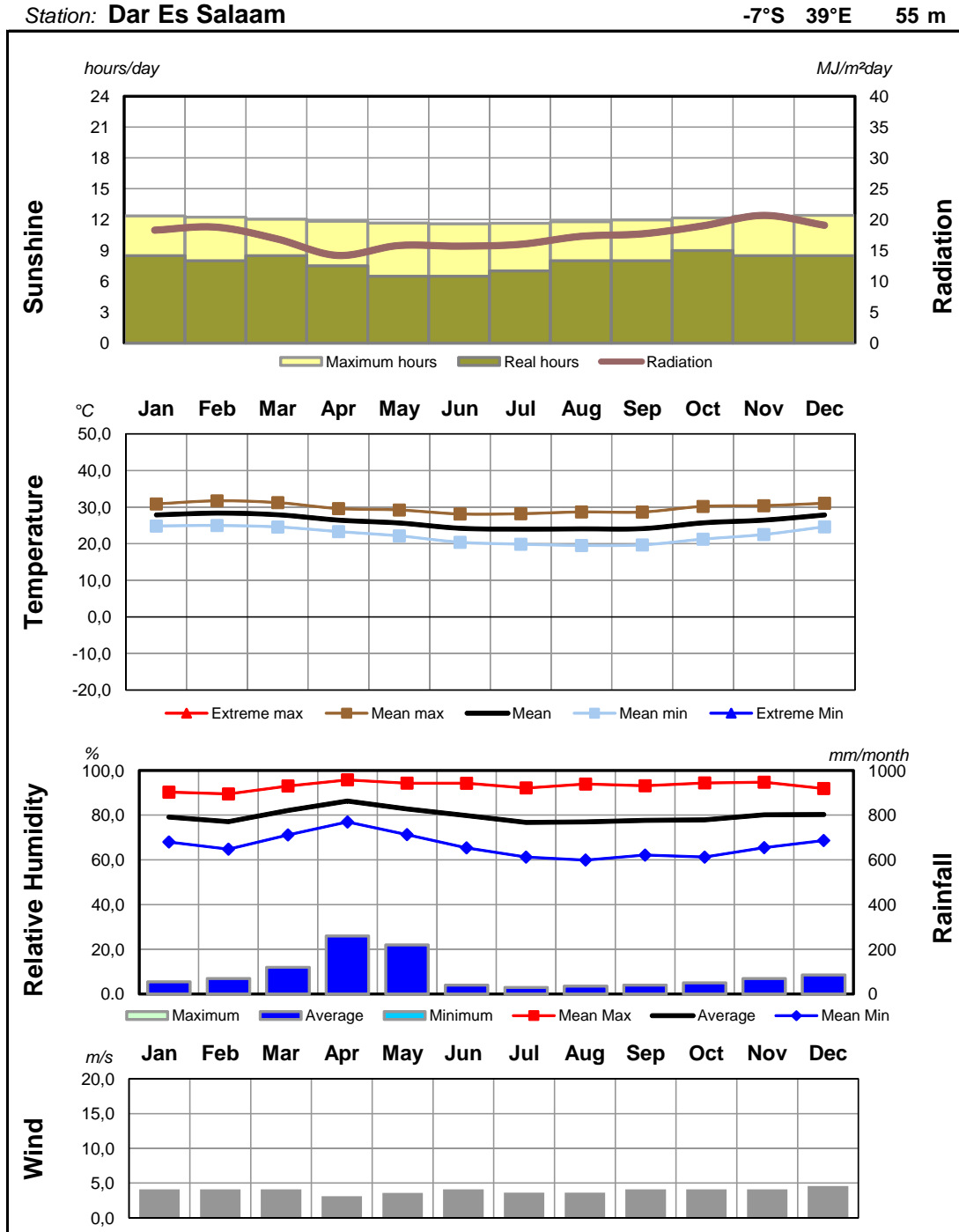
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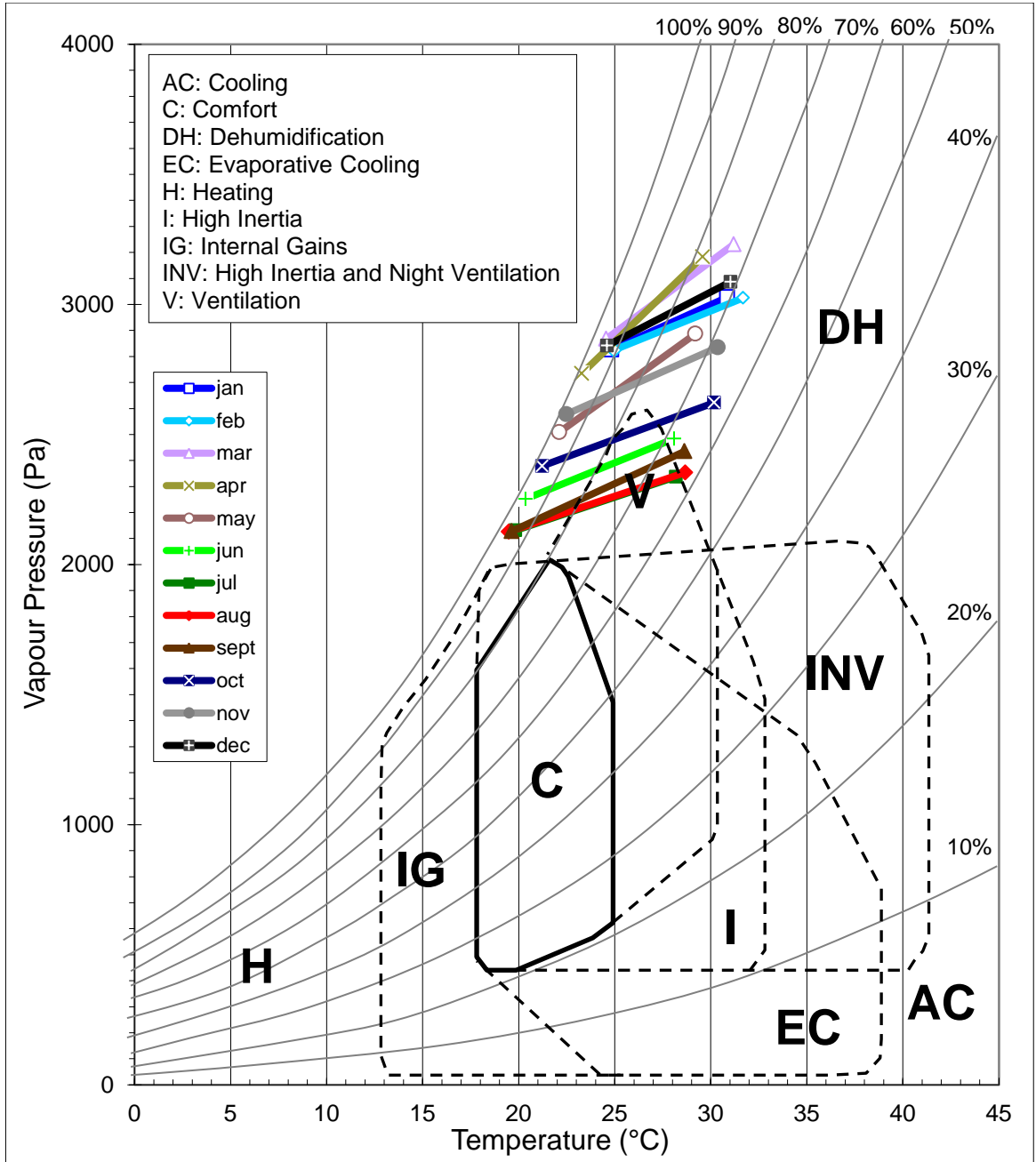
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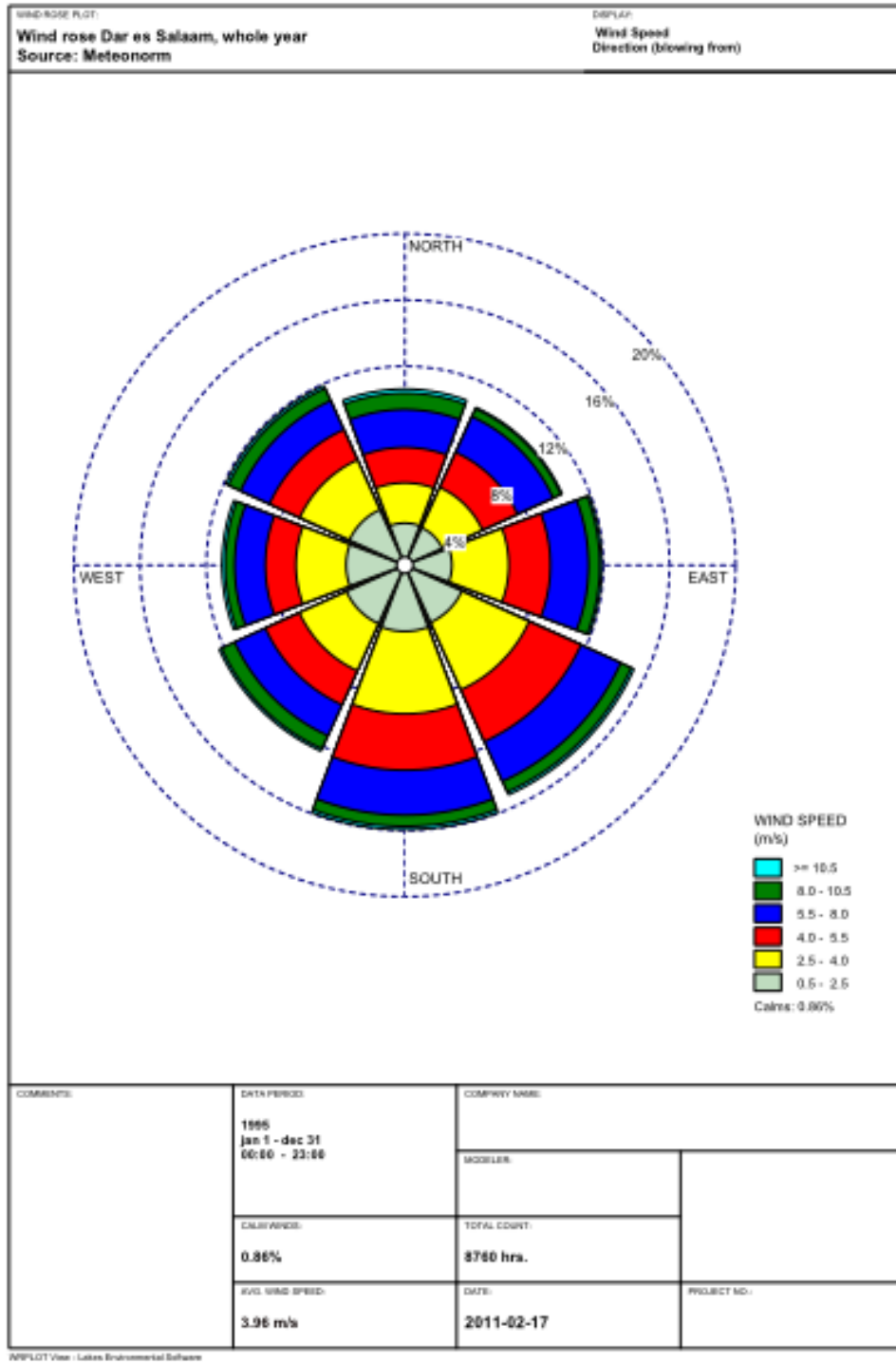
Appendix 1 Climatic data for Dar es Salaam



Bioclimatic Diagram Dar es Salaam (Givoni)



Urban Land Management for a Better Microclimate: the Case of Dar es Salaam



Appendix 2 Third schedule of the Urban Planning Act

THIRD SCHEDULE

(Made under section 9(7) and 27)

Matters in respect of which provision may be made in any schemes

A: Plan Preparation

1. The most important consideration in the preparation of strategic urban development planning frameworks shall be -

- (a) an assessment of immediate land requirement to accommodate specific population needs as they arise for a period of 3 to 5 years,
- (b) detailed allocation of the land requirements to various land uses taking into account compatibility of adjoining land uses and conforming with the general planning scheme; and
- (c) identification of authorities to service and/or develop the various land use allocations.

2. General and detailed planning schemes If a result of unavoidable circumstances the planning authority or Director is not able to make a decision on an application, the planning authority or Director may defer the decision on the application for such further period as he may think fit. shall be -

- (a) action area plans, for comprehensive planning of areas selected for intensive development, which is to commence within a specified period.
- (b) subject plans, for detailed treatment of a particular planning aspect, such as, residential, transportation, water supply, sewerage, etc.
- (c) advisory or zoning plans, indicating permitted sub-division, use and density of development; and
- (d) part development plans, indicating precise sites for immediate implementation of specific projects including land alienation purposes.

B. Use of land

1. Providing for the reservation of areas, zones and sites for -

- (a) dwelling houses, flats and tenements of various classes and densities including dwelling houses classified under informal housing;

- (b) shops, offices, trading premises and other commercial development, with or without residential accommodation;
 - (c) industries of various classes, warehousing and service trades, or any particular industry or trade; informal sector development; small scale industries for the production of low cost building materials;
 - (d) buildings required for charitable or religious purposes, schools, hospitals or other medical or public health purposes, cemeteries, crematoria, educational or recreational institutions, libraries, theatres, cinemas hotels, restaurants and other places of public entertainment, amusement, refreshment or assembly;
 - (e) agricultural purposes; and
 - (f) other purposes.
2. Permanently prohibiting or restricting the development of any land on any of the following grounds -
- (a) that the land is unsuitable for building; or
 - (b) that development would be prejudicial to public health or other public interests.
3. Providing for the reservation, regulation and control of quarries and mines and buildings ancillary thereto.
4. Providing for the delineation of areas in which development is prohibited, restricted or controlled under the provisions of any other law.

C. Buildings and structures

1. Regulating and controlling either generally or in any particular area all or any of the following matters -
- (b) objects which may be affixed to buildings;
 - (c) location of buildings, extent of yards, Gardens and cartilage of buildings,
 - (d) purposes for and manner in which buildings may be used or occupied including, in the case of dwelling houses, the letting thereof in separate tenements;
 - (e) design, external appearance and materials of buildings and fences;
 - (f) reserving any particular land or all land in any particular area for buildings of a specific class, (including dwellings classified under informal housing) or prohibiting or restricting either permanently or temporarily the erection of any building or any particular class of building on any specified land.
2. Regulating and controlling the density of development in any area, either by limiting the number of buildings of any type which may be constructed on or in any area or plot or by limiting the number and size of plots in any area.

D. Public services

Facilitating the construction of works relating to aerodromes, railways, electricity supply, telephone and telegraph lines, wireless facilities, sewerage and refuse disposal, water supply and other public utility services, allocating sites for use in relation to such services and providing for the reservation of land.

E. Roads

1. Providing the location and reservation of land for roads, car parks, taxi stands and bus stations and the widening, improvement and extension of any roads, and the fixing of building lines.
2. Providing for closure or diversion of existing roads.
3. Restricting and controlling the designing and construction of new roads and the siting of road junctions and accesses, whether public or private, to existing or proposed main roads.
4. Regulating the line, width, level and general dimensions and character of roads, whether new or existing.

F. Amenities

1. Providing for the reservation of land as open spaces, whether public or private parks, sports grounds and playing fields.
2. Providing for the preservation of views and prospects and of the amenities of places and features of natural beauty or interest.
3. Providing for the preservation or protection of forests woods trees, and groups of trees.
4. Preventing, remedying or removing injury to amenities arising from the ruinous or neglect condition of any building or fence, or by the objectionable or neglected condition of any land attached to a building or fence or abutting on a road or situated in a residential area.
5. Prohibiting, regulating and controlling the deposit of liquid, materials and refuse.
6. Prohibiting, regulating and controlling the display of advertisements.