

ISTANBUL OKAN UNIVERSITY

INSTITUTE OF SCIENCES OF GRADUATE STUDIES

DEPARTMENT OF ARCHITECTURE



THE POSSIBILITIES OF CONVERTING THE MILITARY SITES IN TRIPOLI
CITY TO GREEN PUBLIC SPACES BASED ON SUSTAINABILITY

A Thesis

submitted by

in partial fulfilment of the requirements for the degree of

MASTER OF SCIENCE

Belkais Ali Fares Aweda

April 2021

Program: Architecture

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Submitted to Institute of

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MASTER OF SCIENCE

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April 2021

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ABSTRACT

THE POSSIBILITIES OF CONVERTING THE MILITARY SITES IN TRIPOLI CITY TO GREEN PUBLIC SPACES BASED ON SUSTAINABILITY

The landscaping of sites is regarded as that is connected to the environment to be the ideal method for organizing and distributing the buildings, including the preservation of the land topography surrounding it. Including the ecology of these sites nature and creating parks and open spaces to enhance the neighbouring environment for the benefits of humans and other organisms housing the ecosystem. Therefore to build or create a sustainable landscape and ecology urban design, these challenges need to be faced with efficient and creative ideas to succeed.

The study will focus on the environmental issues, investigating and working on the development of old military sites and army camps, which destroyed by the war in Tripoli since 2011. To convert and redevelop it in order to create an open public green space based on ecology and sustainability, as a way of solution for the lack of open green areas in the city and to abolish the presence of military sites within the city.

Therefore, these sites will be taken as a case study for the thesis to integrate them within the urban land use planning of Tripoli city, considering the idea of sustainable landscape design of the urban built environment of thy city. The study will emphasise understanding the foundations of the ecological and sustainable landscape design process from past studies summary and supporting these theories with global existing examples that respect these foundations as a stage of post-war development.

Keywords: Sustainable and ecological landscape development in Tripoli, Post-war development, Re-use of devastated army sites in Libya.



To my family...



ACKNOWLEDGMENT

First and foremost, I would thank my supervisor Prof. Dr Demet Irkli Eryildiz, for all her valuable guidance, kind support, incredible patience especially during hard covid quarantine time she has always answered me when I had a question about my research or writing at any time, and for that, I will always be grateful.

I wish to thank my jury members Asst.Prof.Dr. Bahar Bařer Kalyoncuoęlu and Asst.Prof.Dr. Özgün Arın, for their constructive critics and effectual comments .

Special thanks should be given to the Department of Architecture at Okan University, Prof. Dr Semih Eryildiz, Prof. Nur Esin, Dr Özlem Özer.

I would like to express my gratitude to my father Prof Dr Ali Fares Aweda, who always be my inspiration and my role model, he was keen to follow me and advise me to step by step.

Thanks to my life partner and companion, my husband for his support and patience all the time. I would not have done it without your unconditional love and support .

Thanks to my mother for believing in me and for her continued support and prayers and sincerely compassion. My brothers and my sister and my kids for their endless support and their warm and kind words of encouragement.

To My friends and colleagues, who helped and supported me through this study period and we created a strong friendship I will cherish forever .

You are all a part of this, you have made an impact big or small and in dark times you pushed me to the light and for this, I will always be thankful.

My biggest thanks to my country, Libya, which gave me the opportunity and scholarship to complete my higher education, gave me all the support and belief in my ability. In its most severe stage and difficult situation.

As the daughter of this wounded country, I have lived in it all the stages and period of the wars it has fought since 2011. I know exactly what his primary needs are, with which I can help him as an architect. Over the past ten years, I always hoped that I did not see any manifestations of weapons inside my city like any Libyan. I was upset and terrified by every war aimed to control the army camps inside the city. From here my idea and proposal come, to turn and develop these terrifying sites into an icon of safe life and sustainability, to ecological and sustainable parks. As a small gift to heal the wounds of this country and these people. I hope that this ordeal will end soon, and may God protect you, Libya.

Thank you

Belkais Aweda

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ABBREVIATIONS

GPP Generation Planning Project.

GMMR Great Man-Made River.

LUP Land Use Pattern.

SPP Sewage Purification Plant.

TDS Total Dissolved Solids.

SWOT Strengths, Weaknesses, Opportunities, Threats.

UPA Urban Planning Authority.

NSP National Spatial Policy.

I. INTRODUCTION

1.1. The Aim and The Objectives of The Thesis

This thesis will focus on how to apply ecological development in green public spaces in the Libyan capital, Tripoli city. And, will suggest avoiding the lack of green spaces particularly in the sites devastated by the War in 2011 and the civilian war later.

Whereas, all the camps, warehouses and weapons stores in Tripoli, which are located in the middle of the city and surrounded by residential areas, have been destroyed and have become deserted, devastated and terrifying areas. These areas can be exploited and developed to compensate for the lack of green areas and public parks, in addition to other open spaces.

There are more than nineteen destroyed military sites within Tripoli city, most of them can be developed and exploited to reduce the lack of public spaces and places. Those can integrate them within the urban fabric of Tripoli, taking into account the idea of sustainable and ecological landscaping for the coordination of harmonic with the urban built environment of Tripoli city.

The three major aims of this thesis are directed in the general area of landscape sustainable development views:

- Developing the devastating areas and convert them, to be green public spaces based on sustainability.
- Create new urban spaces and public spaces to be at a high level of ecology and sustainability.

- Filling the shortage of green spaces in the city and increasing the per capita share of it.

The idea of the study will be to concentrate on implementing the principles of ecology development and the open green spaces of the masses in these destroyed special places that mediate residential areas. The researcher believes that the idea may carry a kind of positive energy that helps the Libyans to forget the hard past and try to rebuild what was demolished, by creating a sustainable friendly environment for having a clean atmosphere to life. The study will be divided into two parts, the first part will include the theoretical definitions and foundation criteria of post-war development and ecological and sustainable landscaping design and the process of creating ecological parks and green spaces, as well as, supported this theoretical by international existing parks that applying the same criteria. The second part is the practical part, focused on collecting, analysing and evaluating data that affect strongly for the possibility to create sustainable green public spaces in Tripoli city. also, present a proposal solving the research problem, with the site and SOWT analysis, development strategy and design criteria, and at the end of the study found a thesis result and several recommendations that could help the future study in the same topic.

1.2. Problem Statement

The increase in population in Tripoli led to increased urbanization and encroachment on open land. that had led to Inadequate and unequally distribution of Tripoli green spaces, it has a big lack supply of public greenery and had a strong effect on the quality of the existing green area. whereas the accepted standard is (10m² per capita) as per international standards (commonly). as well as, all the global cities are moving to achieve sustainability on several dimensions, not just environmentally,

which the most important element, due of influent on quality of life, human health, and natural eco-system.

The first sign of a weak spot has seemed in Tripoli as the degradation of urban public space. So many districts have a land degradation process. Especially the green public spaces have declined in comparison to 30 years ago, "Tripoli City Centre's Current green areas open to the public: only 30% of the population is served in a radius of 250-meter around these spaces". (Tripoli City Centre's Urban and Architectural Charter /, 2009). We should note that the urbanization movement is fastly increasing around the last ten years in Tripoli city. But unfortunately, without any planning programs or advice from the government and municipal and responsible authorities, whereas the citizen expansion of residential dividers does not have any kind of urban design basis, they have been forgetting and ignore about any open public spaces .

As a result of this un-planning movement, the vegetation of the city has been violated, and the average lack of green space is incredibly aggravated from bad to the worst situation.

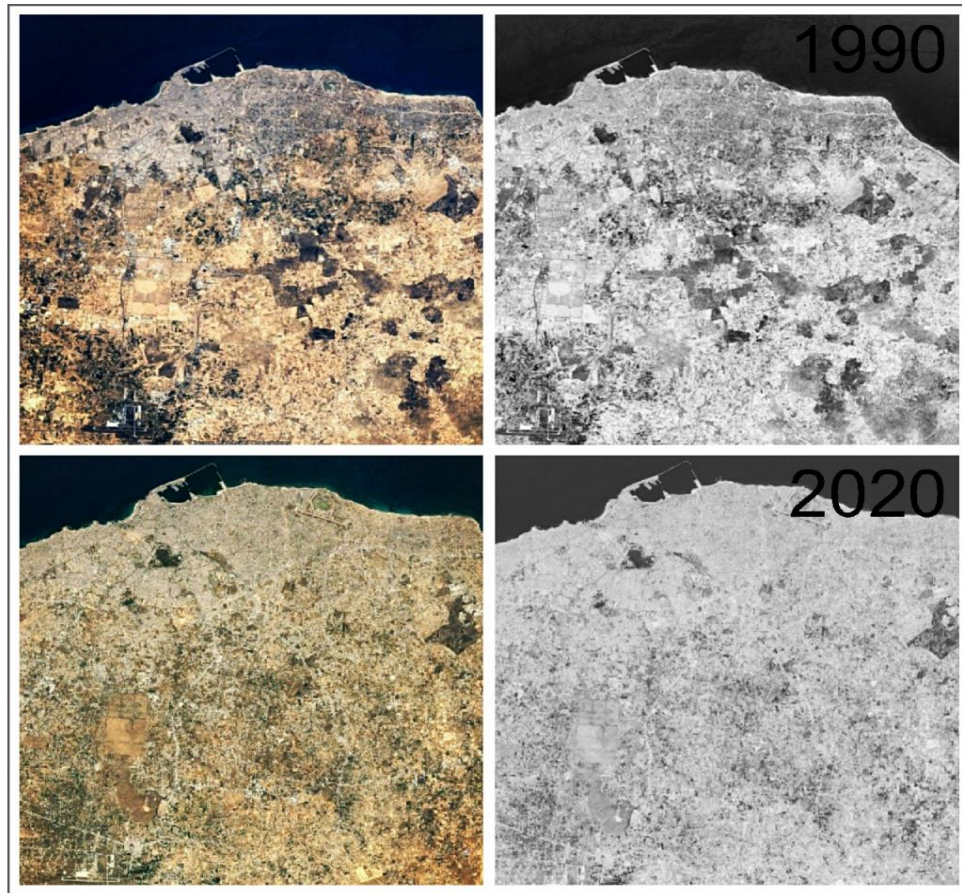


Figure1 .1: A comparison between 1990-2020 showing the encroachment of urbanization on vegetation in Tripoli city. © Author from Google Earth

On the other hand, the urban of Tripoli is having a huge army area in the middle of the city urban fabric, where these areas had become troublesome and scary due to wars. which become completely demolished and destroyed. The research problem discusses, how to get rid of these old army sites and convert them to new green public spaces. this is to fill the deficiency of existing open spaces in Tripoli. also, this conversion will be based on the foundation of ecological and sustainable landscape criteria design.

1.3. Hypothesis of The Study

In this study, one main hypothesis is put forward in the context of the thesis, which is:

- There is a possibility to transform destroyed military areas into gardens and parks to reduce the shortage of green areas in the city.

And the following others are sub-hypothesis:

- By using sustainability principles, destroyed military areas can improve, and Integrate within the urban fabric and increase the greenery in Tripoli city.
- By transforming the destroyed military areas into green spaces, the land degradation and desertification in the region can be addressed.
- Encourage the sustainability concept in Tripoli city by applying in the demolished area and public places and passing it to the other areas in the city in the future.

1.4. Research Questions

In the context of this study, basic research questions are defined to structure the research. These questions are indicated below:

- 1) What are the concepts and key requirements, that should understand by urban planners to redevelop destroyed sites?
- 2) What is the theoretical conception of ecological and sustainable landscape development, and how can take it up in the planning of green public spaces?
- 3) How can the international expertise in "ecological sites " be helpful for Libyan cities to develop the postwar areas in a sustainable Landscape way?

- 4) What are the difficulties facing achieving ecological landscape development in Tripolis demolished military sites?
- 5) How we can reduce the shortage of green area in Tripoli city?
- 6) What are the sustainable principles or criteria that can be used to improve the landscape of a destroyed area in Tripoli?

1.5. Limitation of The Study

The thesis will focus on the possibility of creating green public spaces in the capital city of Libya –Tripoli, with particular attention to the quality of life perspective. The limitation area will be specified on the destroyed army site and the weapons stores, that has been bombed in the 2011 war by Neto military aircraft. The merging of these areas into the existing urban fabric of the city will be studied, in sustainable and ecological processes. Tripoli is selected as a case study due to its urban planning problems. Which is the biggest one is the shortage of green public spaces.

The flows of the study are:

- **Chapter I:** In the first chapter, will study the aim and objective of the thesis, then setting up the expected hypotheses related to the research problem for this thesis. and giving the research questions, Then the limitations and the research methodology and methods used will be present.
- **In Chapter II:** The first part: The topics of post-war development and sustainable landscape design will be studying on understanding the foundation concept and strategy and policy of application. To learn and try to give suitable ideas that help the Libyan demolished sites to develop sustainably. The learned point will be determined after each of them. The Second part: the inference by

international examples and experiences that had been achieved and success to have an ecological and sustainable landscape area. also, we will be presenting the matrix of examples and evaluation them (environmentally, economically. and socially).

- **In Chapter III:** The analytical and descriptive method was used to study the possibility of applying an ecology and sustainable landscape in Tripoli- Libya. A detailed analysis will be made for them, in terms of the topography of the land and the resources upon which the establishment of an ecological and sustainable landscape, such as water resources, land use condition, classification of the soil in terms of its suitability for agriculture, the status of agriculture and forests in the country and evaluate it. Also, present Tripoli environment hazards evaluation that could have a strong impact facing the provision of creating a sustainable and ecological landscape, as part one of this chapter.
- **In Chapter IV:** A detailed analysis will be made for the classification of public green spaces in Tripoli, and a complete inventory of all these sites will be made in terms of area and evaluated. The purpose of this detailed study is to emphasize the problem of the lack of public open green spaces and their per capita share of these spaces. Then, the importance of creating additional spaces especially in new residential compounds. This will be a prelude to the researcher's proposal in the next chapter to solve this problem.
- **In Chapter V:** The proposed site for this model for sustainable green public spaces will be identified.

First: The site will be analyzed as site analysis. and the reasons for choosing that will be determined as SWOT analysis.

Second: it will present sustainable practical ideas as a development strategy can be followed.

Third: a park design criteria in matrix presenting the criteria, principles and elements the can apply in the park. and supported by park land-use zoning example that could be followed in the future by any urbanists planners and architects, who will design this park .

The analytical method was used to study the possibility of applying it in Libya for the rehabilitation of destroyed areas and buildings through a case study on a sample of army sites such as destroyed and abandoned camps, warehouses, and army stores. Which were in the centres of the cities. The essence of the work strategy in this study was almost entirely dependent on field visits and the follow-up of many of these projects on the realty by the researcher to take and analyze information through observation and photography. The analytical descriptive approach was followed in the study of the current situation and present a proposal idea.

- **Chapter VI:** will give the conclusion and author recommendation of this thesis.

1.6. Methodology and Structure of The Study

A qualitative mix-method approach has been chosen for understanding urban green space planning and the use of the eco-landscape services process in Tripoli. There are several major stages in the approach.

The method of the study consists of two parts, The first part will be the Theoretical. First Inclouding the knowledge construction will be generated by literature examination which includes theory and practice in the field of post-war developmental

and ecological and sustainable landscape planning of green areas. This reference brings together the understanding of the approach of after war development and reconstruction and ecology and sustainable landscaping development and design. by identifying the (conception, foundation, process, strategy, policy)of application for both of them.

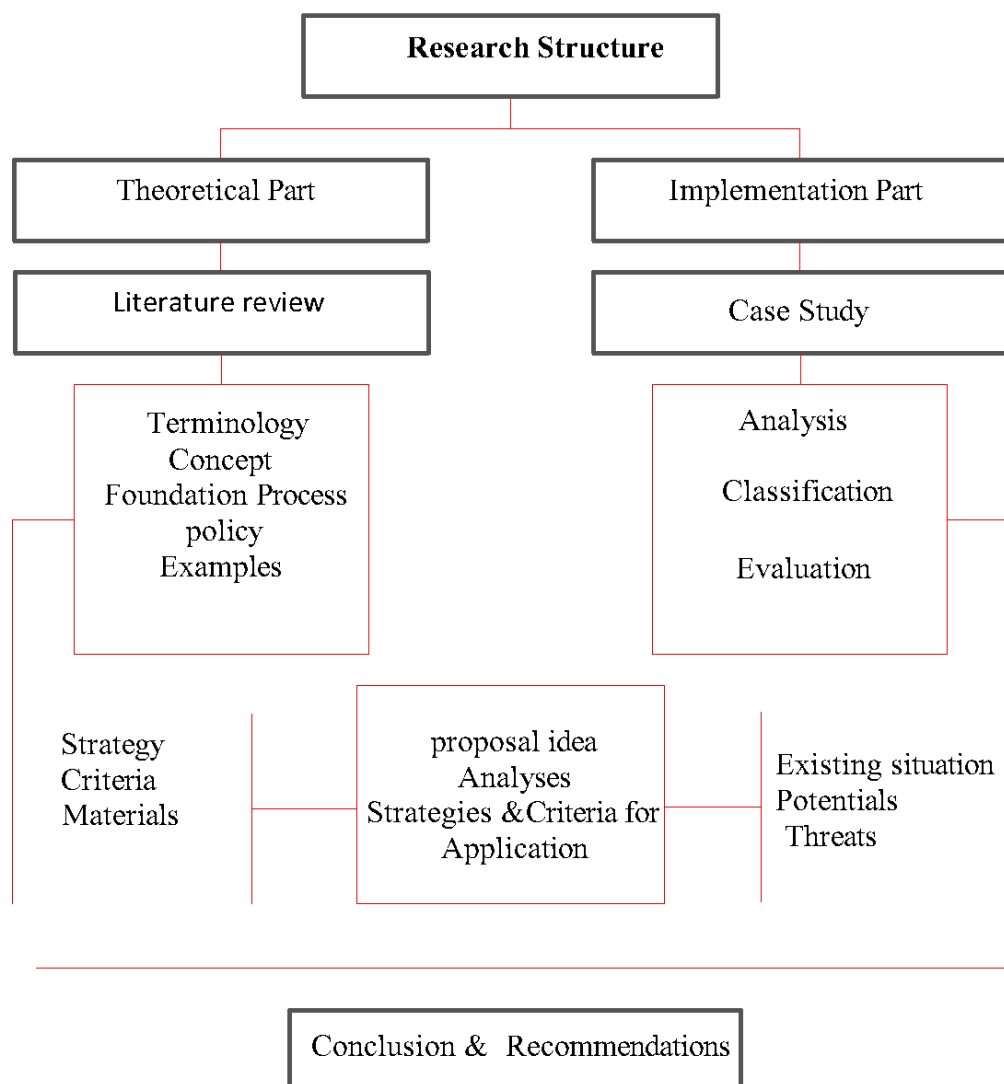
The second part of the literature research consists of examples of ideas and cities which use ecological criteria and principles in green space planning. New York, Berlin are the sample cities from their experiences in the (central park -Manhattan, Tiergarten Park-Berlin), we will draw a path for Tripoli by applying the same sustainable criteria of park design in the old military site. A matrix of examples and evaluation it(economically, socially, environmentally) will be passed through the study.

After literature research, the implementation part of the research will be started by the environmental issues for Libyan land will be studying. the first step is to analyze the current situation diagnosis using different materials/documents to understand natural potentials, that needs to create a sustainable landscape. such as (Topography and Landscape, climate, Current Land Use patterns, soil, Vegetation and Agriculture., Forests and Protected Natural Areas, water resource) and the environmental weaknesses and hazards like (Land Degradation, Sea Water Intrusion) that threaten the sustainable landscape and greenery.

The second part will be an analysis of existing green spaces in Tripoli. by describing (urban vegetation within Tripoli city, the Problem definition, international indicators of green spaces and vegetation in the city, Tripoli Green spaces

classification, Existing and Proposed green public Spaces) will analysis to help to find an ideal solution to solve the problem of green public spaces shortage.

The final part of the practical study will be a proposal in which the author tries to apply the theoretical part by developing the destroyed military site as a post-war development on sustainable and ecological development way by creating sustainable green spaces that consider all the strategies and criteria that suits Libyan condition.



Diagrams 1.1: Research structure

Tools and material of study:

- First, the theoretical study will focus on definitions, foundations detailing, strategies and policy, and inference by international examples and experiences that had been achieved the point, to apply it and developed in Tripoli condition.
- Second, The selection of Tripoli data involves arranging and conducting interviews with stakeholders and field visits for collecting that important data and governmental reports, which are unpublished.
- Third, data analyzes using information from government reports by content analysis of strategic planning documents and governance background analysis.
- fourthly, The existing green public spaces in Tripoli will determine by location and space area, classification, also quantity& quality evaluation to find out the per capita share of it.
- Fifth, present a solution proposal, to fill the deficiency of green open area, and get rid of demolished army sites by converting the theme to new green public spaces considering the environmental issues and based on ecological landscape criteria design .

Table 1.1 : Thesis methodology tools and materials. © Author

Methodology	Material
Theoretical concept, foundations, dimensions, Implanting, the strategy Examples, phases of the implantation of greening action	Thesis, articles, reports, initiatives, official websites, photos.
Analysis of the existing and potential areas, global examples.	Maps, site observation, global experiences, existing examples.matrix
Case study definitions, Land & resource analysis, evaluation	Local concepts of implantation, Governmental reports, interviews, field visits, maps, photos.
The problem statement, analysis, evaluation	Determine location and space area, classification, quantity& quality evaluation.
Solution Proposal, analysis, strategy, criteria	site analysis, SWOT analysis, strategy matrix design criteria, photos
Result	Conclusion and recommendations

II. LITERATURE REVIEW

One of the most important research tools, adopted by the researcher, is previous literary studies as a literature review. The author tried to integrate the topics and patterns on which the classification of the city of Tripoli depends and the challenge that will be faced to solve the problem in the research.

This chapter will summarise the literature on the post-war developing topic and sustainable and ecological landscapes design topic, in a way of proses, concept, and foundation that help to create sustainable and ecological parks also, the social and environmental benefit impact of green public spaces. as well as, to understand the idea and challenges and extract the benefit of international cities experiences that consider the idea of creating an ecological and sustainable landscape in a city that can be classified as a compact city to be a green city in the future.

The parks and cities that selected are Tiergarten Park, Berlin and central park, manhattan- New york. by collecting and presenting their ideas and programs and strategies that could suit the case study and can be applied in Tripoli parks. Comparison Matrix of examples and Author evaluation according to sustainability dimensions (economy, environment, social) will be presented through this chapter.

2.1. POST-WAR DEVELOPMENT

2.1.1. The Definition of Post-War Development Concept

The post-war development concept may be understood as the process of building up structures destroyed by disaster or war. However, this is less defined because it considers the rebuilding of what is destroyed by physical structure only and neglects

the rest of the components of the urban tissue of which the physical structure is a part since the physical structure is a reflection of the people's cultural, social, economic, history, technology and climate life(Baradan, 2006).

Researcher (Baradan) defined post-war and post-disaster reconstruction and development strategies as a set of processes and policies to be developed to address disasters and then to rebuild, in the short and long term, those affected by war. These policies are comprehensive in all aspects of life and are concerned with rebuilding what was destroyed during the war into sustainable (social, economic, environmental) content. These policies may be different in nature from those that are put in normal circumstances because they are concerned with meeting needs in unnatural and unstable conditions(Baradan, 2006).

2.1.2. Intervention Strategies and Policies for Post-War Development

Any strategy for post-war redevelopment is based on four principles, which are considered as determinants of it and work to guide it (UN-Habitat, 2005). which are:

- **Preventive:** Not only does it develop plans to address the effects of the war disaster, but it also sets plans to avoid the disaster as much as possible, by taking preventive measures in advance.
- **Comprehensive:** It deals with all the effects resulting from the war disaster, at different levels and different elements in parallel, whether they are social, cultural, economic or political.
- **Merge into development plans:** This strategy is part of urban development plans, as war disasters are likely to happen anywhere, so it must be taken into account when preparing any development plans in the future.

- **Sustainability:** This strategy must achieve sustainability, can re-manage the wheel of life and its continuity by itself, and works to strengthen societies in the face of war disasters.
- **Flexible:** adjustable and adaptable to developments and changes on the real ground.

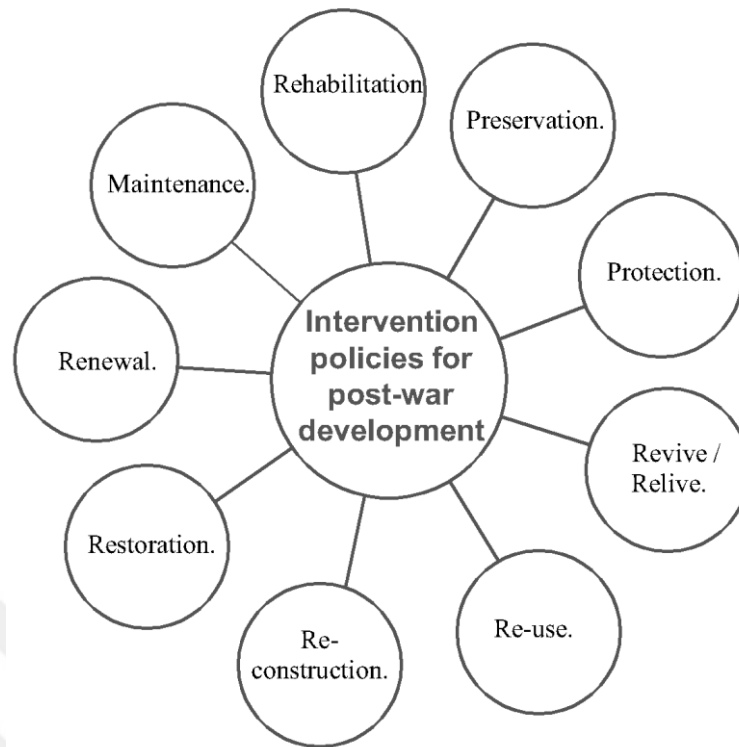
As well as, The process of preparing a redevelopment strategy includes several processes that must be carried out at different stages of time, intending to move the strategy from the theoretical level to of implementation level. as most important points are:

- Making policy
- Organization
- Modification & implementation
- Follow up & evaluation

That means it is an ongoing process, in which processes are assessed, lessons learned and lessons learned, to modify policies, avoid errors and improve performance(Baradan, 2006).

And before the reconstruction phase begins, officials should determine what policies are needed in the affected area, depending on the technical and environmental situation and the extent of damage and destruction at the site to be rehabilitated.

Policies for the reconstruction of the affected sites can be categorized as follows(Adib & Nejem, 2019):



Diagrams 2: Intervention policies for post-war development. © Author.

2.1.3. Urban Sustainability in Post-War Development

Achieving urban sustainability in the post-war period and reconstruction projects are aimed at "protecting lives, environment, property, reducing losses, preserving and not depleting sources, safeguarding the right of future generations and improving the sustainability of society". To achieve this sustainability, all components of the urban environment (environmental, economic, and social) must be addressed, and the more these components overlap, the more sustainable society will be.

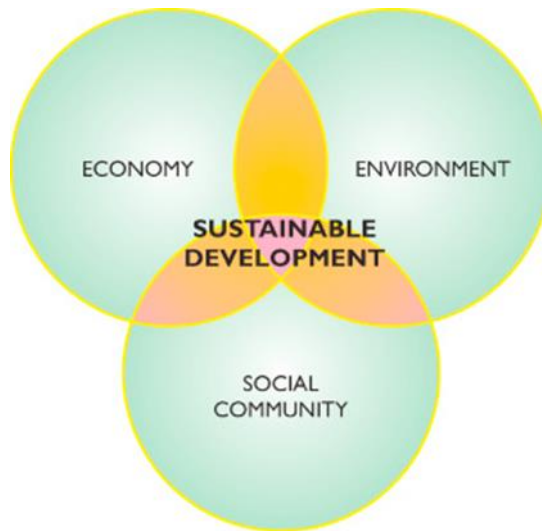


Figure 2: Pillars of sustainable development.

For Sustainable planning redevelopment has a set of principles to be achieved, which are :

- The development process should be fair in the distribution of public services and utilities so that it provides an opportunity for everyone to participate in decision-making.
- It should reflect the civilized environment, the surrounding features, the beauty and the civilization of the area.
- Planning for development should be flexible, scalable, expandable, and accommodate rapid changes.
- Maintaining a balance between flat green spaces and biodiversity, and between built spaces. and achieving the sustainable urban environment idea.
- Easy planning that ensures interlocking, communication and amalgamation between neighbourhoods.

- That development planning ensures the achievement of a diverse built environment in which uses and is vital at the same time, the integrated and solidarity.

2.1.4. The most Important Actors in The Redevelopment Process

They are the parties that have the responsibility to carry out the burdens of the redevelopment programs. Each party has a special role in coordinating and integrating these entities, which is one of the most important reasons for the success of the work, as the role of these bodies is complementary, not individual because success depends on cooperation between these entities.

- **State (National Government):** They play the primary role in the development of post-war disaster management and reconstruction strategies and also ensure the means and processes to complete these operations, whether at the outset, readiness, and the preparation of strategies and then implementation and reconstruction
- **Community:** The role of society is considered one of the most important roles in the preparation and reconstruction and development process. It depends on the role of the community in the successes of these projects. The more ready the society is, the faster the confrontation with the disaster, the recovery, and the speed of the reconstruction achievement.
- **Private sector:** The private sector plays a very important role, especially in post-war development programs. The private sector has skills, capabilities, employment and resources, and is highly flexible and adapted to circumstances.

- **Local authorities:** These authorities are municipal, provincial, or village councils, and typically bear the burdens and responsibilities of being prepared at the local level to implement and manage the national strategy in coordination and cooperation with all actors in reconstruction programs.
- **Non-governmental and civil society institutions:** In particular, non-governmental institutions play an important role in preparing for the consequences of war and development in the future. They help and relieve the burden on official institutions. This role is even more important as political power is weakened or absent. These institutions play an important role in the social, economic and cultural fields, provide humanitarian aid and emergency relief assistance, carry out assessments and survey, and fill gaps that can arise in the absence of a government role.
- **International assistance:** External assistance is in two basic forms assistance, financial, technical. These are the United Nations with its various programs, the World Bank, the European Union, regional banks, governments and foreign companies.

The Earnings from this part of Study

The most important points we can learn from this part are :

- Those interested and responsible for the redevelopment of sites in post-war cities, in general, should learn about the basics and policies of the process before starting to prepare for it. And for the ease of understanding the idea and helping them develop a strategy suitable for each site for the success and sustainability of development.

- Learn about the scientific methodology in developing proposals and justifications for the redevelopment and reconstruction of post-war sites, this showing in chapter III.
- This part of the research made it easier for the researcher to set sustainable standards to create sustainable landscapes at the study site to suit the site environmentally, societally and economically. This can be seen in the proposal presented in Chapter V.
- The process of redevelopment and reconstruction of destroyed sites is essentially participation, competition, development of skills and expertise and reconstruction.
- The main focus of ensuring access to a successful re-development is the integration of sustainability components and trends (environment, economy, society) into the basis of the process.
- This part of the study will be cited in the development of proposed ideas to support the start of the redevelopment of the study site in chapter V.

2.2. SUSTAINABLE & ECOLOGICAL LANDSCAPE APPROACH

After studying and understanding the main idea and strategy that should be filled in post-war development. whereas sustainability is the main key role of global development nowadays. and to build a Sustainable community it should focus on how can provide a place that people like living in and want to stay in, neighbourhoods with real character and a sense of place. These successful places should have well-designed green spaces that people will want to use and respect.

How green spaces can offer lasting economic, social, cultural and environmental benefits. It links high-quality green spaces with increased house prices and

demonstrates its role in tackling issues such as anti-social behaviour, especially after the war period.

2.2.1. Backgrounds and Concept of Sustainable and Ecological Landscape

Urban ecology is a science that is rapidly growing and is of great significance for sustainable urban design. While in recent ten years many frameworks have been suggested, there is still no full mature theory for urban ecology. However, general concepts have emerged which can make such a theory easier to construct. These concepts will in the meantime serve as valuable guides to design and maintain ecological landscapes (Cadenasso & Pickett, 2008).

To construct ecological outdoor and urban designs, sustainable landscape architecture starts with suitable structures to address functionalities, cost-effectiveness, elegance and sustainable environments. The combination of ecological, social and economic factors to design landscape areas to help protect wetlands, to help manage stormwater and to preserve waters among other objectives is a broadly spoken sustainable landscape architecture. In landscape architecture, the current trend is to combine esthetics and the purpose needed for a sustainable and efficient design.

Eco-designed urban environments may use ecological processes and human values as elements that create a shape. In addition to their many environmental advantages, these ecosystems include energy-efficient constructions, green buildings, stormwater and waste management (Eisenstein, 2001).

In 1980 a New Urbanism Movement advocated ways to limit the dispersed urban expansion of cities by using more environmentally friendly urban design practices such as walkable neighbourhoods, mixed land use and Transit-Oriented Developments (TODs)(Lehmann, 2011).

Moreover, the theory of sustainability in the 1990s reconciled social equity, economic growth and environmental preservation with city development(Campbell, 1996). And opened the way for the development of other concepts such as sustainable city green urbanism, livable city, and compact city among others. Those are still current and are at the centre of the debate on the influence of urban forms city designs, use of natural resources, energy and other issues linked to urban sustainability(Jabareen, 2006) .

In the years 2000, urban forms like electricity, resource efficiency, and environmental performance were central to the quest for new ideas and methods for defining and measuring the sustainability of cities. These recent trends have contributed to the introduction of the words green and sustainable development (Brilhante & Klaas, 2018). The growing emphasis on sustainability, awareness of environmental degradation and integration into the broad set of objectives of sustainable development policy has resulted in the development of appropriate ways of specifically including environmental integrity in decision-making (Levent et al., 2004).

2.2.2. The Importance of Green Public Landscape Areas

Green public spaces may offer urban people several benefits including environmental, social, and economic benefits and functions. These advantages of urban green public space are further summarized below.

Environmental Impact

The environmental role of green spaces has been demonstrated through several studies. we can summarize as follows (Levent et al., 2004):

- Green areas are one of the world's major places as they are a factor in fighting erosion, dust, etc. And serve to soften the air of cities as green towns.
- green areas are the lungs through which the cities breathe, and make them healthy.
- The green area plays a central part, with its various forms and colours of plants and esthetic looks like fountains, ponds, arches and more. They also play a major part. This enhances and attracts attention to the surrounding sites.
- Green space may filter air, remove pollution, attenuate noise, infiltrate stormwater, and replenish groundwater. Moreover, it can provide food
- Trees in urban areas may reduce air pollution by absorbing pollutants from the atmosphere. It can also moderate temperatures by providing shade and cooling an area, thus helping reduce the risk of heat-related illnesses for the city.
- Green spaces are capable of providing flood control and stormwater advantages through precipitation absorption and storage. Pollutants can also be stored in their plant's roots and stalk rather than in waterways and seas.
- Helping to Upgrade the level of quality of the environment for a better atmosphere of life.
- Well-designed green spaces also provide habitat protection and biodiversity conservation

Social Impact

Many studies have shown that access to green spaces can improve social cohesion. The presence and accessibility of the outdoor areas in the neighbourhoods are therefore linked to a stronger feeling of community identity. we can summarize as follows:

- Greenery affects the quality of life positively.
- Places for relaxation and psychological calm. Even for social contacts .
- Encourage neighbourhoods and intimate relations among the citizens, which strengthen their sense of belonging and familiarity to their areas of residency.
- Promote citizens' environmental cultures .
- Parks are often used as physical sites associated with improved health and decreased risk of death and many chronic illnesses.
- Children with more access to parks and recreational facilities are more active than children with less access, and most results for adults are similar.
- The increase in the green areas means the healthy environment of the human being, the high art and the taste of the peoples, and contributes greatly to the consolidation of the social ties among the people, where they meet and meet each other.
- Vegetation could influence crime reduction. The researchers suggest that the green space's calming influence can lower mental illness and aggression.
- A strong link between human and their surrounding area because they need to have a place to calm, reassuring their feelings and mind, as well as behaving their social contacts. The use of trees in most cities is focused on aesthetics, behavioural and artistic values, although these values are important to a large

extent, but can be used constructively or architecturally to create or identify external spaces or to make plant curtains to block some unwanted scenes.

Economical Impact

Green spaces help economic rejuvenation and lasting economic prosperity has been achieved. Several advantages have been shown, such as (*Economic Benefits of Parks: ConservationTools*, n.d.):

- Improving parks and other green spaces can help boost tourism, which provides substantial earnings.
- The creation and conservation of well-planned parks can yield a financial return several times higher than the amount of money invested in the project, even if the project expenditures are taken into account.
- New employment opportunities in several sectors.
- It has a direct effect on property appreciation. Homebuyers prefer homes near parks, green areas, and open space.
- green areas can draw people to neighbouring restaurants, snack shops and businesses, depending upon the size, from nearby and far. Festivals, concerts and sporting events take place in the parks and offer further support to the local economy.
- green areas that are unpaved and permeable retain rainwater, recharge groundwater sources and slow the release of storm runoff. The vegetation stores and permits the evaporation of some water. Reduced runoff and improved water storage may reduce the size of the stormwater treatment system in the community and lead to considerable cost savings.

In brief, sustainable landscapes have an enormous value not only for the environment and wildlife but also for human health, security and the state of the economy. Improving old parks and sites and other landscapes, the focus on conservation and sustainability of natural resources is an advance that can improve the quality of life for all in the community.

2.2.3. Ecological Landscape Design Policy

Ecological landscape designs fall into four categories, which is highly recommended that you focus on them when creating "Ecological landscape" :

- Preservation of existing, functioning, ecological systems.
- Enhancement or re-establishment of degraded ecological systems.
- Intensification of ecological processes to mitigate potential or existing ecology.
- Environmental interventions reduce nonrenewable resource consumption (Mozingo, 1997).

Ecologically designed urban landscapes can use both ecological processes and human values as form-giving elements. In addition to their many environmental benefits, these landscapes -which include systems such as energy-efficient buildings, and stormwater (Elik, 2013).

2.2.4. Strategies of Creating Sustainable and Ecological Public landscape Areas

We need to know what kind of natural resources are available in the region before any efforts can be taken towards building a sustainable landscape. A natural resource inventory will help to properly implement, build and maintain the landscape. The

natural resource inventory lists and describes all land characteristics, including soil, base, groundwater and surface, plants and wildlife.

In the natural resources inventory, the following categories of resources are commonly used to define the natural environment:

- Wildlife in the area.
- Water Resources.
- Forest resources and green cover.
- Wetlands.
- The climate.
- Geology and soil.

It defines criteria for the locations of natural resources, a description of the relationships between resources, the identification of pressures and threats to these resources, the uses that appear on the resources, the standard criteria for their use when measuring the change in the future, and suggestions for the future (Jessica Sprajcar, 2017).

2.2.5. Criteria for Creating Sustainable and Ecological Public Landscape

Areas

The right balance must be struck between architecture and ecology in a sustainable park. It can be generated by taking the following steps (Jeff Caldwell, 2014) :

- **Recycle the park materials:** Parks should have 100% recycled plastic furnisher rather than using wooden. These plastic furnishers are not only long-lasting but also impressive and attractive for many years to come.

- **Conservation of existing infrastructure:** Achieving sustainable infrastructure often does not mean reconfiguring the existing layout. In many cases, it is more efficient to use the existing infrastructure. Durable parks should be built and they might also retain the soil, indigenous farmlands and saturated lands. The cost of establishing new flora, soil and habitat will be greatly reduced by this practice.
- **Developing a soil control system:** Officials should make sure that parks have sufficient vegetation to withstand erosion and compaction during the building process. Its quality must be checked before entering new soil into the parks. Especially check for the soil's profile of nutrients, alkalinity, acidity and humus. Better soil health, less fertilizer requirement.
- **Use native plants to add beauty:** Use plants that are well adapted to the local environment. These plants will significantly reduce natural resource consumption and maintenance costs without any specific requirements for soil, light, fertilizers and water.
- **Employ organic manure:** If inappropriately used, chemical fertilizers may interfere with plant growth. As a result, authorities should employ organic manure. Organic manure is more expensive than artificial fertilizers, but it eliminates the need for any extra supplements. Furthermore, chemical fertilizers are washed away during the monsoon, degrading rivers and endangering aquatic life. On the other hand organic waste, even though washed away by rainwater, has no hazard to marine life.
- **Green-house pollution reduction:** private cars in and around parks should be prohibited. Rather, people can use either public transport or safer modes such as bicycles.

- **Optimize water supplies using:** Water can be preserved in sustainable parks as one of the most precious natural resources by building green infrastructure for stormwater management. Examples of approaches that are extremely cost-effective compared to water storage systems created by people include rainy gardening, flat-covered reconstruction or permeable pavements. And Using rainwater well by activities such as irrigation of rainwater. Collect rainwater and render water drinkable through an inbuilt filtration process.
- **Set up solar panels:** Parks can harvest and store solar power in batteries by installing solar panels. The solar energy accumulated can then be used to provide green LED lighting during the night and reduce energy consumption and costs.

Earnings from this part of a Study

- Understand the concept of landscape sustainability and focus attention on the basics, foundation, strategy and policies of its establishment and creation within cities.
- The landscape and green areas within the city play a key role in raising the quality of life in many respects (economic, community, environmental).
- The sustainability of green parks and landscapes has a direct impact on the sustainability of the city and its residents.
- This part of the research made it easier for the researcher to set sustainable standards to create sustainable landscapes at the study site to suit the site environmentally, societally and economically. This can be seen in the proposal presented in Chapter V specifically (5.5).

This Thesis will focus on how to apply these principles in the Libyan capital (Tripoli) Especially in the areas devastated by the war in 2011. Which is a large area, in the middle of the city; it had been bombed and destroyed and has become devastated abandoned and terrifying areas .The idea is to implement the principles of cultural development and the open green spaces of the masses in these destroyed and special places that mediate residential areas. This has a strong and effective reference to the human and environment. Also, it is a solution to the lack of green public spaces in the urban and architectural fabric of the city. as well as It may carry a kind of positive energy that helps the Libyans to forget the past and try to build what was destroyed in a safe, sustainable and environmentally friendly way.

To emphasis the idea we can focus on international examples:

2.3. THE EXAMPLES

The examples in New York, Berlin, were selected to analyze because they have a variety of similarities, both of them are unique cites, where they had been present in wars, for example, a part of central park manhattan was a weapons store, and military uses(The Arsenal), and it is become the most important city economically, which one of the sustainability dimensions. also, it has a special environmental strategy we will focus on through the study.

And, Tiergarten Park, Berlin, had been witnessed the worst world wars, and the vegetation cover and wooded area have been disappeared and demolished. and become nowadays it is one of the greeners cities by advanced planning in ecology landscaping.

Both of them have long developed and wide-ranging environmental and planning policies, shared a similar territory of cultural diversity, increasing population and growth .and they are known for their groundbreaking environmental management.

That makes them ideal examples should focus on to take the advantage of their experience to create ecological and sustainable landscape parks in Tripoli city.

2.3.1. Central Park, Manhattan, New York, United States of America.

2.3.1.1. Background of Manhattan, New York City

New York is a metropolitan city of over 8.3 million on the north-eastern coast of the USA. (Van Herk et al., 2011). A diversity of estuarine and terrestrial habitats has been characteristic of the city's climate since the mid-19th century, and have influenced urban growth (Gandy, 2003). Despite having a high percentage of open space (27%) compared to other American cities. Because of its high population density (10,430 people/km²), it is not enough. The city has an active civil society that has campaigned for environmental, urban design, and quality-of-life concerns since the mid-nineteenth century, and has more recently developed into key players in the city's greening efforts (Emily Lorange Rall et al., 2015).

The inhabitants of New York City frequently referred to Manhattan as the city, Is the most populous of New York city's five municipalities, which coexists with New York County, one of the original New York state municipalities. As the economic and administrative hub, cultural identity and historical centre of the birth of the city of Manhattan (JEN CARLSON, 2012).



Figure 3: Overview of Manhattan. © Jermain Ee/ Unsplash

Manhattan is represented as the world's capital of culture, finance, media and entertainment. the location of United Nations in Wall Street in Lower Manhattan's. the district has been dubbed both the world's most economically strong city and the world's leading financial centre, and Manhattan is host to the world's two largest stock exchanges by total market capitalization (JEN CARLSON, 2012). Is also one of the world's largest inhabited areas with a census of 1.628,706 people projected in 2019. (U.S. Census, 2019). "Living in a land area of 22.83 square miles (59.13 km²), or 72,918 residents per square mile (28,154/km²), higher than the density of any individual U.S. city. On business days, the influx of commuters increases this number to over 3.9 million" (Stephanie Valera, 2014).

After Brooklyn and Queens, Manhattan is the third-largest population in New York City, and the smallest municipality in terms of territory. If every district was considered a city, Manhattan would rank as the sixth-largest city in the world(NYBits, 2014).



Figure 4: Manhattan green spaces. © Resilient design institute.

Parkland composes 17.8% of the borough, covering a total of 2,686 acres (10.87 km²).e U.S. Central Park, the largest park comprising 30% of Manhattan's parkland, with some 20,000 workers crafting the topography to create the English-style pastoral landscape Olmsted and Vaux sought to create(Wayback Machine, 2006)

From this point of view, we can classify the city as a compact city as well as, it has a very high economic property and diversity of cultures and societies. Also, it has one of the most famous ecological landscaping parks which are the central park. All those elements make the city in a significant position for the author to look for and analyzing them to get the advantages from and invest that in favour of the case study of Tripoli city.

2.3.1.2. The History of Central Park

Central Park is Manhattan City's oldest and largest public park. "It occupies an area of 840 acres (340 hectares) and extends between 59th and 110th streets (about 2.5 miles [4 km]) and between Fifth and Eighth avenues (about 0.5 miles [0.8 km])". It was one of the first parks built in the American state using methods of landscape architectural design.

In the 1840s, Manhattan had become increasingly urbanized and a modern, massive park was called for to be constructed on the island by poet editor William Cullen Bryant and landscape architect Andrew Jackson, Downing. They were widely viewed and supported and in 1856 they acquired much of the park's existing land at about \$5 million that the state legislature took over. The demolition of old buildings, several dispersed hovels and squalid fields, free-roaming cattle, and many open drains and drains involved in the clearing of the site, which started in 1857. Architects Frederick Law Olmsted and Calvert Vaux designed a plan to protect and improve the natural characteristic characteristics of the terrain, to provide urban dwellers with a good quality park. The project was selected in 1858 from 33 entries received in a \$2,000 contest. The resulting park has shifted millions of dirt and top-level cartloads towards building the site, planting about 5,000,000 trees and shrubs, laying the water supply system, and building several bridges, arches and roads.



Figure 5: Central park location in the 1800s .© Museum of New York.

Central Park, which opened to the public in 1858, became the first landscaped public park in an American city. The finished Central Park opened in 1876 officially and is now one of the most significant accomplishments of the artificial landscape. The park's grounds and vegetation ranged from flat, grassy hills to soft paths and shady glens to steep, rocky gullies. The park has amazing views and walks almost everywhere. In the park facing the fifth avenue is the Metropolitan Art Museum (*Central Park: Additional Information | Britannica, 1999*).



Figure 6: Central Park in the 1800s and 2000s. © Kaytlin Er & Sophia Lo

A zoo, an ice-skating rink, three tiny lakes, an open-air theatre, a bands shell, several sports and play areas for kids, many fountains and hundreds of monuments and plaques spread throughout the city. There are also several sports areas. There are also a police station, some blockhouses from the early 19th century and "the Needle of Cleopatra" (an ancient Egyptian obelisk). The park has several walking and biking routes, and there are many roads. (*Central Park: Additional Information | Britannica*, 1999).



Figure 7: Central Park Manhattan. © Digital Globe/ Caters News Agency.

2.3.1.3. Flora and Fauna

Central Park has over 20,000 trees along Mall and Fifth Avenue, including one of the largest and final American, stands in the world. These trees are picturesque but also helps a little easier for New Yorkers to breathe. A mature tree can absorb more than 48 pounds of carbon dioxide into oxygen from the atmosphere in a year. Every year, Central Park trees extract about one million pounds of carbon dioxide from the city's air. The trees of the park not only reduce carbon dioxide but also help maintain cool NYC in the summer sun. In metropolitan areas like New York City, the heat-

absorbing materials such as concrete and glass are also "urban heat islands," which are hotter than rural surroundings. whereas Trees act as natural air conditioners that not only shade the people underneath but also cool the entire town. These trees also absorb water that evaporates in the heat, cooling the air temperatures around them. A little more Trees stuff... Trees have many other environmental advantages, such as air capture, rainwater and minimizing the contaminants that enter into the water, but Central Park's trees play a much greater function in preserving the landscape. Trees have many environmental benefits. Every year at the composition work in the park, the Mount, around 3,000 cubic meters of the leaves and 5,000 cubic meters of other tree wastes find a second life. In flowerbeds or ground, wooden chips become a fine mulch and the leaves become compost. Leaves are occasionally turned into 'compost tea,' which is used as a natural fertilizer in new plants in the park and flower gardens. Parks Have wildlife urban housing. There are few spots that New York City's wildlife community can call homes, among skyscrapers and apartment buildings, so Central Park is a welcome retreat! The Park comprises among its permanent resident's turtles, ducks, fish, scabbards and chip-mongering, and the park's landscapes and aquatic bodies are the subjects of more than 230 different bird species throughout the year. Central Park provides adequate space for resting and feeding on migration during spring and fall, also a significant stop for numerous birds (Jessica Sain-Baird, 2017).

2.3.1.4. Community and Park

(Make healthy people in healthy parks)it is a clear result. Access to open areas for physical activity leads to 25% more exercise 3 days a week or more (Wolch et al., 2014). This is fantastic news for the million New Yorkers living near Central Park. Within a 10 minutes walk from the park, over half a million people live and about 1.2 million more are in a half-hour bus or subway ride. Central Park offers New Yorkers a

range of possibilities to be involved with ball areas, basketball courts, handball courts, playgrounds, ice-skating rinks, boat rental, swimming pools, running paths, etc. Recently restored areas such as the North Woods and the Hallett Nature Sanctuary provide a chance for peace and loneliness in the heartbeat of New York City for those looking for relaxation. Sanitary urban parks are required. they are creating environmentally friendly and healthy landscapes for all New Yorkers. While dedicated personnel maintain the visitors' trees and habitats safe, they also provide volunteer opportunities and student internships to the next generation of stewards in the park. By taking sustainability into account and ensuring that Central Park gives New York City back to future generations (Jessica Sain-Baird, 2017).

Visitors: Central Park, with 35 million visitors annually, is the largest urban park visited in the United States, and one of the most popular tourist attractions in the world. There are far fewer tourists, with between eight and nine million visitors to Central Park, with between 37 and 38 million visits, as stated in a Central Park Conservancy study of 2011. In contrast, the number of tourists in 2009 was 25 million and in 1973 there were 12.3 million. As a proportion of total visitors, the number of tourists is much lower: in 2009, an estimated 1/5% of 25 million visitors to the park were tourists. The Conservancy study for 2011 showed a similar park use ratio: just 14% of visitors are for the first time visited by Central Park residents. Nearly two-thirds of visitors regularly come into the park at least once a week, with around 70% of visitors are living in new york. Also, summer weekends were peak visits, and most visitors used the Park instead of for physical sports for passive activities such as walking and sports. (Park & City, 2015).

2.3.1.5. The City and The Park Sustainability

- **Watercourses:** There are many bodies of water in Central Park. It is fed by two interlinked water elements, which was initially fuelled by a natural spring but then refilled by the water system of the city. And some of them is a man-made pond .It was intended to accommodate boats in the summer and ice-skaters in winter. in the side of recreation .also it is spout Utilities(Eugene Kinkead, 1990).
- **Electricity and gas:** are offered to all in Manhattan by Consolidated Edison. Con Edison's electricity company traces its history back to the first electric energy company, Thomas Edison's Edison Electric Illuminating Company. Con Edison operates the largest district steam system in the world consisting of steam pipes, consisting of 105 miles (169 km), which provide heating steam, hot water and air conditioning. When a new gas pipeline opened on 1 November 2013, Manhattan saw the natural gas supply supplied to the district increase by double.
- **West management:** Removal of garbage is the responsibility of New York City Sanitation. After the 2001 closed-out of Staten Island's Fresh Kills Landfill, the majority of the city's waste is eventually disposed of using megadumps in Pennsylvania, Virginia, South Carolina and Ohio (by transportation stations in New Jersey, Brooklyn and Queens). Often a small amount of garbage is burnt at waste-to-energy installations at transfer sites in New Jersey. New Jersey and much of Greater New York are dependent, on exporting their garbage into vast areas.
- **Transport:** The clean-air diesel-hybrid and compressed natural gas fleet in New York City are also operating in the country in Manhattan. There are also some of the first electric taxis, most of which work in the biodiversity of Manhattan (Public Transportation for the New York Region., 2018).

- **Public's involvement:** The preservation of parks, according to Robert L. Ryan, comes from a wide group of park participants. To demonstrate the economic development of the park is to demonstrate that the park has a net profit. The public's participation is vital for the success of park sustainability, particularly in an urban environment. Central Park has strong longevity with the number of volunteers, the number of donations and the huge population of visitors. Central Park's volunteers are the secret to seeing how the park is well maintained. Citizens' efforts to preserve, cultivate, and lobby for the park demonstrate their dedication to the park. Central Park offers several service opportunities and a variety of tasks to support anyone. anyone has an opportunity to contribute to the diffusion of biodiversity through plantation projects, to educate others by helping people to enter the park, and clean up all waste that the trash receptacles have lost. The park has raised more than \$600 million since the Central Park Conservancy was established in 1980. The combined efforts of volunteers and donations enable the park to operate and draw tourists.

Central Park is sustainable due to the cultural focus that started in the 1890s on public parks. Frederick Law Olmstead said that when talking about the urban park value, in an environment that promotes engagement with nature a park would have a greater appreciation. In other words, society must recognize its significance to better understand nature and must accustom its people to its value (Robert L. Ryan, 2011).

- **The health:** Central Park clearly shows signs of sustainable development. Sustainable development means that a park can tailor to the needs of the people while also balancing the maintenance and wellbeing of the park. Central Park is able to provide services for the people who visit the park without jeopardizing the park's appearance and general health. They monitor any possible sicknesses and fungi that

may be harmful to the biodiversity, as was mentioned by Ken Chaya. When the Conservancy took over Central Park, they made sustainability part of their agenda, as Peter Harnik deems essential to the excellence of a park. The plants and physical structures they put in place helped decrease the maintenance work for the future. The staff of the Central Park Conservancy can be seen working and walking throughout the day within the park. According to Harnik, this also adds to the public's feeling of safety within the park and reinforces their desires to interact with it (Robert L. Ryan, 2011).

2.3.1.6. The development of Park Strategy

The idea of developing and using the military place in this park can be summarized in the following points:

- The Arsenal; this 166-year-old structure was built for the New York State National Guard weapons storage facility. It is older than Central Park itself and represents New York's eternal ability to reimagine itself. Begun initially to store arms and ammunition of the New York State Militia in 1848, the Arsenal has proven itself a chameleon building in serving the City in a vast array of ways.
- The main idea was to end the military appearance in the area of the Arsenal building. So the strategy was to change the use of this building and all its facilities and surrounding it. This brick structure has redeveloped and reused as a police station, a museum, a weather bureau and a zoo. Today it offers a free treat to visitors with an ever-changing art gallery located on its third floor.
- The Park's Board of Commissioners quickly realized that militia drills involved large numbers of armed, marching through the landscape. . Introducing the animal element to consolidate the idea of a place supporting

biodiversity and qualify its design and use as a landscape of the population. where they started with a flock of sheep was introduced to heighten the pastoral feeling of the area.

- Remove all huts and randoms that were in the area, and setting the topography of the area and qualifying it for the development phase .
- Involve the community and organizations in the process of establishing this park .
- The local community and residents contributed to the completion and construction of the proposed park. and has become a focus of attention from all regions of the world.

"the Arsenal—holds a wealth of history both military and civilian." (*Arsenal Gallery : NYC Parks*, n.d.).

2.3.2. Tiergarten Park, Berlin, German

2.3.2.1. Background of Berlin City

Berlin is situated in the eastern part of Germany and its administrative boundaries extend over a region of more than 891.12 km². Berlin's population is estimated to have increased to 3,543,676 million inhabitants by 2012(Amt Für Statistik Berlin-Brandenburg, 2013). and the city's population is expected to increase by 254,000 over the next 20 years(Emily Lorange Rall et al., 2015). Over the previous 10 years, total Berlin urbanization increases in a residential area in 2000 (18.023 ha) and 2011 (21.044 ha) have been accompanied, whereas urban green areas in 2000 (9087 ha) or 2011 have risen to a smaller degree (9677 ha). Recent demographic estimates indicate that by 2030 a further 254,000 population would likely increase density in the centre of the city, as around 137,000 new flats will have to be built Public green areas and

forested areas currently cover over 44% of the urban area and make the region one of the world's largest green cities. Public green spaces include parks (>10 ha), private courtyards, settlements, cemeteries, leisure areas, sporting areas and road greenery.

In the past two decades, urban green space planning in Berlin has been optimistic. The greening and design of many brownfield regions like the park and the former railway region "Gleisdreieck" are examples of modern developments (Senatsverwaltung für Stadtentwicklung und Umwelt, 2013).



Figure 8: Aerial view of Berlin. © Wikipedia 2019

The old Berlin Wall is located in a large portion of the Green Network. At the same time, this green public area can be an integral part of the city's green network. Any of the projects carried out concerned the ecological potential of the region in particular, e.g. the southern area, where natural areas were left as urban wilderness (GISEKE, 2004).

The many tree-lined streets of Berlin transform it into a green city. Every kilometre of the city's streets is roughly 80 trees on average, bringing a total of roughly 431 000 trees. But trees are also a significant feature of the many open fields,

playgrounds, schools, cemeteries and semi-natural areas of Berlin's view and recreation. a big decreased trees in Berlin from around 411,000 in 1939 to around 161,000 by 1946 when its stock of street trees had been badly decimated by World War II. At the end of 1990 reunification, the city stocked some 370,000 street trees; currently, some 431,000 trees line the streets of Berlin, around 20,000 more than the total pre-War (*Data and Facts / State of Berlin*, 2019). While the city's planning tools are historically focused on federal legislation, informal visionary approaches and strategic strategies, including the City Climate Department, Biodiversity Strategy and Urban Landscape Strategy, are increasingly being developed. (E L Rall et al., 2012).

Today, for 2.2 million Berliners, the nearest green space is just 500m away from home and is easy to get to on foot. Farmland, forests, water and allotment gardens, parks and sports groves constitute almost 44% of the city's surface. The average number of trees in every kilometre of the city's roads is about 82, or about 440,000 in total. The objective of the "Street Trees for Berlin" initiative was to plan up to 10,000 new trees by the end of 2017, in addition to the 3,300 trees planted annually in Berlin (centre-sustaining urban space, 2019).



Figure 9: Green spaces in Berlin is 27% of the city area. © Here/Urban Mobility index/ Berlin 2018.

Berlin – a compact and green city, The building's layout in Berlin is rather varied. It covers whole areas, from the architectural wills of the 20th century to the examples of urban planning and architectural history during the time of rapid growth in Germany at the end of the 1900s. The administrative district's neighbourhood centres are the backbone of the city and its public transport system offers efficient links between districts. The multi-centred configuration makes Berlin a 'compact city,' which is close to residential areas with services and attractive social infrastructure. Wide-open areas transform Berlin into a green city (Colomb, 2012).



Figure 10: Tiergarten park location in the Berlin city. © Author based on Berlin map

2.3.2.2. History of The Park

“The 21st century is the century of the city and green spaces within cities. To a great extent, all the important issues facing us in the future, from demographic change to climate adaptation, can be answered through the appropriate treatment of public spaces. As the owners of these spaces, cities and neighbourhoods are responsible for implementing the Strategy for Berlin and achieving significant benefits for an attractive Berlin 2030 with realistic means.” Reiner Nagel, Board Director Federal Foundation of Baukultur (caenter-sustaining urban space, 2015,p45).



Figure 11: Tiergarten Park in 1939. © Marc Barbey/A.C. Byers/Hein Gorny/Collection Regard

Central Park is in New York and the famous Tiergarten Park is in Berlin. Tiergarten Park, like Central Park in New York or London Hyde Park, is a green lung for Berliner people. The 210 ha, some 519 acres – marginally higher than the Hyde-Park – are located near the city centre and border big sights like Brandenburg Gate or Potsdamer Platz.

In the centre of Berlin life, Tiergarten Park attracts many joggers, skaters, cyclists and walkers and others who want to simply unwind in the sun heat. The green lands of the park are popular with family picnics, ball games or simply relax and relax (*Tiergarten's Green Lung*, n.d.).



Figure 12: People of Berlin had cut down Tiergarten trees to use as firewood.

© Ray D'Addario/ 1945

In the late seventeenth century, Friedrich III, the Elector of Brandenburg and Duke of Prussia, turned the former royal hunting grounds just outside the city into a “park for the pleasure of the general population”. Tiergarten Park has since been rebuilt many times, most of them between 1833 and 1838. In this important renovation, the leading Prussian countryside gardener Peter Joseph Lenné was inspired by English models for the transformation of the site and the shape that the park still has. During the Second World War, Tiergarten Park was badly damaged particularly during the fierce war in the last year of the war.

However, in the aftermath of the war, it was still very suffering. In the winter of 1945/6, in the face of an acute shortage of coal, the Berliners slashed the trees of the park as fuel almost deforestation of the region. Tiergarten Park, with many trees from all over Germany, was replanted in 1949 thanks largely to numerous donations(*Berlin after 1945 - Berlin.De*, n.d.).

Following the war, Tiergarten was part and parcel of the West Berlin British Occupation. But the region underwent a sudden and violent transformation; most woodlands fell to firewood as a result of coal dearth, and, by order of British troops, the vacant fields had become temporary farms. Around 2,550 pieces of land for potato and vegetable cultivation were available at that time. However, the once large forest was almost ruined because of these two factors; of the over 200,000 trees that lined the park, only 700 remained, the water sources were silent, each bridge was destroyed, the monuments laid on their side and were badly destroyed. Plans were also made for the filling of rubbish from the war in the waterways but were prevented by the Director of the Environmental Planning Office, Reinhold Lingner, Berlin (*Tiergarten (Park)* - *Wikipedia*, n.d.).

2.3.2.3. Flora and Fauna

On the one hand, it is the climate-influencing feature of the internal ventilation and temperature equalization of the city and on the other, it is an urban sanctuary for wild plants and animals. The park is of special ecological importance. The Großer Tiergarten is an urban treasure chest of biodiversity," with some 1400 species, of which over 100 are on the red list of endangered species in Berlin". In the Tiergarten, the "nightingales tree" is still legendary. Old trees, in particular those before the Second World War, should be handled with special care (*Großer Tiergarten Berlin / State of Berlin*, n.d.).

2.3.2.4. Community and Park

The involvement of people in city greenery is characterized by permanent active persistent like Schöneberger Südgelände and Gleisdreieck conservation activism and recently housing prevention at Tempelhofer Feld, the former city airport. In the

forming of public spaces as intermittent users, including community gardens on brownfields, civic associations play an active role. The transformation of the former city airport BerlinTempelh stands as another example in which changes in land use have created green space(Kabisch & Haase, 2014). Many outdoor opportunities can be accessed by foot through a dense network of green areas and hallways. The green areas are multifunctional and are used for leisure and physical activity, promoting good health and improving the environment in the city. Berlin's healthy living is guaranteed. Another important aspect of the feeling of Berlin is the broad spectrum of culturally generated activities for all, which animate the neighbourhoods in Berlin. Berlin is a child and family-friendly town due to its diverse range of opportunities and the wide range of services it offers. The combination of these factors attracts the people of Berlin and their different neighbourhoods with their character and great living places (centre-sustaining urban space, 2015).

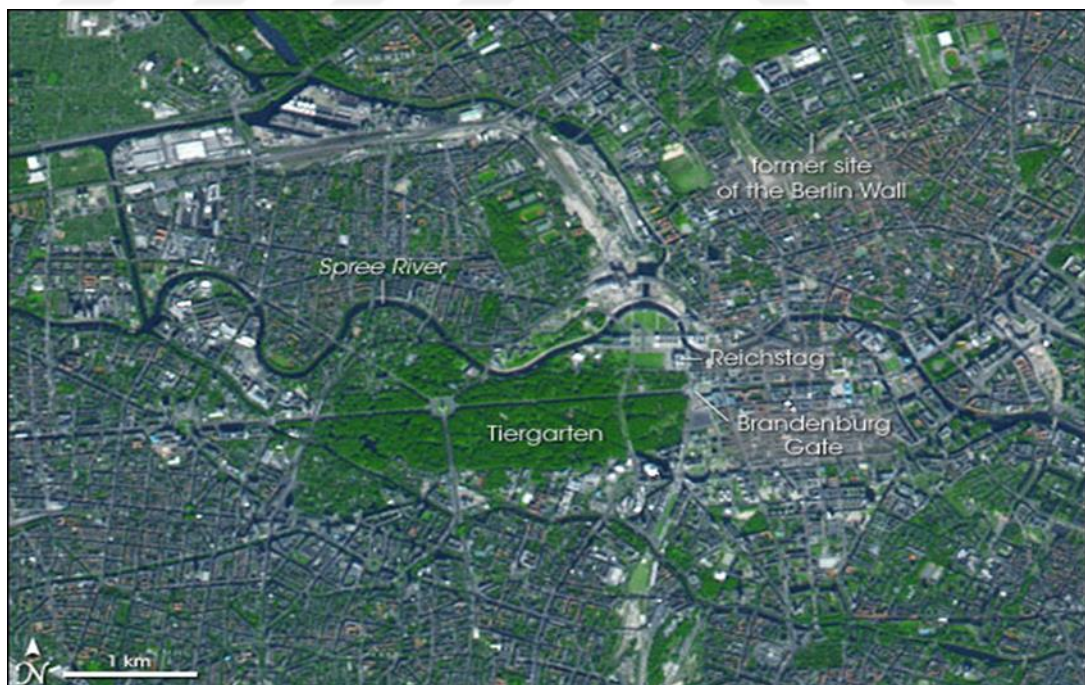


Figure 13: Tiergarten Park. ©eoimages.gsfc.nasa.gov

"Tiergarten" park is easily accessible by public transport. It is linked by the stations to local "S-Bahn" and "Metro" trains and regional and long-haul trains. Ideal for a cycling trip The "Grosser Tiergarten" park is easily reachable by bike because of its central urban position. There are spacious bike trails along the roads inside and at the edges of the park which are well connected to the nearby bicycle trails in Berlin. Besides, the trails inside the park can be driven carefully, always bearing in mind that footpaths are of utter importance! The key roads near the park can be easily reached by car and cross the parking space. Parking in nearby streets is restricted and parking charges should normally be charged (*Großer Tiergarten Berlin / State of Berlin*, n.d.).

The 'Tiergarten Berlin' park was always of utmost importance for Berliners' leisure, initially situated at the outskirts of the city, then later as the city expanded, in its middle. Apart from traditional walking, water sports, camping and peaceful nature exploration, all forms of recreation and sport are practised here today. Situated in the southwest corners of the park, near Potsdamer Platz there is space suitable for picnics, barbecues, jogging, cycling, and fields, such as football paddle-tasks. Often include In cold winters, ice skating on some of the park's small ponds is rarely possible in the Berlin zoo. Monuments to English Gardens (Soviet War Memorial). Berlin's Tiergarten Park has ancient streetlights both from gas and electricity worldwide. (*Großer Tiergarten Berlin / State of Berlin*, n.d.).

2.3.2.5. The City and The park Sustainability

- Careful urban development: Visual architectural characteristics are highlighted with creative and unconventional methods and high-quality architecture based on the types of buildings in Berlin, the city's past and its identity. The same goes for the inclusion of (traffic).

- Urban infrastructure: promoting high-quality internal growth About development, Berlin has decided to densify the current urban landscape employing the reuse and conversion of existing buildings, thereby allowing new urban qualities and identities to be created in a neighbourhood.
- Improve the urban entrances: The main entrances to the metropolitan region, arterial roads and areas around major rail stations, which take characteristic elements of the visual green landscape into account, are being updated to a high standard.
- Connects to and improves free spaces: the links between residential and open areas in the city are improved through suitable elements, especially an attractive greenway network. The main emphasis is placed on the 20 green main roads, which are built around the urban edge in the vicinity.
- Conservation and enhancement of ecological qualities: Various strategies and proposals to conserve natural resources have been drawn up, including soils, green environments, water, atmosphere and air. This would reduce the use of land and reduce emissions.
- Sustainable water resource management: the criteria for further growth are to minimize soil sealing. With creative solutions, water supply, land and rainwater management are continuously improved (centre-sustaining urban space, 2015).

2.3.2.6. The Development of Park Strategy

- Attention to highlighting and preserving the historical and heritage value of the city. Where the Tiergarten Park offers many fascinating monuments, as well as cultural and political sights, and not just winding tree-lined trails and open green areas. as (The Soviet War Memorial, Brandenburg Gate, the Haus der

Kulturen der Welt arts and exhibition centre, The Federal President's office adjacent to the Palais Bellevue, the President of Germany's official residence,).

- Protect and Improving the type of general voids. Since 1991, the "Großer Tiergarten Berlin" park has been protected as a historical landmark based on its outstanding historical and artistic importance. Park preservation work exists in the form of long-term instructions for all maintenance, preservation and on-site development measures. that as a sustainable strategy to saving for the future.



Figure14 :Areal view ot Tiergarten park. ©mytravels.biz/2017

- Leaving the spaces empty and invest them environmentally. After the end of World War II, the local government executed the plan to restore the Tiergarten, so a large number of young trees were brought in from all over Germany to

plant. Tiergarten was again decorated with new pathways, new plants, trees and bushes, and the alteration process continued even after the fall of the Berlin Wall. New buildings were added around the park like the Congress Hall and the German Chancellery office.(*Großer Tiergarten Berlin / State of Berlin*, n.d.).

- Participation of the local population in the reconstruction and development. The community contributed to developing the park, so they planted trees brought from all German cities, as a message to the cohesion of the community, and many teams of volunteers contributed to maintaining it.

2.4.1. Comparison Matrix

These examples could be followed in such a way as to create sustainable and ecological open public spaces and places within the cities.

The following matrix emphasizes this idea:

Table 2: Greenspace and Park's Examples Matrix. © Author

Criteria	Green Space and Parks Examples	
Park View		
Place	Manhattan, new york, USA	Berlin, Germany
Park name	Central park	Tiergarten Park
City area	Km ² 59.13	Km ² 891.12
Population	1.628,706	3.543,676
Green space in the city	27 %	44 %
Park Area	3.41km ² / 341 he	2.10km ² / 210 he

Visitors	25 Million annually	18 Million annually
Ease Access	• 0.5million/10min walking. • 1.2million/30min by bus or metro.	Ease access
Natural sources	• Hills • Nature reserve • natural lake	• Rivers • natural lake • valleys
Trees and plants	• 20000 Threes • Lawns • Single trees • Shrubs	• Lawns • Meadows • Groups of trees • Shrubs
Flora and Fauna	• Zoo/wildlife • Aquarium • Leaks	• Zoo • Rivers • leak
Urban landscape	• Waking area • Bicycle lines • Horse and Carriage Rides lines • Cars lines • Boathouse • Garden • Pool & Rink • Theatre	• Waking area • Bicycle lines • Horse and Carriage Rides lines • Cars lines • Boathouse • Garden • Theatre
Sustainable system	• Composting • Power generation-district steam system • Waste management • water system	• Careful development of the urban environment. • Infrastructures in the urban context. • Enhancing the gateways to the city. • Connecting and enhancing free spaces. • Safeguarding and improving ecological qualities. • Sustainable water supply management.
Street furniture	• Sets • Kiosks • wastebaskets • Leed light • Fountains • Bridges • Bollards	• Bollards • Kiosks • Wastebaskets • gaslight • Fountains • Bridges • Sets • Signs

Historical factories	• Castel • Statues • Paranoiac obelisk monuments and plaques • Museum	• Statues • Museum • Political centre • Memorial • monuments and plaques
Recreation	• Playground • Fountains • Bicycling and greenways • Ice skating • Fishing • Horse riding • Yoga curt • Rowing canoes • Tennis Center	• family picnics • ball games • simply unwinding • Ice skating • Playground • Bicycling and greenways
Social and physiological Values	• Sleeping zone • Barbecue zone • Policy station • Carnivals • Walking tours • Clinging grubs • Wedding party	• Sleeping zone • Barbecue zone • Policy station • Carnivals • Walking tours • Clinging grubs • Wedding party
	-	-

2.4.2. Evaluation of The Matrix

By presenting and shedding light on the most important design criteria on which these examples are based, which strongly touch the most prominent pillars of sustainability, namely society, the environment, and the economy. And she succeeded. We mention some of the points that we want to focus on when building the Libyan experience, which the researcher will present in the fourth chapter of this thesis.

Economically

- The gardens of Central Park Manhattan New York, Tiergarten Berlin, had a great impact on the surrounding area, as the price of surrounding lands and real estate increased upon completion of their implementation, and the buildings adjacent to Central Park became owned by the wealthy and their prices increased by 700%, and in Trigarten Park it became a place for foreign

embassies and houses of diplomats as well as Presidential headquarters. As it positively affected the quality of ages and the building around them.

- Providing various job opportunities, including farmers, maintenance staff, cleaning workers, security points...
- New York City and Berlin received millions of dollars in revenue from visitor spending inside the parks and taxes for filming serials inside them.

Socially and Culturally

- These parks are the first destination for residents of the two cities, as they contain all recreational and sports activities for all segments of society.
- It is the perfect place for picnics, barbecues and relaxation from the hustle and bustle of the city, with the irony of being located in the city centre.
- Excellent venue for parties, festivals, theatre performances and weddings. That is, it is a place for people to meet and consolidate relationships.
- The inclusion of citizens and residents in volunteer campaigns for planting trees, pruning and cleaning the garden, is one of the strongest messages that support and instil a sense of responsibility in the individual towards his city.
- The presence of memorials and statues is the biggest sign of support for culture in the city.
- Museums and public correspondence also support art and culture.
- Preserve the historical value of the place as memorials were placed to the history of the place, even if it bore some kind of pain, but on the other hand, it sent a message of peace as New York suffered from the civil war. Berlin suffered from the world war. But now they are among the most successful cities

Environmentally

- The biodiversity found in the two parks is very excellent, as there is a wildlife area, zoo, fish ponds, artificial and natural ponds, and a diversity of aquatic and amphibious life. Also, the two places are the favourite place for migratory birds.
- The percentage of afforestation in the two gardens is excellent. And also the way to design a landscape.
- The natural features of the place were preserved from plateaus, riverbeds and natural pools.
- Contributed to the positive impact on the climate of the two cities.
- The water management method in the two parks is similar and effective, as it relied on rain and greywater. And preserve the natural resource of groundwater.

III. ENVIRONMENTAL ANALYSIS OF CASE STUDY (TRIPOLI CITY- LIBYA)

All information was collected that would build parks on the foundations of environmental sustainability. These theories were supported by the existing universal examples, that have mentioned in Chapter Two.

In this chapter, the study case area will be defined, starting with the country and city review. A detailed analysis will be made for them, in terms of the topography of the land and the resources upon which the establishment of an ecological and sustainable landscape, such as water resources, land use condition, classification of the soil in terms of its suitability for agriculture, the status of agriculture and forests in the country and evaluate it. Also, present Tripoli environment hazards evaluation that could have a strong impact facing the provision of creating a sustainable and ecological landscape, as part one of this chapter. it mainly affects the research problem that will be presented in Chapter Four, and then the solution proposal that will be presented by the researcher in Chapter Five.

3.1. OVERVIEW OF LIBYA

3.1.1. Libya as a State

Libya is an African republic. on the coast of the Mediterranean Sea with one water-based boundary. It is enclosed in six other African countries, on the West edge of Libya sit the countries of Tunisia and Algeria. South of Libya, the Niger and Chad borders. In the east, on the other side of Libya's eastern frontier both Egypt and Sudan. " Libya's GPS coordinates are made up of a latitude of 26° 20' 4.96" N and a longitude

of 17° 16' 9.16" E. The GPS coordinates place Libya above the equator". Libya is also within the northern and eastern hemispheres(*Where Is Libya in the World?* n.d.).

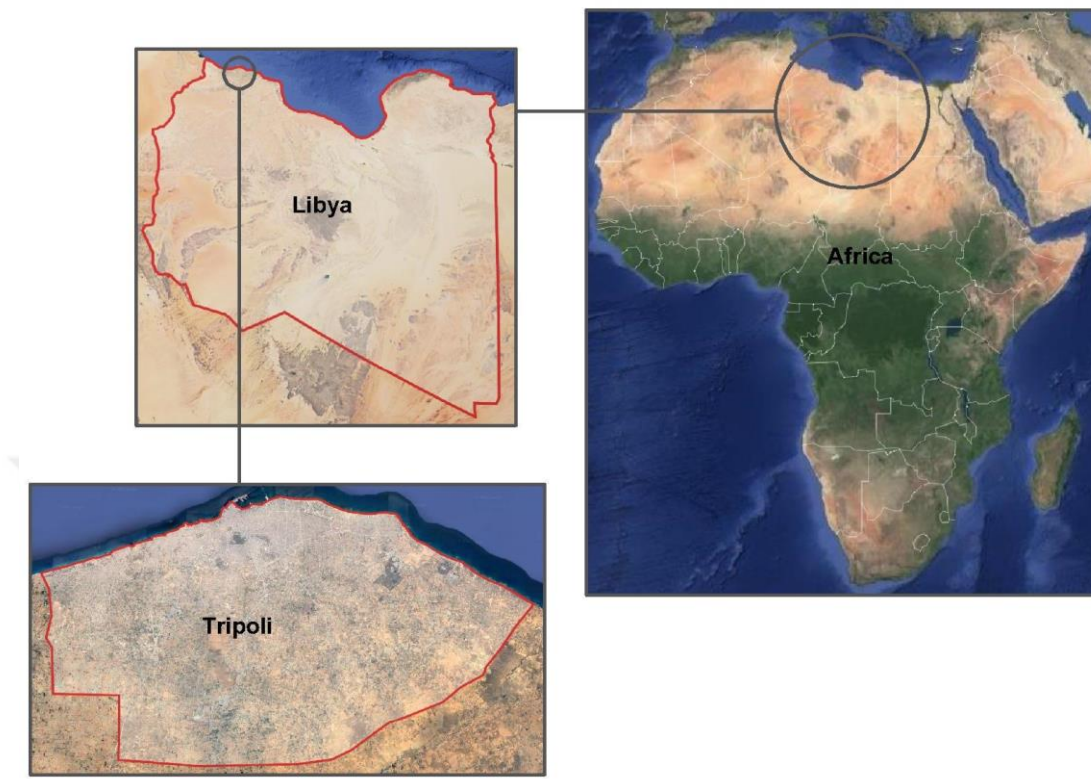


Figure 15: Libya and Tripoli Location from The World. © Author/ Google Earth

3.1.2. Demographics of Libya (Total Size and Population Density of Libya)

Libya is a calculated area as the fourth largest country in Africa and 16th largest country in the world, covering approximately 1, 67 million square kilometres. Libya has the world's 10th largest proven petroleum reserves. Libya's biggest city In western Libya, Tripoli is the capital with more than three million of the seven million inhabitants of Libya, all land regions. Libya has no big water bodies within its borders(*Libya's Geography*, n.d.). As the 108th most populated place of all countries and dependent nations in the world, Libya has a population density of about ten people per square mile of land.

Libya is a big nation with a limited population and a very narrow population on the coast. The population density of the two northern regions of Tripolitania and Cyrenaica is around 50 people per square kilometre but falls to less than 1 person per square kilometre (2.6 per square kilometre) elsewhere. 90% of the population lives in less than 10% of the area, mainly along the coastline. Around 88% of the people are urban and mostly in Tripoli, Benghazi, Sabah, Misrata, and the four largest towns (United Nations, 2019). There are around 6.7 million people in Libya, of which 27.7% are under 15 years of age. The population of Libya is projected to grow by 8 million by 2030.

Table 3: Libyan Population per Planning Region. © Libyan Urban planning Authority UPA¹/2006.

Planning Region	2000	2006	2020	2030
Tripoli	3,165,000	3,283,000	4,157,000	4,777,000
Benghazi	1,247,000	1,299,000	1,645,000	1,890,000
Kalij	381,000	383,000	485,000	614,000
Fezzan	333,000	359,000	455,000	576,000
TOTAL	5,126,000	5,324,000	6,742,000	7,857,000

¹ UPA aggregation based on data from The National Authority for information and documentation, including Census 2006 data, and the following assumption: population growth rate 2006-2020: 1.7% per annum and 1.4% per annum for the period 2020-2030. The equal growth rate for all-region. non- Libyan population excluded.

"Libya's native population of Arabs-Berbers, as well as, Arab migrants of various nationalities collectively make up 97% of the population as of 2014. As of 2013, the Estimates that around 12% of Libya's population (upwards of 740,000 people) was made up of foreign migrants. Before the 2011 revolution, official and unofficial figures of migrant labour range, from 25% to 40% of the population, that mean (between 1.5 and 2.4 million people). Historically, Libya has been a host state for millions of low- and high-skilled Egyptian migrants, in particular" (Libyan Urban Planning Authority, Demographics, 2006).

3.1.3. Environment Condition Evaluation of Libya

In the last few years, the need to incorporate environmental considerations in national economic and spatial development plans as the main long-term criteria and also in sector development strategies and investment programmers has become increasingly apparent.

Libyan environment is adversely affected by such regional and global phenomena's as climatic change, desertification and degrading of natural ecosystems, as well as by local developments such as contamination and salinization soils and groundwater resources, continuing depletion of groundwater resources, land contamination, air pollution in and around cities, the depletion of rain-fed farmland due to urban interference, Coastal water contamination, and so on .Effective measures need to be taken to reduce and prevent these adverse environmental impacts. Environmental health is an important issue for settlement planning and upgrading of the existing housing stock. It is the urban poor in particular that are most vulnerable to environmental dangers. The combination of a variety of unfavourable factors like overcrowding, air pollution, noise, dust, insufficient sanitation, problems with clean

drinking water and inadequate waste disposal leads to unhealthy conditions that are conducive to some diseases. affect humanity and the culture in particular.

Enhanced environmental health is vital to clean drinking water provision, sanitation, collection of waste, adequate waste management and air pollution control and the provision of open green public space. It is an important issue that needs urgent attention(Libyan Urban Planning Authority, Environment, 2006).

3.1.3.1. Land Conditions

Libya occupies a central position in the North African Region. The country's 1,820 km coastline provides convenient maritime contact with the rest of the world. Through the recorded history of Libya, its geographical position has always given it certain importance. The location of Libya on the southern coast of the Mediterranean Sea has had a great effect upon the ethnography, history, economy and politics of the country. It was reflected also in the physical development of the country, which is visible till now in the location of settlements, harbours and transit routes. These two areas Tripoli and Benghazi regions were settled and intensively cultivated in ancient times due to the favourable natural conditions in the rain-fed coastal plains. At that time settlement networks and agricultural lands, supplied by local irrigation systems, were created on these two coastal plains and then considerably extended.

Libya has varying climatic and environmental conditions. These conditions have influenced, to a high degree, the physical development and spatial distribution of human activities. Natural environmental factors have eliminated the possibility of development in large, mainly southern areas of the country. Desert conditions, water restraints and climatic circumstances have created effective barriers to the spatial expansion of human activities. Population and cultivated lands are limited to a relatively small percentage of the national territory although some drylands are now

being transformed into productive and inhabited areas with the support of the Great Man-Made River water resources. The overall land area of Libya is 1,67 million km² but almost 95% of this area has to be considered on the macro scale as difficult to develop. The general classification of the country's present land use is depicted in Table(Libyan Urban Planning Authority, 2006,p22).

Table 4: General Libyan Land use in 2006. © Libyan Urban planning Authority UPA/2006.

General Land Use	Area (km²)	Per cent of total national land
Urban (Including mixed urban area)	3,888	0.23
Agriculture/irrigated and rain-fed	17,900	1.07
Pasture Land and grassland	70,000	4.18
Forest & woodlands	5,000	0.30
Waste land / mainly desert	1,577,789	94.2
Grand Total	1,674,577	100.0

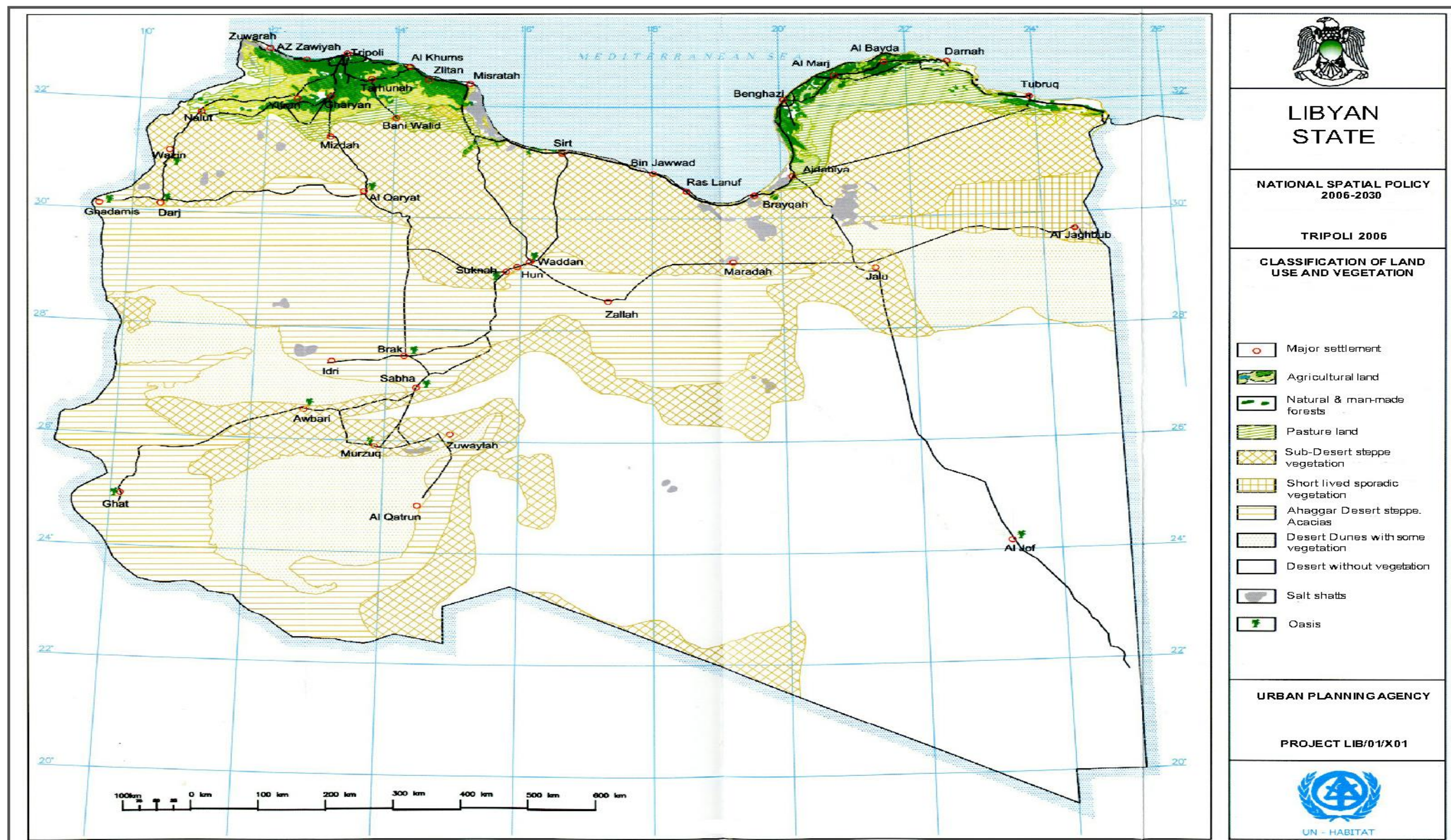


Figure 16: Classification of Libyan land use and vegetation. © Libyan Urban planning Authority UPA/2006

The most favourable living conditions in Libya are found in the rain-fed coastal zones of the Tripoli and Benghazi regions which enjoy more than 250 mm of annual rainfall and which regions account for most of the national population. Over vast areas in the south, conditions are harsh and arid with little annual precipitation rarely exceeding 50 mm. Most of these areas consist of desert land with a few oases and valleys. Over 40% of the whole country's area is desert without any sign of natural vegetation. Another 40%+ is desert with only very limited vegetation and a further 10% is steppe or semi-steppe land. Most of these areas are - because of their barrenness and remoteness - unsuitable for development except where there are oases and valleys. Extensive underground water resources of good quality are to be found in the central and southern desert zones .

One of the main problems that Libya faces in its development is the distant dispersal of settled areas. This factor creates serious economic and functional limitations of development at the national level. The separation of several already settled and cultivated lands by deserts has reduced in the past the functional integration of the country. The uneven distribution of population and economic activities, with concentration being mostly in the Tripoli and Benghazi metropolitan zones, has created also certain physical, social and economic problems (Libyan Urban Planning Authority, 2006,p23).

3.1.3.2. Soils

Due to the large area extent of the Libyan lands, several types and classifications were found when conducting a comprehensive survey of the Libyan lands in 2000. This study gave a comprehensive and accurate description of all types of soil that

were found. We are interested in describing the western region of the country in which the Thesis study area is located, and concentrated.

The North West and Coastal Belt zone consists mainly of soils from aerosols of alluvial origin, often deep at the base of hills or over the valley deltas but more shallow and salty over the mountain areas. The soils have a reasonable potential for cultivation provided that there is adequate water and that sufficient nutrients are provided. Infertile areas exist in some places in the immediate coastal strip due to shifting dunes and saline sabkhats but there are many areas where the horizontal expansion of agriculture is possible if other necessary resources were available at an economic cost (Libyan Urban Planning Authority, 2006, p25).

3.1.3.3. Agriculture and Forest.

Libya is a desert country as only 2.5% of its territory or 43,120 km receives an annual rainfall of 150 mm or more. Only one-quarter of this area receives rainfall of 300 mm or more. However, most of this rainfall area is not suitable for agriculture because much of the land is mountainous, non-productive, or urban land .

Agricultural lands, which are good for rain-fed cultivation, total only 1,181,800 hectares, or 0.71% of the national territory. The rain-fed agricultural lands are located in the north-eastern and north-western parts of Libya where Tripoli is located .where rainfall reaches annually 200 mm or more. Annual rainfall of 200 mm represents the minimum required for grain cultivation. Soils of Tripoli are good for cultivation and range from loamy sand to sandy loam. These coastal agricultural lands suffer from groundwater shortage due to continuing overexploitation. The area is also reduced by desertification and urban encroachment. To protect the agricultural

land from desertification and drought .depending on the groundwater wells in that region and the (GMMR), this causes a large depletion of the groundwater reserves in the future.

Pasture lands are confined to the area where the annual rainfall is between 50 and 200 mm i.e. in a narrow strip along the coast to the south of the rain-fed areas. These lands are considered too risky for rain-fed cultivation due to the irregularity of precipitation and the poor quality of the soils. Also, the cultivation of these lands is considered to be one of the main causes of desertification. also, the Evaporation of irrigation water is extremely high most of the year, implying that expansion of cultivation lands greatly increases consumption of very limited, non-renewable groundwater resources(Libyan Urban Planning Authority, 2006,p 40).

3.2. TRIPOLI CITY

3.2.1. Background of Tripoli

Tripoli is the largest and most important city in Libya. According to the 2018 census, its population is about 3,283,000 individuals, including the areas of Tajura and Janzur, al Qaser, al Swani, Einzara .which are a part of the great Tripoli within the area 3770 km². The area contains settlements having local, regional and national importance and serving the urban functions(Libyan Urban Planning Authority, 2009,p13).

Tripoli city is the primate city at the Libyan national level. It performs the administrative functions of the national capital and is classified as multi-functional since it represents the political capital of the state and the economic, industrial and service capital that communicates with the outside world and its historical tourist

attractions. as well as being the commercial capital. It is also the largest settlement in Libya and expected to serve the population in the education and health sectors. This being a historic city, it is famous around the world for its cultural heritage. Beautiful beaches near the city add to the recreational assets of the region. It all points to the need for strong linkages with the immediate surroundings, within the region, with Libya as a whole and the outside world(Libyan Urban Planning Authority, 2009,p14).

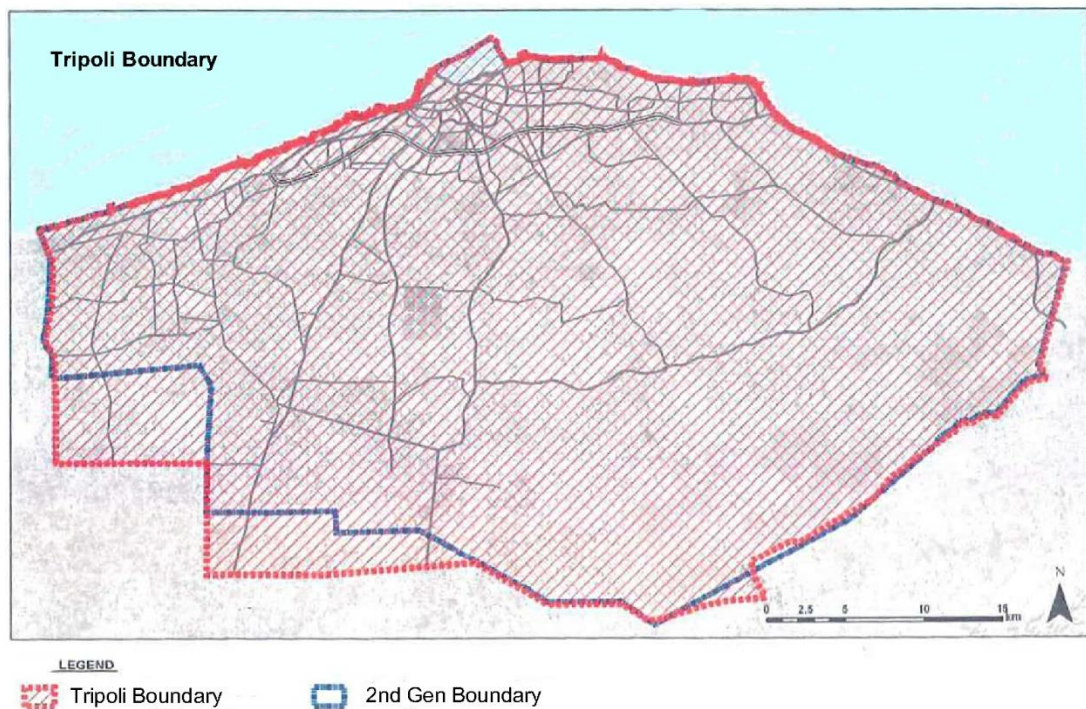


Figure 17: Tripoli City Boundary. © Libyan Urban planning Authority UPA, Tripoli Agglomeration plan / 2009

Tripoli is undergoing urbanization the transformation of land to urban use has been doubled in 20 years since 1976 and the process is still ongoing. The past growth trend around Tripoli city has been analyzed and the results are:

- Urbanization is increasing at the cost of vegetation areas and plantation areas. The growth from 1976 to 1989 was fast compared to the growth from 1989 to 2001.
- Urbanization was visible and was spreading all over. Urban expansion has been progressing mainly towards the south, south-west and south-east sides of the 2nd GPP areas of Tripoli, Janzur and Tajura. (2nd GMP, Second Generation Planning Project is a governmental program was aimed to develop Tripoli city, yare 1980 - 2000).
- The growth is more towards the airport, Binghashir, As Sawani, the area to the south of Janzur, densification around Tajura and sprawl towards the south of Ayn Zarah and along Wadi Ar Rabie
- There is slow urban development towards the south-east and more
- With the availability of water for irrigation, the agricultural areas are growing and the forest cover is decreasing(Libyan Urban Planning Authority, 2009, p19).

3.2.2. Topography and Landscape

The Greater Tripoli Plan area is situated in the northwestern part of the Libyan Plain. The terrain in the area of Tripoli is slightly undulated. The elevation of the southernmost part of the city is about 20 m above mean sea level and is descending towards the sea. Small hills parallel to the coastline. Towards the inland, the

landscape remains relatively flat with an increase in altitude to around 100 m above sea level at the most. The Al Majinin valley is coming from the Nafusa mountain crossing through the city and has an outlet in the western part of the city centre (Libyan Urban Planning Authority, 2009, p39).

3.2.3. Climate

Tripoli is influenced by the Semi Mediterranean climate characterized by relatively high rainfalls. The temperature is generally warmer towards the inland during summer but milder towards the coast during winter. Humidity is less further from the coast. The mean yearly temperature is around +21 °C.

Table 5: Climatic Data from Meteorological Stations within Tripoli City between the year 2000 – 2010. © Libayn Meteorological Department, Climatological section.

place	Mean monthly temperature Aug (C ⁰)	Mean monthly temperature Jan (C ⁰)	Annual mean temperature (C ⁰)	Average rainfall (mm)	Humidity (%)
Tripoli	+28	+12	+21	250-350	65-75

The warmest month is August with an average temperature of around + 28°C. The coldest month is January with an average temperature of around +12. In extreme cases, the temperature can drop down to around 0°C or just above while on a hot summer day the temperature may rise to more than + 45°C. Annual mean Air Humidity stretches between 65 and 75% with only minor changes during the year. In

summer mild northeasterly winds prevail, while southwesterly winds dominate in winter and spring. Hot southern Ghibli winds sometimes bring masses of fine dust particles during the summer (Libyan Meteorological Department, 2000).

3.2.4. Tripoli Land Use Pattern (LUP)

In common terminology, roads are not considered "land uses" as such. It is the land between the roads, which depending on the road system, neighbourhood land use, size, geometric form, buildings, functions and the social life related to each block - and the relationship between these. Much of the city centre has been developed according to the plan of 3rd GPP Sup Regional Report works in 2009. A few major areas outside the city centre have also been implemented according to plan. The main feature that has been implemented according to plan is the road network, particularly the urban expressways (the Ring Roads). It is possible that the informal processes, whether among private or public landowners, have been a result of the needs and interests of the individual owner. There has been a great need for housing, which has resulted in large areas that have been developed for this purpose, also have much lower densities than planned. Different institutions have not implemented the land use according to plan, and this may be due to an internal assessment of needs.

Generally one can see three belts of different types of land use outside the urban city First, an area of mixed urban development stretches along the coast and forms a 5-kilometre belt. There are also a few clusters of mixed urban development located in other parts of the Agglomeration area the second belt consists of a 10-15 kilometre area of sprawling agricultural residential belt, except for the eastern coastal area.

Agricultural residential areas also appear along major roads and functional areas such as the airport and industrial areas, The outmost belt consists of agricultural development interspersed with green and barren areas. It is important to develop regulation tools to prevent the agricultural areas from turning into sprawl if Libya is to have a more self-sufficient domestic agricultural market. Conservation of the green areas is also vital to preserving the few natural areas that are left for future generations(Land Use Pattern Libyan Urban Planning Authority, 2009, p. 100).

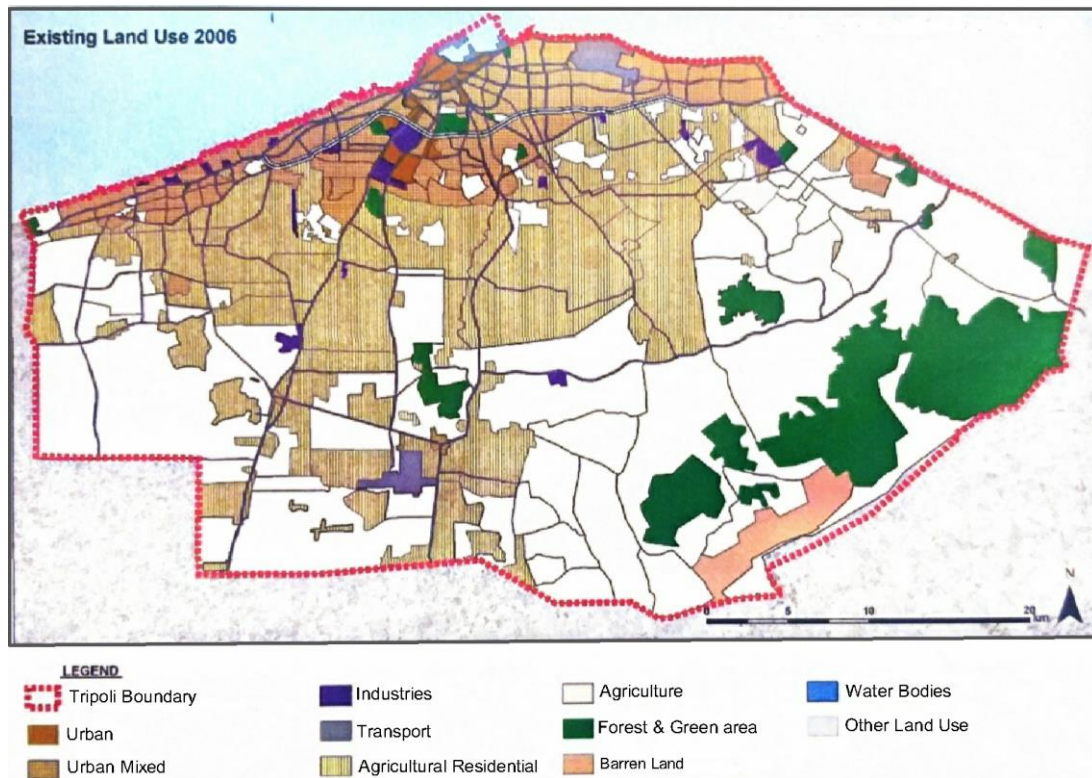


Figure 18: Tripoli Land Use in 2006. © Libyan Urban planning Authority UPA, Tripoli Agglomeration plan / 2009

Several of the rural clusters in the 2nd Generation Master Plan have sprawled into large areas of agricultural residential areas. This has been possible due to the

lack of enforcement of regulations to conserve areas and the rapid growth of inexpensive automotive transportation. Parts of the proposed second green belt and wooded areas have also been taken over by agriculture and sprawling development. In the eastern part of Tripoli, areas have been kept largely intact.

The Tripoli area has been divided into four general groups: The city centre and three generalized belts of development that contain different types of land use. To examine the land supply, the whole city area has been simplified into three main categories, which correspond to different land-use patterns :

- The 2nd GPP, Generation Planning project area.
- The part of the second belt remains on the Master Plan area of the 3rd GPP Generation Planning project.
- The third outer belt. The belts of development are shown in

Figure

Within the 2nd GPP the total amount of vacant land is calculated, and in the second and third belts, the undeveloped land is counted to establish the total amount of open space within the Agglomeration area. The average undeveloped land in the different areas is calculated on an average to establish the general amount of open space.

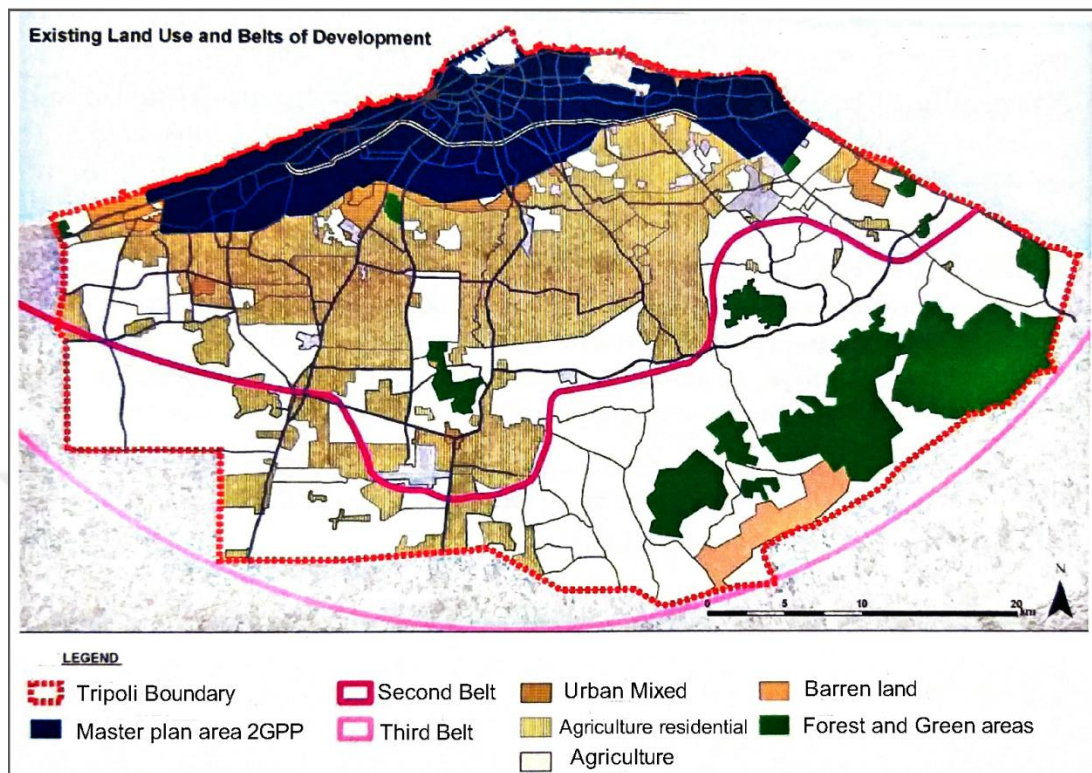


Figure 19: Tripoli Land Use Pattern and The Three Areas of Examination. © Libyan Urban planning Authority UPA, Tripoli Agglomeration plan / 2009

1. **The Master Plan area** in the 2 Generation Planning Project contains the city centre, the first, and part of the second, a belt of development. The vacant land is comprised of vacant lots of land that could potentially be developed and does not include roads, parking lots, parks, gardens etc .
2. **The second belt** contains mainly agricultural residential development with a few agricultural and mixed-urban areas interspersed.
 - **Mixed-urban:** The undeveloped land in mixed urban development within the second belt consists mostly of maintained planted areas and occasional spaces between groups of buildings.

There is a high cost in developing these areas, as they are essential parts of the urban structure.

- **Agricultural-residential:** The undeveloped land within this land use category is mainly cut off from the major roads by buildings. It appears in small to large patches between the houses and consists mainly of farmland. The soil type is generally suitable for agriculture.
- **Agriculture:** The un-built upland is made up almost exclusively of farmland and is generally connected and consists of larger interlocked parcels. Farmland, in general, is very valuable in Libya, and preserved open areas close to the city centre are even more valuable.
- **Forest and Green areas:** These areas consist almost exclusively of forests and adjacent undeveloped areas. A few farms can be found throughout. These are generally very valuable pieces of land, as they provide the residents of Tripoli with public recreational areas and they preserve a higher level of biodiversity. The land is generally not suitable for agriculture.

3. **The third belt** contains mainly agricultural and open lands.

- **Agricultural-residential:** Clusters of houses are surrounded by small and larger patches of connected open areas, which consist mostly of farmland. The open areas are cut off from the major roads by the buildings, but they are more continuous and connected

to each other than within the second belt. The land is generally suitable for agriculture.

- **Agriculture:** The undeveloped land parcels in the third belt's agricultural areas are continuous and connected with one another. Small clusters and detached buildings form islands within the agricultural landscape. Farmland is in general very valuable in Libya, and preserved open areas this close to the city centre are even more valuable. The land is generally suitable for agriculture and grazing.
- **Forest and Green areas:** These areas consist of almost exclusively forests and adjacent open areas. A few farms can be found throughout. These areas preserve a higher level of biodiversity. The land is generally either suitable for grazing or not suitable for agriculture at all (Land Supply Libyan Urban Planning Authority, 2009, pp. 106–107).

Table 6: Land Availability in Tripoli City. © Libyan Urban planning Authority UPA, Tripoli Agglomeration plan / 2009

Area	Vacant/Undeveloped Land of Agglomeration	
	Percentage	Approximate Hectares
2GPP Master Plan Area	1	1,300
Second Belt	21	33,100
Third Belt	38	60,400
Total	60	94,800

As shown, there is almost 1000 km² of undeveloped land. These constitute around 60% of the total Tripoli area. Depending on whether the undeveloped land is located in the second or third belt, and depending on what land use category it is located in, there are varying costs and issues for developing this land in the future. Agricultural residential areas are mainly dominant in agriculture but also seen with residential units built in it. These areas are of high density with scattered development in nature. The haphazard physical development makes the extension of infrastructure to these areas necessarily, and needs to create open areas and redevelopment areas, then at least the agricultural residential areas with more buildings can be used for physical development. Careful analysis is needed before taking these areas for physical development, as agricultural land is very precious in Libya.

Tripoli, Janzur and Tajura Planned Area consist mainly of existing urban areas. However large areas are still vacant or not built up. The Southern Development Zone is characterized mainly by unplanned urban sprawl. It contains mainly low-density urban areas mixed with agriculture, and the plan also recommends the densifying area for residential use, supplied with necessary social and commercial services and with technical infrastructure. The first Tripoli Green Belt functions as a buffer zone for minimizing the future urban sprawl. The inner boundary for the Green Belt is the maximum limit for future urban development during the plan period. Within the Green Belt new development should be strictly prohibited, except complementary buildings in already developed areas.

3.2.5. Geology and Soil.

The main fertile land in Tripoli is covered by the Pleistocene formation which is formed of silt, sand and conglomerate with occasional caliche (calcareous) crust. The Jifarah formation covers all the coastal area (5-12 km wide), the fertile agricultural area south of Tripoli and the banks along the major wadis. Dunes of mainly transverse and longitudinal type are scattered all over the plain. They reach their maximum concentration south and southeast of Tripoli from Wadi Al Majinin in the west to Wadi Turghut in the east.

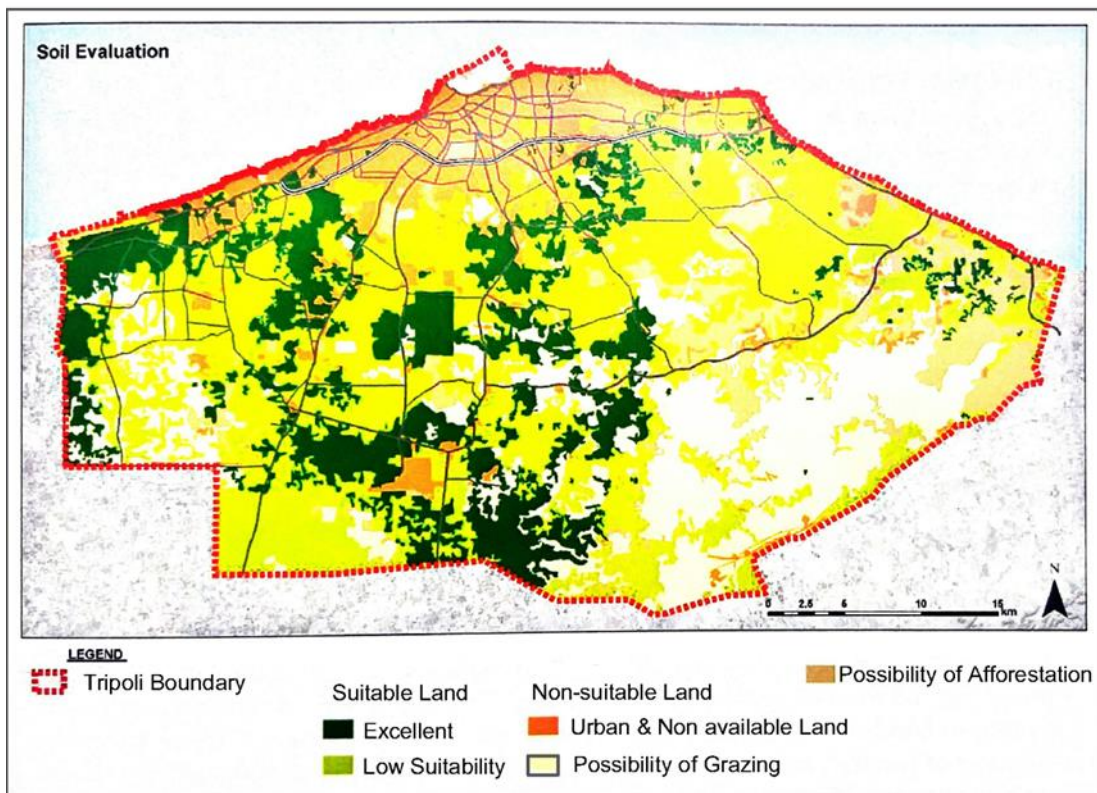


Figure 20: Suitability for Agriculture within Tripoli City. © General Authority for Agriculture and Assessments / Libyan National Policy 2006-2030.

Due to rich soils in many areas and sufficient amounts of rain, the Tripoli Agglomeration is to a large extent covered with land possible to cultivate. As many as 110 000 hectares are considered being agricultural land according to surveys made by the Project of Mapping of Natural Resources for Agricultural Use and Planning in 2005. About 18% of the Agglomeration area is classed as excellent for agriculture. Land non-suitable for agriculture may instead be used for grazing or reforestation (Geology and Soil Libyan Urban Planning Authority, 2009, p. 40).

Table 7: Agriculture Suitability of Tripoli Land. © General Authority for Agriculture and Assessments / Libyan National Policy 2006-2030.

Suitability classes	Brief description	Limiting factors	Area in hectares	Per cent of agglomeration area
Excellent	Suitable for most irrigated crops known in the region.	None	28910	18
Low	Suitable for barley cultivation under rainfed conditions with protection against erosion and application of good management scheme.	Wind and water erosion and sometimes sandy soils.	61370	38

Non-suitable	Suitable for grazing with a good management scheme.	Scarce water resources.	31850	20
Non-suitable	Not suitable for either crop cultivation or grazing, but can be used for afforestation if rainfall exceeds 200mm/year	Sandy texture, wind erosion, absence of vegetation.	15810	10
Non-available	Not possible of any agricultural activity.	Urban areas, rock outcrops.	20950	14

3.2.6. Vegetation and Agriculture

The vegetation of the Tripoli Agglomeration Area is characterized by closeness to the Mediterranean Sea and the fertile soils. Population growth leads to increased competition for space and natural resources. Many ecosystems have been transformed into urban or industrial land, which reduces biodiversity, The Coastal Zone is to a large extent urbanized but areas covered with Mediterranean Coastal belt vegetation can be found. Typical species are *Mathiola* *Panacratum*, *Adonis* *Euphorbia* and plants of *Alzacrae* and *Chenopodiaceae* families. South of Tripoli city, the Jifarah Plain starts. Within the Tripoli Agglomeration Area, the character is generally agricultural with olive and citrus trees covering a major part. Some less

fertile areas are covered with natural vegetation of a Sub-Mediterranean steppe type such as different shrubs and *Asphatelas* (Libyan Urban Planning Authority, 2009, p. 42 Land cover and Biodiversity).

Agriculture was the predominant economic sector before oil exploration started. Due to the continuous urban growth, though the agricultural land in Tripoli urban area has been converted to various types of physical development, the studies reveal that the Agricultural land and practice in Tripoli city is increasing. The agricultural land in 1980 was around 64000b Ha (40.28%) which has increased to around 74000 Ha (46.7%) in 2006. Also, around 44000 Ha of Agricultural Residential areas are in Tripoli city. Though the agricultural extent is increasing, the conversion of the best suitable Agricultural land for Urbanization or Industrialization should be minimized as it will affect the sustainability of the area concerned. where the rapid urbanization within Tripoli city after 2011 is taking place at the cost of conversion of the valuable agricultural land. The extensive parcels of land suitable for agriculture are subdivided and converted to various urban uses. In the context of poor land management and enforcement mechanism prevailing, it will be a major challenge for administrators and decision-makers to control such conversions and thereby conserving precious agricultural land from conversion. (Libyan Urban Planning Authority, 2009, p. 58). The agricultural sector consumes a large share of water and Groundwater usage in this sector has increased rapidly over the last decades and will most likely continue to rise as farmers practice irrigation techniques like sprinkler irrigation system that consumes more water. Awareness should be raised among such users to make them realize the benefits of the drip irrigation system in water-scarce

areas like Libya. Monitoring and pricing the use of groundwater should be done as well and replace by the greywater system.

3.2.7. Forests and Protected Natural Areas

Many forests have been planted in the region in the last century to protect soil from degradation and preventing desertification. They are frequently used by Libyan families for recreation. In 1987 many forest programs were stopped. Large amounts of forested areas have been cut down and were used as building material or for making charcoal. Many forests have been transformed into agricultural land or housing areas. The remaining forests are scattered and uncontrolled and often lacking forest guards. In Tripoli large parts of the forest belt that once surrounded and protected the city has been destroyed. The remaining forests are An Naser Forest close to the Tripoli Zoo, Ayn Zarab Forest along the Airport Road, Khalet Alferjan and Ben-Oan Forests (Libyan Urban Planning Authority, 2009, p. 42).

There are currently two protected natural areas within the Tripoli city boundary, The Bin Ghashir Natural Reserve and Tajura Protected Area. The Bin Ghashir Natural Reserve is situated near Bin Ghashir between Tripoli and Tripoli International Airport. The area measures about 87 hectares and has been created by the planting of exotic trees and shrubs for dune fixation. Tajura Protected Area is situated south-east of Tajuta city Centre. The designated area is planted with forest but the vegetation has been deteriorating fast. Protection and re-plantation are needed. The area measures 561 hectares. The ecological values in the city should be enhanced by the establishment of new protected areas. but most of these mentioned

areas It has been encroached upon and their trees cut down in the absence of the role of the state during the years from 2011 to now.

3.2.8. Water Resources

The availability of water resources in different parts of Libya's territory is of critical importance to the development of the country and for the sustainability of human settlements and vegetation .Water is a vital resource, necessary for all aspects of life and it holds more relevance in the context of making cities sustainable. It is of utmost necessity to improve the living conditions in the wake of the high pace of demographic growth of the cities in the northern shores of Libya, water supply holds the key both in terms of quality and quantity, for the growth of its cities. Water consumption in all sectors has increased during the last 20 years. The water resources situation in the Tripoli Region especially is not sustainable. The lack of water is a major restraining factor for the development of the region and its economy. There are five sources of water in the region, which are:

1. Groundwater

Libya's water is supplied by Water that comes predominantly from non-renewable groundwater (fossil) resources. Other water resources are provided by limited amounts of renewable groundwater recharged annually in fall, limited surface water stored in impounding reservoirs and desalinated water. and there are no permanent rivers or lakes. Whereas Assessment of the water sector over the period 2000-2006 according to The water resources of Libya are witnessing an excessive depletion, due to excessive exploitation. . The quantities withdrawn exceed the safe limits all over Libya, This has resulted in deteriorated water quality, lowered

groundwater levels, and along the coast, seawater intrusion (Libyan Urban Planning Authority, 2006, p. 135).

Table 8: Ground Water Extraction. © Libyan National Program for Water and Sewage, Stage II.

Place	Produced (m³/day)	Wells in operation	Average good depth(m)	TDS² average (mg/1)
Tripoli center	8,000	25	100	3,000
Tajura	7,300	23	242	2,130
Ouhers	38,000	109	176	1,230
Total	53,300	157	518	6360

In 2005, the overconsumption of water was about 890 litres per inhabitant per day within the Tripoli region. The groundwater is the most important source today but is to a large extent over- consumed. This has resulted in deteriorated water quality, lowered groundwater levels, and along the coast, seawater intrusion. In 2005, the overconsumption of water was about 890 litres per inhabitant per day within the region (Urban Planning Authority, 2005)

In Table, the amount of groundwater extracted within Tripoli is given. This water goes to domestic consumption and does not include the vast amounts of water being extracted by the private wells.

² TDS = Total Dissolved Solids. TDS is the sum of all inorganic and organic particulate material. TDS is used as an indicator of mineral content (salt and calcium carbonate) in wastewater and groundwater. TDS is measured in mg/l. The Libyan standard for drinking water is 1,000 mg/l of TDS.

Evaluation:

- Increase in the decline of groundwater levels, all over Libya, the rate of decline reached the range of 0.5-2.0 M / y. Such rates are very dangerous and immediate measures should be taken to bring them to an end.
- Increase in the salinity of water, in some aquifers, especially those adjacent to coast like Tripoli.
- Inappropriate methods of irrigation causing the loss of large quantities of water.
- Increase in salt levels in the soil leading to declining in its agricultural productivity and abandoning of farms.
- Desertification towards the north, as a result of the destruction of many forests, and vegetation damage.
- This situation is expected to deteriorate in the future and could even become catastrophic in the long term due to increasing demand and most of them are not renewable(Libyan Urban Planning Authority, 2006, p. 139).

2. The Great Man-Made River Project

Libya started taking practical steps for utilizing this valuable groundwater resource in 1984. The search for oil fields led not only to the discovery of large oil reservoirs but also great quantities of freshwater .

The main idea of this project is to transfer millions of water liters from the desert through huge pipelines to the coastal cities. From the hard desert environment which can not build urban cities on it and it is empty of any kind of life, to the rather

area which can easily urbanize it and investing this water wealth in a good way to give the life to the rest of cities which have a dense population and arable land.

The completed feasibility studies were implemented, where a comparison was made between several projects that seem in the table were proposed to solve the water shortage, which resulted in the approval of the Great Man-Made River Project, and the start was in 1986 .

The water supply coverage of the settlements within the Tripoli city coverage in Tripoli city centre (70%), Tajura (30%), Janzur (70%), Bin Ghashir (30%), and As Sawani (60%) seems to be satisfactory and the distribution of piped water should reach to all areas. Other aspects affecting water distribution are the conditions of the water network and its management (The Great Man-Made River Project Authority, 2005)

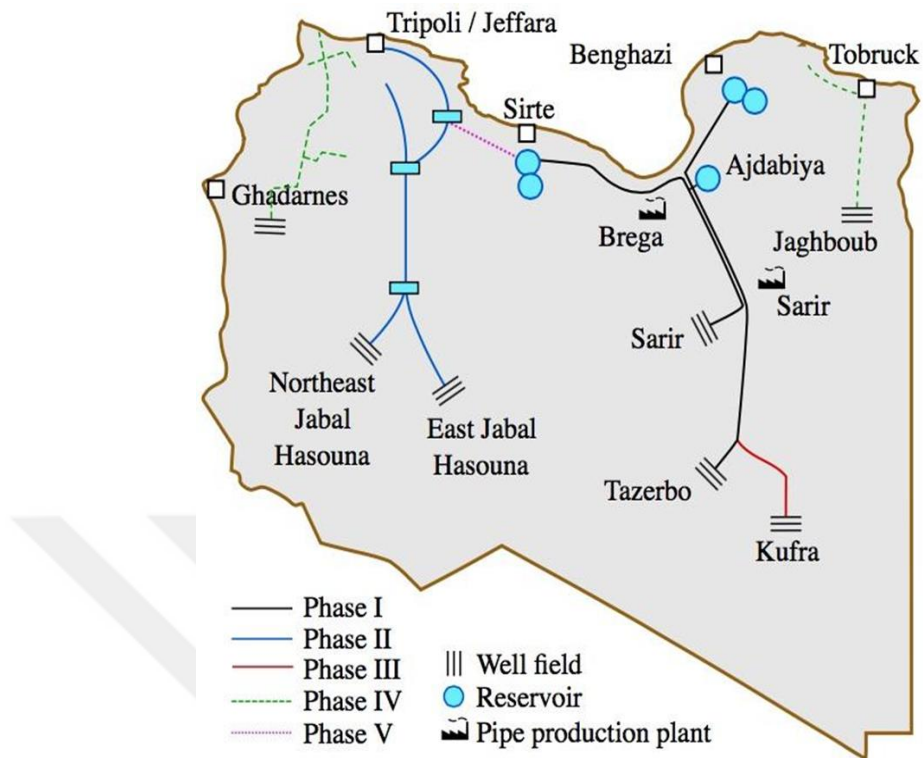


Figure 21: The Great Man-Made River pipeline. © The Great Man-Made River Authority, 2005.

The Great Man-Made River relies on a non-renewable source and this resource should be used wisely. The implementation of the Great Man-Made River (GMMR) Project has effectively contributed to solving the potable water problem, especially in the main areas of population concentration at the coastal area, as a large quantity of potable water flows from the desert.

Table 9: Cost price Comparison for Water Projects Per Libyan Dinar.© The Great Man-Made River Authority, 2005.

Project	Quantity of water per single Libyan Dinar
Transportation by ships.	1.05m3
Desalination dossalomont	0.79m3
Pipeline from Europe	0.74m3
GMMR	14.7m3

Evaluation

- The Great Man-Made River depends on a non-renewable resource and this resource must be used wisely.
- The Great Man-Made River pumping stations are exposed to sabotage and theft due to the current security situation.

3. Rainwater

The Rainfall on the Libyan western coast reaches 300 mm annually and in the east 500 mm. Areas that receive more than 100 mm annually account for only 6% of the national territory. Resulting in tapping more groundwater resources, one of the main contributors to the existing water resources, at unsustainable levels. Most renewable groundwater, replenished by rainfall and irrigation water, is in the Jifarah plain southern Tripoli city, the Al Jabal Al Akhdar plateau and the Bengazi plain areas. Total groundwater recharge is estimated to be 500 Mm3 annually (Libyan Urban Planning Authority, 2006).

There is a known social tradition in Libyan society, which is to build huge underground tanks in most private homes to collect rainwater during its season. This is done by collecting them from the roofs of homes and passing them through special pipes that flow into these tanks; it was used for water drinking and others. If this indicates, it indicates society's awareness of the importance of this natural source and the importance of preserving it. Drainage is fundamental to urban living. The prime focus of stormwater drainage is to collect and convey stormwater to receiving waters. The rapid conversion of land to urban use in Tripoli has profoundly altered the ground profile, changing the flow pattern of stormwater.

Evaluation

- The stormwater system in Tripoli city is not satisfactory; the system network coverage is partial. Both separate and combined system, with sewerage, is used to address the stormwater but lack of maintenance aggravates the problem. In the combined system, sewage and stormwater are mixed and sent to the treatment plant through a common lifting station. The combined system frequently malfunctions due to poor maintenance, presence of solid wastes in the untreated water resulting in clogging and consequently flooding of the system.
- This results in overflows which are normally discharged directly into the sea. The separate system collects sewage and stormwater individually and sends them to the treatment plants through separate lifting stations. The main problem concerning stormwater drainage in Tripoli is clogging and poor maintenance. Clogging is caused due to disposal of solid waste in such

network Water being scarce, proper management of stormwater could make it re-usable, reducing the dependency on groundwater. An integrated approach of improving stormwater drainage coverage, storage system and decentralizing the network and storage to different zones and areas could make rainwater more usable and dependable. Contamination of stormwater is also one of the reasons why it is not being utilized as a potential for irrigation of green areas and agricultural lands .

- the role of stormwater drainage systems cannot be undermined, as this can lead to problems of stormwater flowing along roads, damaging them and collecting all the pollutants as it flows, leading to inundation, flooding of buildings and also polluting the receiving waters and creating environmental hazards.
- All the mentioned resources of water should be utilized very carefully for different purposes. The technologies should be serving the consumption of water in urban agriculture areas. It is essential to feed the urban public parks and gardens within urban areas with suitable water resources. This will help us to create wonderful public parks for Tripoli city and The consideration of sustainability is essential.

4. Seawater Desalination Plant

Desalinated water is another source of water that could contribute to the supply of the rising water demand of Tripoli city and reduce the pressure on the depleting groundwater and over-exploitation of GMMR. Currently, there is two such desalination plants operative in Tripoli, the Tripoli West Desalination Plant and the

one at the State Research Institute in Tajura. The third one, Tripoli DSP, is not working. Total desalination capacity is 20,000 m³ per day but the plants are not producing to their full capacity and only 11,500 m³ per day is produced and supplied to municipal water networks. There were plans to build a large desalination plant west of Tripoli City with a total capacity of 250,000 m³ per day (Urban Planning Authority, 2005).

5. Treated Waste Water

Sewerage networks carry a lot of importance in improving the environment and living standards. The water resource is a scarce and valuable commodity. It is important to have a good network that can handle the collection and disposal, of both sewage and wastewater, to prevent any adverse effect on the surrounding environment in terms of ground and seawater pollution. Hence, it should be connected to a properly functioning network system and maintain the effluent standards.

In Tripoli city, there are five sewage purification plants (SPP), which are: (Al Hadba SPP, Alhaj SPP, Enzara SPP, Janzur SPP, Qaser bin Qashir SPP). The sewage network coverage for all the main settlements in the city are Central Tripoli area (60%), Tajura area (70%), Janzur (60%), Bin Ghashir (40%), and As Sawani (0%). This depicts that the system is partial and inadequate (Libyan Urban Planning Authority, 2009, p. 77). About 80% of the consumed water is converted into wastewater. 318,000 m³ of wastewater is produced in the city of which only 27,000 m³ is treated per day, whereas the remaining untreated wastewater is discharged into the sea or infiltrates into the ground. Treated wastewater was used for irrigation for

an agricultural project in the Al Hadba Al Khadra area (Libyan Urban Planning Authority, 2009, p. 74).

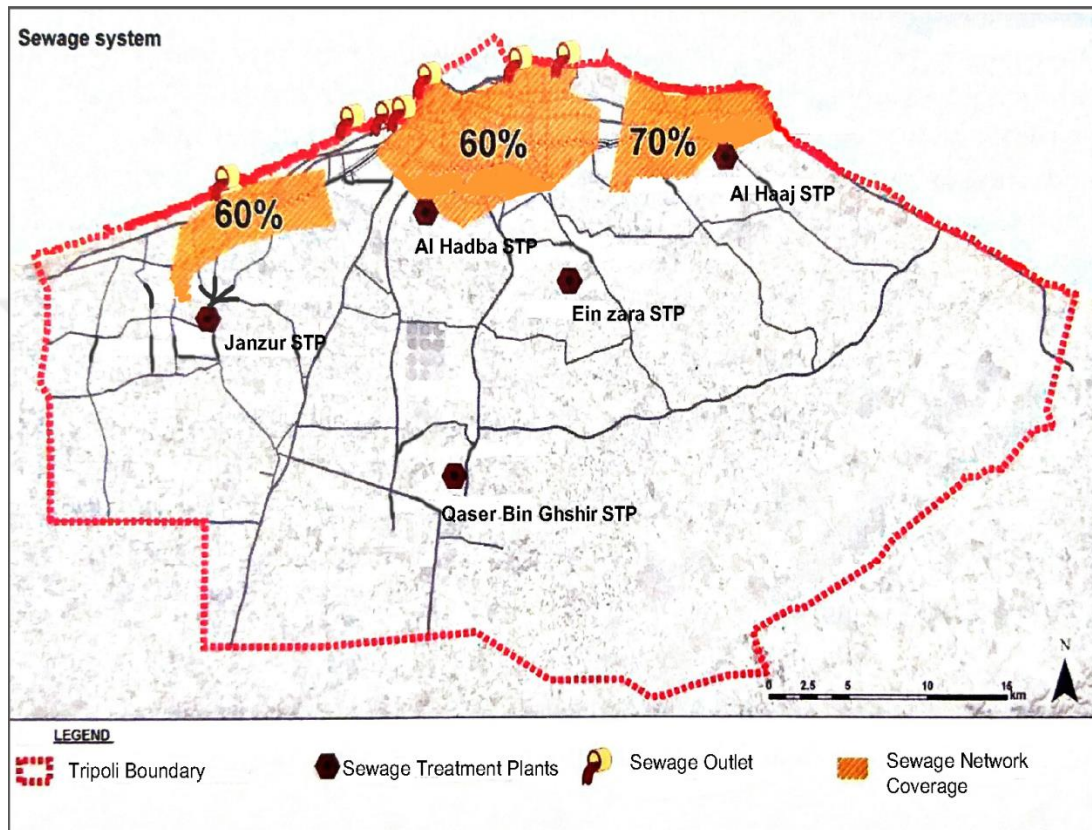


Figure22 :Wastewater and Sewage Systems in Tripoli City. © Tripoli Agglomeration plan/ Urban Planning Authority 2009.

The sewage collection starts at the household level, which is partly sent to treatment plants and the remaining are discharged directly to the sea. This disposal of untreated sewage poses a high risk to the environment and causes health hazards . There are 31 sewage discharges to the sea but the effluent quality of none of these except Total Dissolved Solids (TDS) meets the specific standards .This shows that most of the wastewater goes untreated and eventually reaches the sea or

contaminates the soil, mainly due to the non-functioning of 2 out of 5 Waste Water Treatment Plants. The Al Hadba Al Khadra treatment plant located south of Tripoli City has a total capacity to treat around 140,000 m³ of wastewater per day during the dry season. However, due to lack of maintenance, only 27,000 m³ per day is being treated. The Janzur treatment plant which receives wastewater from Janzur and the western parts of Tripoli City is now functioning after a testing period, but the amount of treated wastewater is unknown. Other treatment plants in the Agglomeration have never worked or are being finalized, like the Ayn Zarah treatment plant near Tripoli City, the Al-Haj near Tajura and the Bin Ghashir plant. Data for sewerage network coverage in the Agglomeration are estimations and cover only planned areas in the cities (Libyan Urban Planning Authority, 2009, p. 78).

Evaluation

- The new urban areas are not included in the estimates. These areas lack such networks. Hence they have to rely on alternative methods of sewage disposal like the use of septic tanks, cesspools etc which poses a higher threat to groundwater contamination due to leaking.
- Wastewater effluents from industries and hospitals are hazardous and need pre-treatment. Lack of management of hazardous waste will further damage the environment. Hence to deal with problems related to industries, hospitals and ports, more investment, regulations and enforcement should be put into managing their hazardous liquid waste.

- In the wake of increasing pressure on the scarce resource of water, it seems to be one of the best solutions for sustainable water supply to be established in the city is the greywater system.
- Urban areas could utilize centralized network systems to treatment plants but in the case of areas outside the urban areas and more scattered settlements, a small scale decentralized network system would be a better option. Locating the treatment plants close to agricultural lands could make treated water usable and reachable for irrigation purposes.
- The concept of replacing the groundwater with treated effluent for agricultural production never materialized.
- It was projected that the consumption of groundwater will reduce to 100-120 million m' annually because of desalination plants and treated effluent, which has not happened, unfortunately (Urban Planning Authority, 2005).
- In the last 10 years, this water was never used in agriculture due to poor maintenance went out of service.

3.2.9. Land Degradation

Land degradation is a complex process resulting in adversely affected land values. The process is constituted of a chain of actions and reactions, leading to desertification. The physical conditions of Libya: hot climate, the scarcity of water and groundwater salinity, making the country sensitive to human actions causing land degradation. The driving force of the process is the wind causing erosion of soil exposed after human actions.

Actions triggering the process are:

- Vegetation clearance - removal of tree cover exposing the soil to the wind.
- Overgrazing - animals causing deterioration of the vegetation cover by eating and walking, and thereby also making the soil sensitive to wind.
- Irrigation with saline water-causing infertile soil conditions(Libyan Urban Planning Authority, 2009, p. 49).

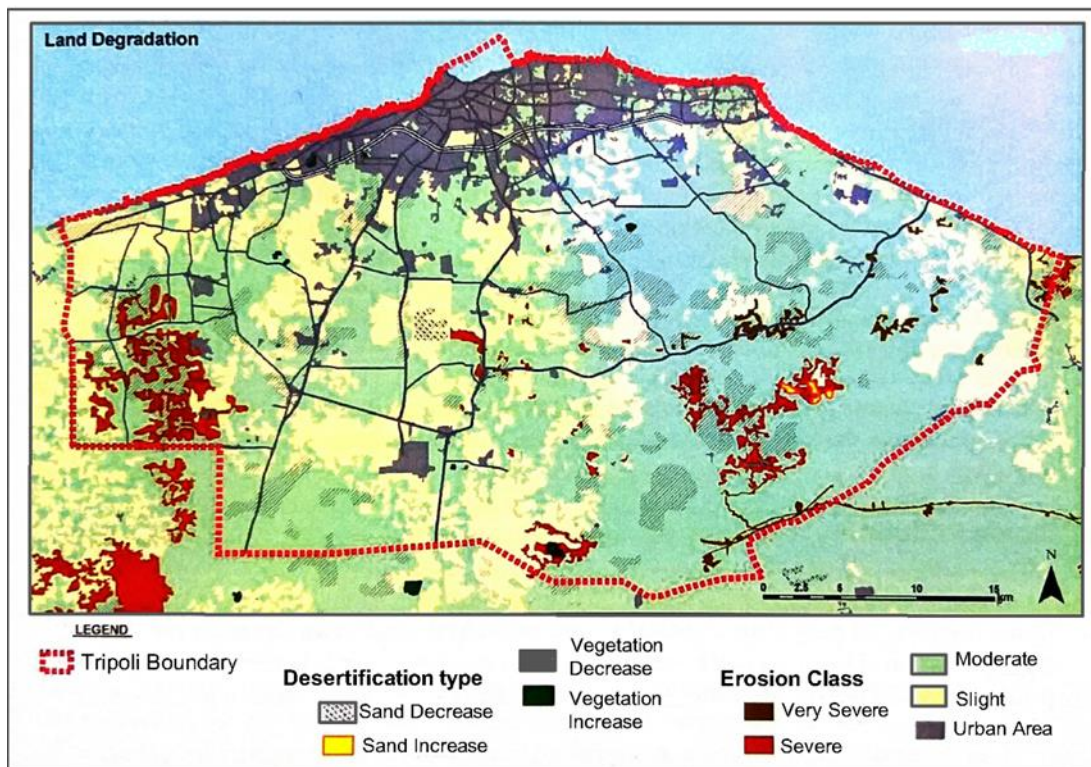


Figure 23: Tripoli Land Degradation. © Tripoli Agglomeration Plan/ Urban Planning Authority 2009.

Evaluation :

- A major key factor leading to degrading actions and reactions is the critical freshwater situation leading to the intrusion of saline water and severing the process of recovering vegetation. In the future.
- Climate change may also pose a future risk if it results in reduced volume and regularity of annual rainfall or strengthens the formation of Gibli winds.
- Land degradation reduces agricultural productivity, and its impact on agriculture has the potential to affect the national economy and can drive migration from rural to urban areas.

3.2.10. Sea Water Intrusion

Seawater intrusion has been observed within a 6-7 km wide zone gradually moving inland. There is no data available on seawater intrusion after 2002. The seawater intrusion is caused by a much higher rate of extraction compared to the natural replenishment from infiltrated rainfall. Along the coast, most of the groundwater extracted from the upper aquifer will be replaced with intruded seawater.

The intrusion process is very difficult to reverse and the best way to prevent further intrusion is to restrict the water outtake from the local aquifers. There are possible technical solutions that have been tested in other parts of the world, for instance creating a freshwater barrier by pumping down treated wastewater into the aquifers along the coastline. Such solutions could also be used in the case of Tripoli to reduce seawater Intrusions (Libyan Urban Planning Authority, 2009, p. 53).

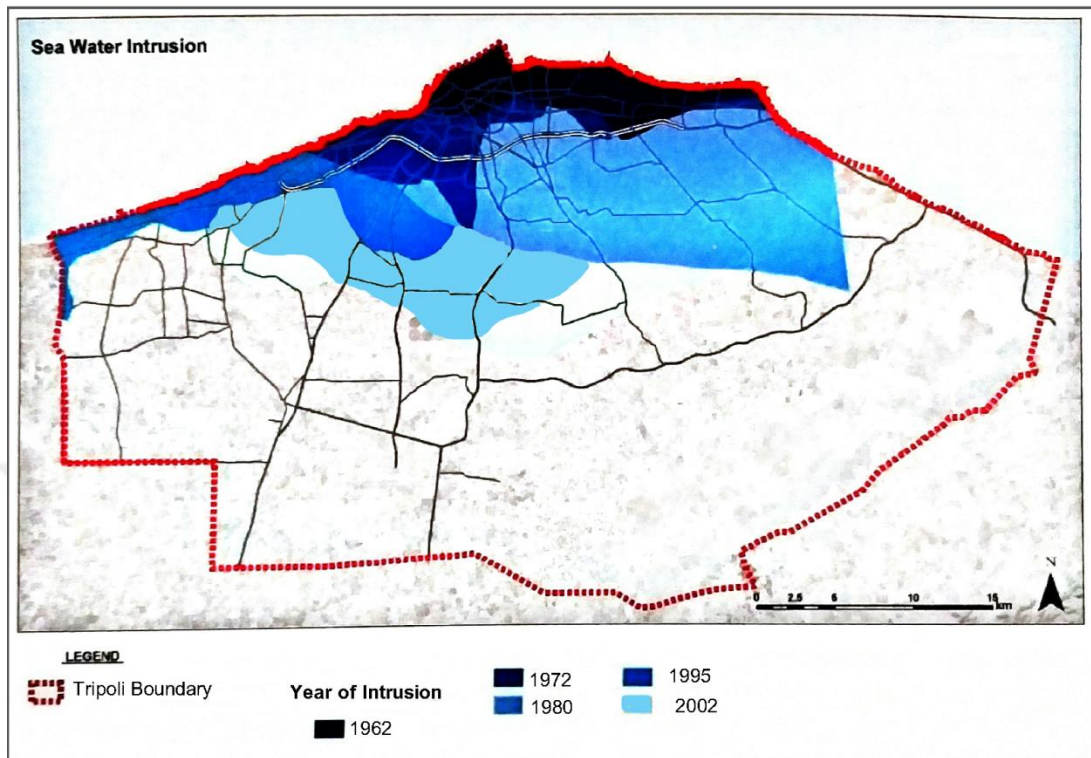


Figure24 : Seawater Intrusion in Tripoli City 1962-2002.© Tripoli Agglomeration plan/ Urban Planning Authority 2009.

Libya is a country with extremely scarce water resources and can't afford extensive water use. Therefore wastewater should be treated and utilized. The water use should be charged and the agriculture should be directed towards less water extensive crops and methods. Shallow aquifers along the coastal belt suffer from seawater intrusion and some areas have seen an increase in water salinity to more than 3,000 mg per litre in the last 20 years. A seawater intrusion extending from 2 to 10 km inland can be observed in coastal zones, which had reached 7 km inland during the early 80s with a salinity of 1000 ppm TDS. The most rapid advance of

this sea waterfront takes place in the vicinity of Tripoli City(Libyan Urban Planning Authority, 2006, p. 134).

This is mainly due to the extraction of groundwater from private wells, and small water towers fed from individual wells which are spread all over the area.

Evaluation:

Tripoli is not very exposed to any natural hazards other than soil degradation, which is to a large extent triggered by human activities. The most alarming impacts on the environment are purely created by human activities:

- Overutilization of water with decreased water quality and lowered water tables as consequences.
- Pollution by untreated wastewater with severe consequences for the coastal areas.
- Un-controlled disposal of solid and hazardous waste disturbing human health and eco-systems.

IV. ANALYSIS OF EXISTING GREEN SPACE OF TRIPOLI

In this chapter, a detailed analysis will be made for the classification of public green spaces in Tripoli, and a complete inventory of all these sites will be made in terms of area and evaluated. The purpose of this detailed study is to emphasize the problem of the lack of public open green spaces and their per capita share of these spaces. Then, the importance of creating additional spaces especially in new residential compounds . This will be a prelude to the researcher's proposal in the next chapter to solve this problem.

4.1. Introduction

Tripoli urban planning has many advantages that underpin its attractiveness and quality of life, the city also suffers from many problems. The first weakness is the decline in urban public space. Where many areas are witnessing a process of deterioration with the decline of Green Spaces in comparison to 20 years ago. In turn, the climate, through irrigation, provides an important palette of diverse vegetation. The Mediterranean basin is one of the most prominent areas of biological diversity in the world, especially in its southern bank, where all plant species-specific to the temperate climate and those that grow in the tropical climate can grow.

4.2. The Urban Vegetation within Tripoli City

The urban vegetation is very unequally distributed If the vegetation ratio given at each point of the territory by the satellite image is not available. Field observation,

however, enables us to identify five types of districts depending on the extension of their vegetation (hereunder in descending order) :

1. Villas' districts, with abundant private vegetation (gardens, courtyards, frost yards of houses), often overflowing onto the public road.
2. Evolving districts (mainly in the East), with still important relict vegetation (agricultural lands, fallows, isolated trees or hedges, gardens) .
3. The “classic” city (inside the green belt), with a high share of land occupancy by the buildings, but main streets often planted, a presence of public gardens and some private gardens.
4. The dense popular districts, with a high share of land occupancy by the buildings and very poor vegetation, even in open spaces ‘
5. The Old Medina, with a high share of land occupancy by the buildings, and some gardens and pergolas. Among districts poor in vegetation, the medina is a traditional urban pattern, which does not go traditionally with a wide presence of plants, however, despite their density; popular districts could bear more plants (Engineering And Consulting Office For Utilities & Charter, 2010, p. 16).

Evaluation

- The last spaces of free nature are ignored and disappear the insufficiency of cultivated nature is partly balanced by the presence of nature relicts, spontaneous or inherited from the rural past. In these spaces, the agricultural land organization left plots, hedges and tall trees (palm trees, olive trees)

shaping the landscape. Lack of maintenance gives scenic and biodiversity qualities related to species spontaneous development .

- Unfortunately, such a nature is ignored and is rapidly disappearing. In the development sectors, there is no rule to protect these spaces. Uncontrolled construction split agricultural areas; vegetation is no longer maintained; fallows are being transformed into illegal dumps. Hundred-year-old trees are cut down; soils that are fragile in these pedagogical and climatic conditions and rich in biodiversity are cleaned and scoured out with bulldozers .
- The problem is not a lack of interest in nature, since, at least in the new districts of villas, gardens are replanted – on grounds on which all-natural soil and vegetation have been removed, then garden earth brought on bare soils. The problem is a lack of recognition and identification of agriculture and spontaneous vegetation. The countryside is seen, more or less consciously, by urban dwellers as a backward world; productive species are not considered as having a decorative value and spontaneous species are seen as “weeds” to be eliminated .
- This is a regrettable situation, where the most adapted species to soil and climate are weeded and where the area is deprived of mature vegetation, biodiversity, and a landscape that gardens need decades to reach. if the aim is to move from a rural image to urban gardens, This process can be carried out progressively by planting new plants under the cover of existing, living grounds and replacing the new ones only after the new ones develop from a rural picture to urban gardens.

This emphasizes the necessity of commitment, from the governmental institutions responsible in this sector, as well as, the people's awareness towards nature and vegetation.

4.3. Problem Definition, Green public Spaces in Tripoli City

Tripoli has many green areas that are not internationally adequate insufficient by international standards (the commonly accepted standard is 10m² per capita). The absence of green spaces affects not all areas equally. For example, The classic city centre is well greener, except the Old City, while the districts of new urbanization area, in particular, are not well planted.

If the green belt project is complete, the shortage of green spaces can be corrected in the classic city area only. but this project is uncompleted due to several reasons .It is important to mention that when work began on the Green Belt project, people were compensated with sums of money in place of their homes that are located inside the project. But instead of securing their move to places that had been planned, the situation was ignored, which led to the people moving to the area outside the green belt, which in turn was unplanned.

The land out of the green belt was mostly private farms. These farms were divided by the owners and have been sold. This resulted in turning into populated areas. Which led to the amplification of the problem of lack of proper planning and attention to public places Open to secure a better quality of life. This transition is since populated urban areas are unplanned by the specialists and the concerned authorities and are almost as described as being devoid of open public spaces.

Hence the formation of the greater city of Tripoli, and the need for public spaces and parks, increased, especially after 2011, when the internal migration to the capital had been increased.

However, the New urbanization movement has happened during the absence of governmental planning, especially during the last 20 years. The transition from rural to urban areas suddenly occurred, without the conservation of old vegetation and land and with the destruction of the spontaneous (soil and climatic-friendly) vegetation that occurs during cultivation. also, encroachment on fully open spaces and convert them to a residential area. This uncontrolled movement led to the elimination of the green area which the city was having, as well as, deterioration in the quality of it if any.

Also, it led to the entry of the military army sites into the boundary of the city, rather, it becomes mediating residential neighbourhoods. This was relatively normal and acceptable for people before 2011, due to the availability of security and safety because of governmental control. But soon the vision changed from the first attack on Libya by NATO (North Atlantic Treaty Organization) when these sites were completely destroyed by missiles of warplanes and naval battleships. These sites became insecure due to the presence of stored weapons and because of the bombing that affected them. After the end of the 2011 war and the return of the residents to their homes, these sites became dark, abandoned, deserted, and closed, followed by fear and bearing dreadful and negative memories for the society.

Green spaces must be built in the city to conserve and emphasize urban vegetation.

The purpose of this thesis is to take up the existing spaces of the Green area classification in the city and knowing the per capita share of it. and the plan's key component is to propose the establishment of the Tripoli city central park in gap areas. The districts that do not have the most public parks and garden areas (especially outside the green belt or from the city centre) are also the ones with the most valuable resource to build new green areas on the damaged and destructive lands, enhance the quality of life of the city inhabitants and protect and cultivate biotopes.

4.4. International Indicators for Urban Green Spaces and Vegetation

- The most common indicator is the green space area per inhabitant, measured by the ratio, within a given area, of the total accessible green spaces, are on the population living within the same perimeter; a standard of 10 sq. m per inhabitant was defined in France during the years 1960-1970 as part of new operations (the 'Vilmorin' regulation, 1973), and then widely used as a reference on the scale of municipalities and even urban areas, without always specifying the perimeter of reference.
- The second indicator is the service by public green spaces, not given by a figure but by a map, which outlines a radius around each green space indicating the served districts; in most studies, several categories of green spaces are defined according to their area, with a longer radius if the surface area is important (250 m for small neighbourhood gardens and 1000 m for major metropolitan parks). here a simpler method was chosen, with a single radius of 250 m whatever the green space area; indeed it is considered here

that an objective may be to have a local service for all the districts, while major parks fulfil both the role of neighbourhood green spaces, for districts located within a radius of 250 m, and the role of metropolitan parks for the whole city through access by car (therefore, for this metropolitan function, a service radius discriminating the districts cannot be defined).

- The third indicator is the vegetation index, which measures point by point the plant cover importance and activity; this ratio is measured by the signal received by satellite in some wavelengths (infra-red and visible), very strong when chlorophyll activity is intense (maximal when the vegetation is watered); it is set to each pixel in the satellite image. Like all indicators and all models, these are simplifications of reality, and therefore have limitations.
- The green spaces surface area per inhabitant is the most limited indicator since it does not take into account the distance existing between people and green spaces; a city can have a high surface area of green spaces per capita even with a major part of the population living too far to be concerned; conversely, it can have green spaces out of its edge, serving a part of the population without being recorded; this standard is a useful indicator provided it is combined with the others .
- The radius of service by public green spaces reflects in a discontinuous way (fully served districts or not served at all according to their location inside or outside the radius) a continuously changing reality (districts more or less served according to their distance); however, it can be improved by taking several successive radii; or the objective may be to have on the studied territory both a green space area of at least 10 sq. m per inhabitant and all the

districts at less than 250 m of public green space(Engineering And Consulting Office For Utilities & Charter, 2010, pp. 13–14).

4.5. Tripoli Green Spaces Classification

The knowledge of the vegetation ratio usefully complements the knowledge of the service by green spaces, but a satellite image of Tripoli analyzed by the wavelength channels that allow its calculation is not available for this study. But, the researcher conducted a comprehensive survey of the borders of the city of Tripoli, careful analysis and evaluation of the status of open green spaces in the city of Tripoli was made, according to the Libyan state's classification of green spaces. The study conducted a complete inventory of all public parks open to the public within the city of Tripoli, as shown in the table below (Engineering And Consulting Office For Utilities & Charter, 2010).

1. Public Gardens (Parks or Promenades, Gardens, Planted Squares):

Tripoli has some urban parks in its centre meant for public access, passing through, walking and-or staying; designed, abundantly planted, equipped with various facilities (benches, children's playgrounds, refreshment areas).and some strong materials like (pavements, low walls, benches made of stone or concrete, metal furniture...). Some parks enclose small businesses (cafés, trinket merchants). Free and open access to the public, for the most part (even if they are fenced) any time.



Figure 25: Al Naser Park. ©Tripoli's City Center Urban & Architectural Charter 2010.



Figure 26: Tripoli Zoo. ©Tripoli's City Center Urban & Architectural Charter 2010.

Evaluation:

- Large urban parks are not well designed and maintained. With one exception of a zoo park in Tripoli.

- The public parks and gardens' maintenance is often inadequate: this appears in pavements, fences and furniture in a poor state and the quasi absence of shrubs and flowers.
- Neighbourhood gardens well designed but often poorly maintained.
- A lack of green spaces in most districts.

2. Road Green Spaces (Roundabouts, Triangles and Slopes) and Buffer

Zones: This category includes green spaces laid out on the parts of the street space that are not devoted either to the street or to the sidewalk. It consists of central islands of roundabouts and other important crossroads, triangular islets separating the lanes at crossroad approach, and slopes of expressway embankments or clearings. Roundabouts often include fountains or other decorative elements. The largest is fenced, landscaped and used as gardens.



Figure 27: Road Green Space in Tripoli City. © Author and Tripoli's City Center Urban & Architectural Charter 2010

Evaluation

- Roadsides and junctions often landscaped.
- Some inaccessible planted spaces along roads, currently listed as public gardens, should be listed as road green spaces.
- Rebalance the sharing of street space to the benefit of pedestrian areas and green spaces.

3. Street trees and vegetation: Most of Tripoli centre main streets are shaded by regular, dense, and proper maintained tree lines. Generally planted on sidewalk, enhancing the streets, giving shade, without occupying too much space .



Figure 28: Tripoli Centre Street Trees.© Wikipedia

Evaluation

- Regular alignments, in fair condition, that structures the urban landscape .
 - Very few continuous rows .
 - Significant potentialities for planting out of already planted roads.
4. **Institutional Parks and Gardens:** Hospitals, universities, etc.; not meant to be public gardens, but part of them has pedestrians' free access. Publicly or privately owned, their main characteristic is that they are open to the public for another purpose than garden visit. For most of them, public access is not limited in practice to the use of the facility, and these gardens can be used as resting and promenade places. However, their use by the public may differ greatly. At most, their accessibility is complete and they are considered real public gardens



Figure 29: Tripoli Medical Hospital. © Tripoli Municipality.

Evaluation:

- Well maintained spaces, often a good landscape quality .
 - Access meant for people attending the facility, but usually not controlled.
 - Potential for a complete opening to the public, to provide green spaces to districts lacking them.
5. **Green Belt:** The green belt is a project was planned by the Libyan government sins 2009; it was aiming to surround the city of Tripoli with green public spaces to reduce the lack of green areas in the city.



Figure 30: The Green Belt of Tripoli City. © Tripoli's City Center Urban & Architectural Charter 2010

Evaluation

- Two existing forests (mainly Ghabat a Nasr, Former agriculture research centre Sidi el Masri) and the zoo as well as, Tahrir round about an Abusita stadium, were included in this project.
- A high landscape and ecological value.
- Large urban green spaces 10% of completed.
- Unfortunately, this project has stopped due to several reasons.

Other Urban Open Spaces **(Undeveloped Facilities)**

6. **Cemeteries:** Cemeteries are regarded as open spaces due to their non-developed and non-surfaced character, as well as to their vegetation, even their primary purpose is not to be green spaces: abundant grass and flowers in spring and some trees. Meditation and silence places in the middle of urban agitation Places of reverence and quietness amidst the urban hustle and bustle.



Figure 31: Cemeteries Landscape.© Tripoli's City Center Urban & Architectural Charter 2010

Evaluation

- Large grassy areas, some trees, abundant herbaceous vegetation in spring, not meant for public access apart for the families of the deceased, low attendance, for spiritual reasons.
- It is possible to evolve into landscaped cemeteries, with other green space functions, compatible with the character and function of the place.
- Cemeteries are not supposed to be visited for other reasons than funerals, visit and maintenance of graves. They are closed and guarded, hence limiting other functions.
- But theoretically, nothing prevents entering them and staying, if the calm and the reverence of the place are respected.
- A potential of well-planned and planted will be useful for the city vegetation and environment.

7. Sports Grounds:

Most of the sports ground and playgrounds within the districts are unplanted, except the general stadium of Tripoli.



Figure 32: Tripoli Stadium. © Tripoli's City Center Urban & Architectural Charter 2010

Evaluation

- Generally, it is unplanted.
- Open spaces, poorly planted if found.
- A potential of trees planting for some sports grounds.

8. Bare Lands and Fallow, Urban: Car parks, open-air storage, scrap yards and other spaces without vegetation out of the streets network, around buildings or isolated. usually area of demolished buildings, with more surfaced grounds than in rural fallow, some with vegetation leftover from former gardens.



Figure 33: Bare Lands Proposed Green Public Area. © Tripoli's City Center Urban & Architectural Charter 2010

Evaluation

- Unexploited spaces correctly, unattractive
- It has an activity that can be moved provided that new locations are found where they can still contribute to the urban landscape.
- Spaces can be of production and landscape quality altogether.
- A potential of planting and vegetation.
- Still productive spaces in the city, which provides them with management .

- Strong potential for creating green spaces with mature vegetation, provided that the traces and character of an agricultural space are preserved.
- Havens of biodiversity.
- A usually unpleasant aspect due to lack of maintenance.
- Strong potential for creating new green spaces with mature vegetation and high biodiversity, provided that a significant part of spontaneous or formerly cultivated species are preserved.

4.6. List of Existing and Proposed Green Public Spaces in Tripoli

All public green spaces in Tripoli have been identified by the Author, and the classification of these parks and the area has also been mentioned in the Table. The names of these parks are numbered ascending according to their proximity to the old city centre. Closer, then farthest. And also their locations in the city were clarified in the Figure.

Table 10: Existing and Proposed Green Public Area in Tripoli. © Author based on Tripoli's City Center Urban & Architectural Charter 2010

Number	Name or location of the park	Area (ha)	Category	Uses
1	Kubra park	7.6767	Public park	Public park
2	Um Hamad Al Magarief park	0.0462	Public park	Public park
3	Ghazala(A,B,C,D)park	2.7005	Public park	Public park
4	Cornicepark (Ghazala, Ministry of Education)	1.6713	Public park	Public park
5	Jnan An Nawar (Wadi Street)park	0.5765	Public park	Public park
6	Omar Mukhtar Street park	0.5437	Public park	Public park
7	Mizran park in front of the Social Security	0.0798	Public park	Public park

	Building			
8	Mizran park in front of the mosque	0.2088	Public park	Public park
9	Suleiman Khatr park in front of the Dutch embassy	0.0732	Public park	Public park
10	Al Fatih Tower park	5.9881	Public park	Public park
11	Al Dahra Souk park	0.8143	Public park	Public park
12	Sidi Bukr park	0.6024	Public park	Public park
13	Philadelphia Murad Agha park	0.1492	Public park	Public park
14	Abu Hrida (A, B)park	2.7100	Public park	Public park
15	Saadun Swaihli park	0.4837	Public park	Public park
16	Iranian Embassy park	0.2190	Public park	Public park
17	Bin Ashur (Sokra) park	0.5301	Public park	Public park
18	Girls military college	7.820	Public park	Public park
19	Jumhuriyya and al Nasr park	0.7688	Public park	Public park
20	Soug Tlat(A) park	1.5300	Public park	Public park
21	Kishlaf park	4.4439	Public park	Public park
22	Soug Tlat (B)	5.6384	Public park	Public park
23	Soug Tlat (C)	3.1000	Public park	Public park
24	Al Sarim besides Palestine Square park	0.1699	Public park	Public park
25	Garden South of Al Qods Circus	0.3949	Public park	Public park
26	Islamic Museum B park	1.3126	Public park	Public park
27	New Cornice Culture Palace park	17.4337	Public park	Public park
28	Jraba Street park (Drebika)	0.7504	Public park	Public park
29	Al Dahra Amrua Mosque park	0.1201	Public park	Public park
30	Fourouseia	12.700	Public park	Public park

31	Mujahidin Garden	0.7482	Public park	Public park
32	Al Huriyya park	3.2866	Public park	Public park
33	Bin Ghashir park	1.0994	Public park	Public park
34	Al Hani park (A, B)	0.8386	Public park	Public park
35	A Nasr Forest	159.6843	Green belt	Public forest
36	Tripoli Zoo	45.3573	Green belt	Zoo
37	Sidi El Masri former Agricultural Research Centre (west)	54.7512	Green belt (agriculture)	Public forest
38	Sidi El Masri former Agricultural Research Centre (East)	31.8812	Green belt (agriculture)	Public forest
39	Shula Garden	0.5389	Facilities garden	Facilities - Public park
40	Ali Warith School park	0.3718	Facilities garden	Facilities - Public park
41	People's Castle (Qasr Ash Shaab) Garden.	5.1191	Facilities garden	Facilities - Public park
42	Al Qods Garden	0.8844	Facilities garden	Facilities - Public park
43	Central Hospital Garden	3.4388	Facilities garden	Facilities - Public park
44	Islamic Museum Garden	3.1567	Facilities garden	Facilities - Public park
45	Planetarium Garden	1.4477	Facilities garden	Facilities - Public park
46	Under Develop area (un completed)	223.700	Green belt	Public park
47	Bare-agriculture land proposed to develop	39.4597	Bare-agriculture land	proposed to be a public green space
	TOTAL	657.0401he		

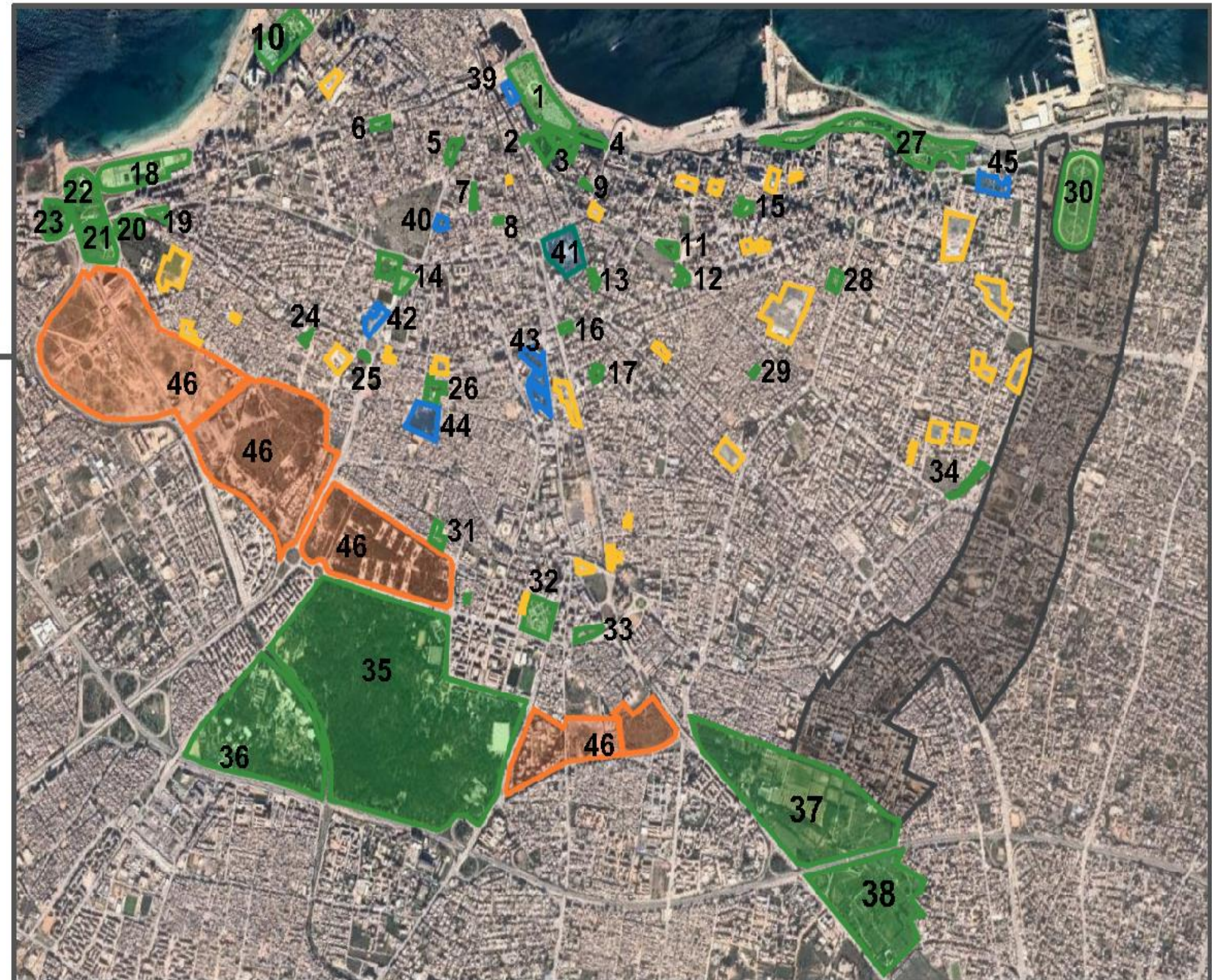
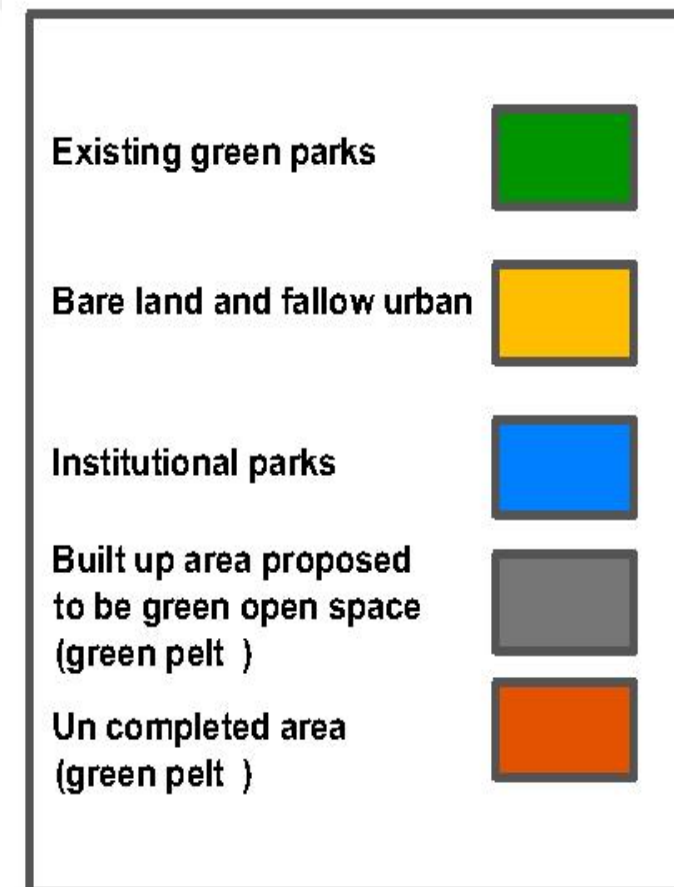


Figure 34: The Existing and Proposed Public Green Spaces in Tripoli City. © Author based on Google Earth.

From the analysis of this table that the per capita share of open public green spaces is 2 m^2 per capita. This is by calculating the total of existing green space in the city, split up by the total number of inhabitants. Whereas, the standard set for the per capita share by the World Health Organization and UN-HABITAT is from 10 m^2 to 15 m^2 per person .

That shows that there is an urgent necessity to create a new open public space that could increase the percentage of per capita share from these important areas.

Hence the idea to find a solution to this problem. Attempts began to create public open areas with the possibility of afforestation and close to new population centres.

V. PROPOSED PROJECT AREA

After presenting the case study, and analyzed all of Tripoli's land that has the potential for greening, as well as, concentrated on all resources, main pros and requirement that help to build sustainable green spaces, in chapter III.

Also, focus on the problem definition, analyzing and evaluating the existing green public space, that showed the urgent need to create new green spaces to raise the per capita share of it, In chapter IV.

All of these processes is a kind of preparation for choosing the best site to establish the proposal of converting a demolished army site to a green public space.

This Chapter will have :

- The proposed site for this model for making sustainable green public spaces will be identified and giving an introduction, definition and evaluation of the site in **Proposal Site Background**.
- The site will be analyzed in detail and will show the area of the site. The number of visitor flow that could access the site. The distance and time arrival from each settlement and the main uses roads. The water resources that may feed the site and the surrounding existing land uses. All of this data will present in **Proposal Site Analysis**.
- The strengths, weaknesses, opportunities, and threats of the site proposal will be present in a **SWOT analysis**.
- presented Some proposed practical strategies and ideas, that can be followed when the stakeholders decide to start to redevelop these areas,

these ideas based on sharing the sustainable dimensions in redevelopment **Suggested Practical ideas for the redevelopment of the affected areas.**

- Also, we will present the sustainable park design criteria or the main principles to develop like these sites is based on sustainability and consider the ecological ideas. that could be folwed in the future from any urbanists planners and architects designer in **Sustainable Park Design Criteria**. These criteria were learned and tracers from the international examples and literature study in chapter two.
- As well as, park land-use zoning example, will be passed at the end of this chapter. It is only to emphasise the idea of the criteria and giving reasons for choosing to etch area in the **Land-use zoning proposed.**

5.1. Proposed Site Background

When the urbanization in Tripoli was increased, as we previously mentioned, the army sites and weapons storage places entered the Greater Tripoli component, and residential complexes were built around them. This was relatively normal and acceptable for people before 2011, due to the availability of security and safety from governmental control. But soon, the vision had been changed from the first attack on Libya by NATO (North Atlantic Treaty Organization) when these sites were completely destroyed by missiles of warplanes and naval battleships. These sites became insecure due to the presence of stored weapons and because of the bombing that affected them. After the end of the 2011 war and the return of the residents to

their homes, these sites became dark, abandoned, deserted, and closed, followed by fear and bearing dreadful and negative memories for the society.

The description has not expired yet. After the collapse of the regime in Libya and the militia groups had controlled, they soon fell out with each other and civil war broken out in 2014. These militias are fighting over control of these military sites due to the strategic value that this site has. This situation made great and tragic suffering for the citizens. Some of them had their homes destroyed, losing one of their families members, and many of them lose their lives at homes during the sudden bombardment between the militias groups.

These lands are the most suitable areas to be converted into parks and green areas, because of their ripened vegetations and high biodiversity that have. Most of the land still grows and has plenty of trees, which is evidence of live soil. Therefore, a network of neighbourhoods (districts) green area is proposed as future green public areas where it is appropriate.



Figure 35: The Demolished Army Campos in Tripoli

From this point, the idea of the architectural research in converting these areas located inside residential fabric into places opens to the public. To become a source of safety, positive energy and cultural diversity. The idea of the research is to turn these dark places into a torch of light and life as a gift to the people who are suffering due to wars and as a gift to his city, which could be a safe green city in the future. Also, because of their need for green public spaces, and to satisfy the standard ratio of green spaces per capita. So we have to create a central satisfactory (park, parks) covering Tripoli city needs. And to serve and satisfy the citizen needs in an ecologically way. This is what the researcher works on to create the proposal.

Evaluation:

- Strong potential for vegetation and planting.
- Areas can be landscaped and re function as public parks.
- These lands are the most suitable areas to be converted into parks, because of their ripened vegetations and high biodiversity. Most of the land still grows and has plenty of trees, which is evidence of live soil.
- Large areas in the city centre can be invested for the benefit of the environment, society and the city's economy.
- It needs strong management and specialised workers teams to remove the rubble and secure the site.

5.2. Analysis of Proposed Site

In Tripoli city, there are approximately 19 army camps, these camps differ only in the pattern of uses. Some of them are for training, or storing weapons, and other

military uses and functions. Most of them are characterized by large open spaces, interspersed with some administrative buildings and huge warehouses.

The researcher chose one of these camps to achieve the proposal, for several reasons, which will be cited as strengths of the project. This site is called "the Naqliyah camp"; it was used as a centre for financing and exporting all the needs of other camps. Such as food, health supplies, logistical support, military support, and more. But it was subjected to very great damage and big sabotage.

The area of this camp is estimated at 722ha, and it is the largest camp in terms of area space and strategic importance. It is central to all Tripoli district municipalities, so it could be converting it into a central park of Tripoli city. The census has been determined for all district municipalities that would visit and will have benefited from this proposal, which are showing in (Table 11).

Table 11: Visitors Number that can Access The Site from each District Municipality. © Author based on Tripoli Population Census 2018.

Tripoli District Municipalities Names	Population Density
The City Center	1,641,500 people.
Janzour:	295,470 people.
Al-Swani	262,640 people.
Al Qaser:	328,300 people.
Ain Zara	393,960 people.
Tajoura	361,130 people.

Therefore, the Tripoli agglomeration populations are 3,283,000 people.

As well, we try to count the distance and the time arrives from the etching municipality to the site, as is showing in (Table 12) below.

Table12 : Distance and Time Arrive from Tripoli District Municipalities to The Site Proposal. © Author.

Districts Municipalities Names	Distance	Time Arrives
The City Centre	15 km	15 min
Janzour	14km	15 min
Al-Swani	6 km	7 min
Al Qaser	1.39 km	2 min
Ain Zara	9.50 km	9 min
Tajoura	20.35 km	21 min

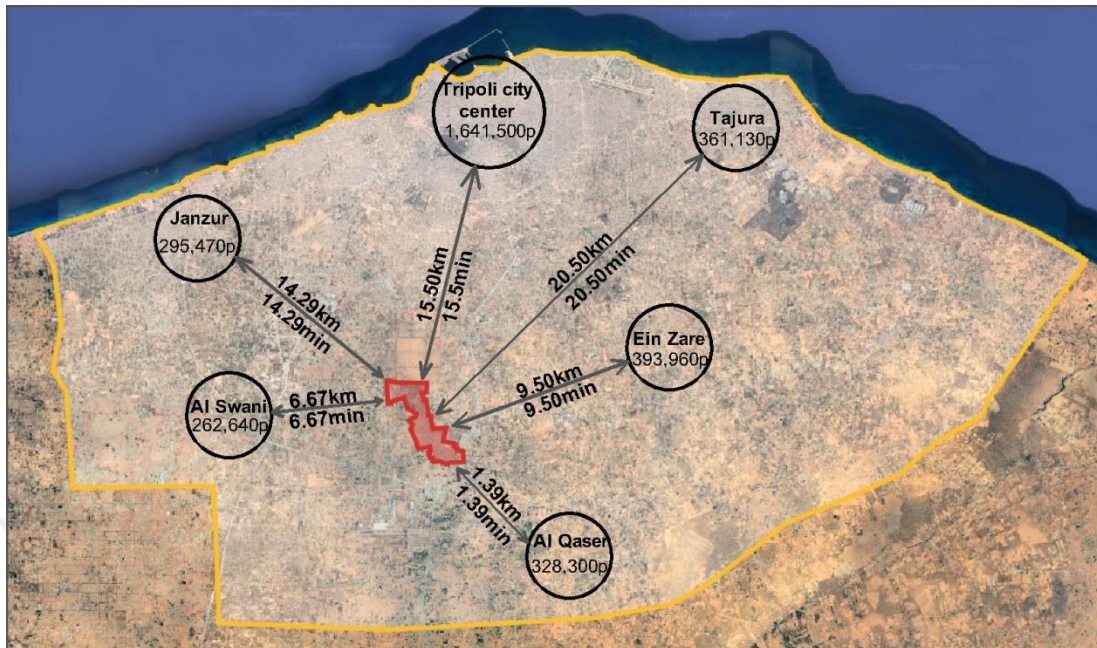


Figure 36: The Distance, Time arrival and Visitors Population. © Author based on Google Earth.

Considering that the roads leading to the site are dual main roads, and the average speed is 60 kilometres per hour. According to the permitted Traffic Law in Tripoli. This means that most of Tripoli's city residents can arrive in between 2 to 20 minutes.

The roads leading to the site are major arterial roads. such as, the west road that connects between Tripoli International Airport and the city centre, Also on the same line there will be a metro line, which will participate essentially for visitors to reach in a shorter time. From the east, there is the road of "Salah Al-Din, Qaser bin Gasher" which connects between the municipality of Qasr bin Ghashir and the municipality of Ain Zara to lead directly to the city centre of Tripoli. And from the south, there is "Al-Qasr Al-Sawani road" which connects between the two previous

roads and extends to the districts municipality of Al-Sawani and from there to the municipality of Janzour.

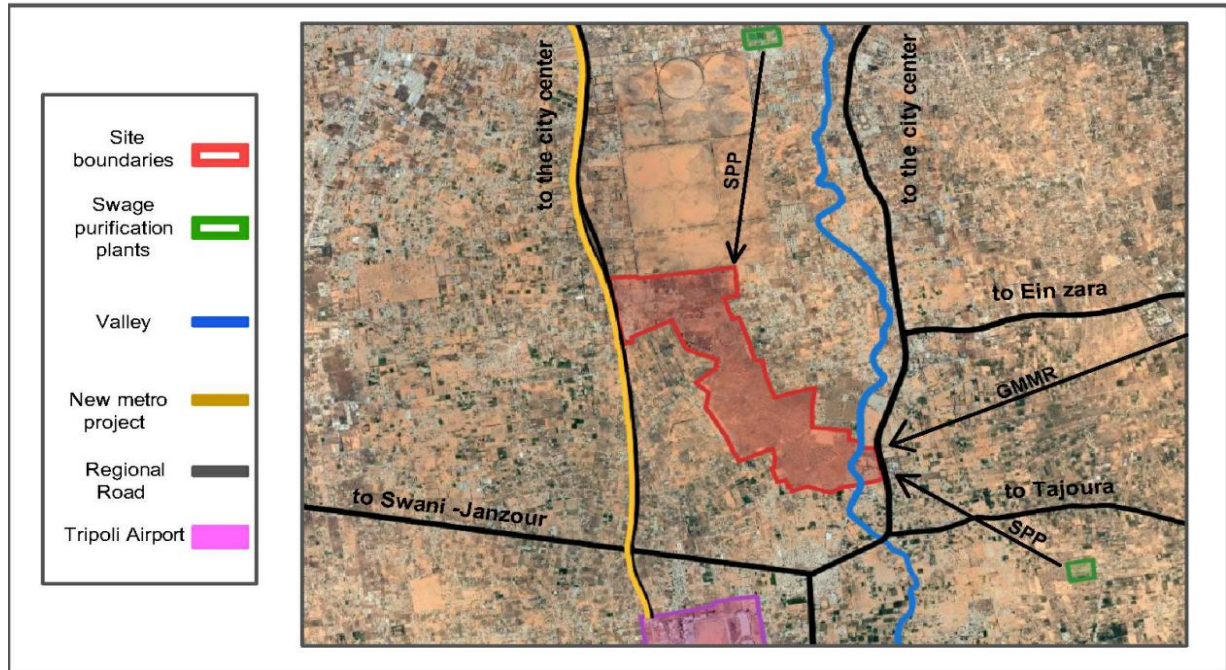


Figure 37: Roads and Water Resources Analysis. ©Author based on Google Earth.

For the geographical nature of the site, it is characterized by land flatness, and there are no plateaus or depressions. It should also be noted here, that a valley, called "Wadi Al-Majinin", passes through the site, and it is characterized that in the rainy seasons it is almost full. and this feature can be exploited well in water management for the project. Also, this site is located between two sewage purification plants, which are: "Alhadba SPP and Qaser bin Ghashir SPP". The details previously mentioned in the third chapter. Also, there is the main GMMR line that feeds Tripoli city main water tanks is very close to the site, which easily can provide drinking water in the site. So there are tree water resources that can take a benefit to feed the site (figure 34).

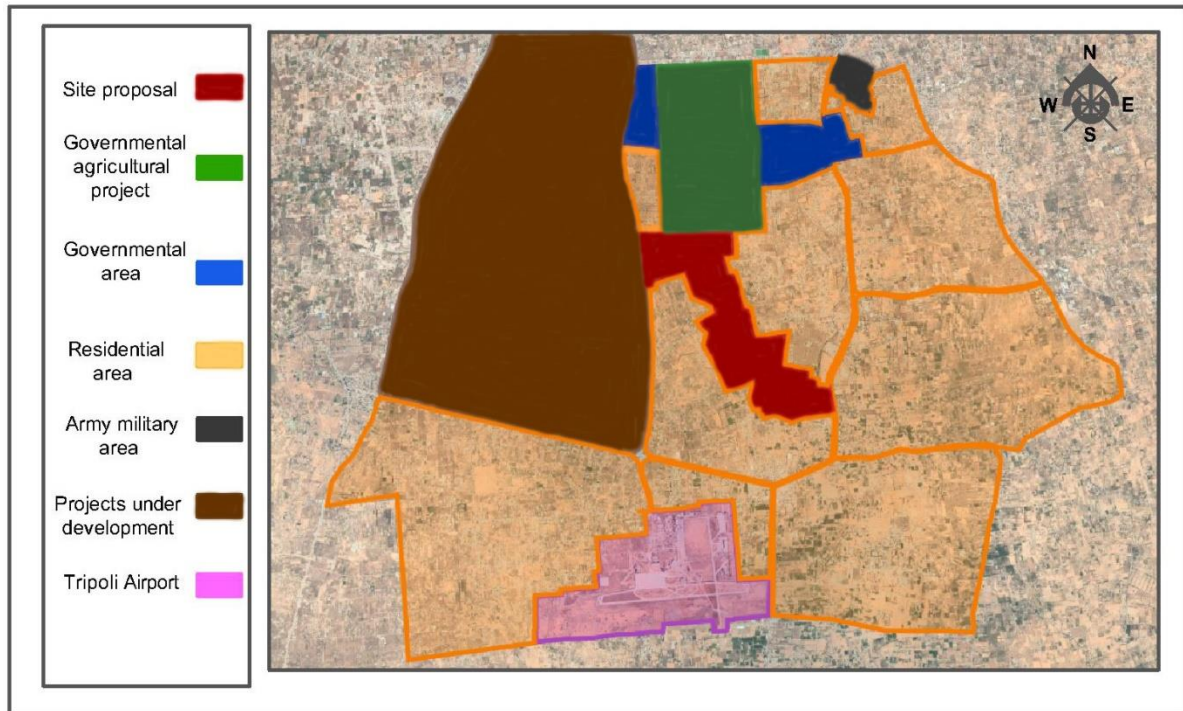


Figure 38: Existing Land-Use Zoning Analysis. © Author

The sounding existing land use can be identified on six classifications showing in (figure35). The northern side is bounded by a governmental agricultural project which feeds on "Alhadba SPP" and might facilitate the site agriculture. The eastern and southern sides are completely residential area free of open public places. There are some government buildings and land uses. And the " Yarmouk" military army site, which has been destroyed also. On the western side, there is a new project that included mixed uses, like housing, flats, malls, and others, it is a huge project that can bring in new users and visitors of the park proposal.

5.3. SWOT Analysis

SWOT analysis is a strategic planning tool used to evaluate the Strengths, Weaknesses, Opportunities, and Threats involved in a project or a business venture

or any other situation requiring a decision. It is logical to determine in this proposal, the strengths and weaknesses of the project, as well as the concerns and threats facing it, also, the opportunities that can be accessed.

Table 13: Proposal SWOT Analysis. © Author

Strengths	Weaknesses
• A large open space devoid of buildings can be invested as a central park for all greater Tripoli's municipalities. • There is fertile soil that holds opportunities for greening and vegetation support. • Flatland is easy to form with natural advantages such as a valley for rainwater, which can be used for a different purpose. • It is located between two sewage purification plants, which can be used for irrigation. • Society's desire to ending the weapons appearances, and evacuate camps presence inside the capital. • Strategic location; it is in the middle of all the municipalities of the greater Tripoli city, supported by an excellent main road network.	• Worn out and damaged vegetation Percentage is high, which requires great efforts to reconstruct the land. • The presence of war remnants and weapons remnants and rockets fragments that have not been removed, which should be removed carefully to start implementation. • Lack of specialized expertise capable of removing these mines and explosive remnants and securing the place. • Lack of previous experience in managing and implementing this type of project. • Poor maintenance and poor conditions of wastewater treatment plants working, which are proposed to be relied upon for the site's feed. And this is considered a strong threat to the

Ownership of the land belongs to the state, and it does not bear the trouble of compensating the owners.	sustainability process.
Opportunities	Threats
- Raise the economic level of the lands surrounding the project. - An attraction point that can relieve the burden and congestion in the city centre. - Create new job opportunities for the project. - Improving the environmental atmosphere of the city. - Creating hiking places, and sports practices zones and social communication to raise the health and psychological level of citizens.	- The project cost can be high. - The possibility of exposure to non-maintenance so will carry a negative effect on the sustainability of the project. - An increase in the seepage of seawater layers and turn an increase in the level of salinity in the land, which affects the efficiency and quality of soil for agriculture. - The increase in desertification and creeping from the south to the north of the region.

The existing area of open green spaces in the city is about 657,0401 hectares and the area of the proposed park site reach 722 hectares. That means if we combined this proposal with the area of the existing park can achieve 1379.0401 hectares of green public spaces in the greater Tripoli city. Also, that means it increased by 109 %, and we will obtain an increase in the per capita share to 4.2 m². And It is surrounded by good road networks that linking all Tripoli municipalities, and metro line, that directly contacting the city centre, which has the largest concentration of

population. Whereas the site has all the ingredients that allow it to be a sustainable central park of the city. If all the principles of sustainability have been applied.

Each of the strengths and opportunities available to this site has been shown as evidence that it is a typical site for the establishment of this kind of park that Tripoli needs. On the other hand, there are some weaknesses and some difficulties that can be faced, and we must address them as mentioned, which in turn may threaten the continuity and sustainability of the project.

5.4. Social Background

Culture

Libya is a very religious country where almost the entire population belongs to Islam which is visible in cultural activities. Approximately 97% of the Libyan populations are Muslims and this is evident in the cultural supply in the country and also in Tripoli city, where the most common cultural building within the region is the mosque.



Figure 39: Tripoli Cultural Life

There are non-religion cultural activities like Concerts that are generally held in the Public Square and the conference building Qaser Al Shab. The musicians are Arabs who play Arabic music. There are many theatres and cultural centres in Tripoli. Poetry evenings, public celebrations and cultural seminars are held in the cultural complexes. There are two big libraries in the city, the Libyan Jihad Center and the National Library for science and technology. There are no operas, concert halls or theme parks in the other Tripoli parts Most of the above activities are situated in the Tripoli centre. The community's interest in attending such events is very strong.

Urban Lifestyle

The supply of green areas and sporting facilities in Tripoli plays an important role in encouraging a healthy lifestyle. Since physical inactivity, due to the luke of walking and sports areas led to an increased risk of many chronic diseases, including

cardiovascular disease and diabetes, urban green planning is one means of improving the health of the population to reduce health risks in Tripoli city, there is a need to address of shortage of green public area to maintain the health life in Tripoli.

Libyan society, in general, is characterized by strong families bonding and a large circle of relationships. As they have a great ability to visiting public places. And Libyan families have traditional events like barbecues, especially on official occasions and holidays. Tripoli city is characterized by a moderate climate that encourages going out throughout the year.

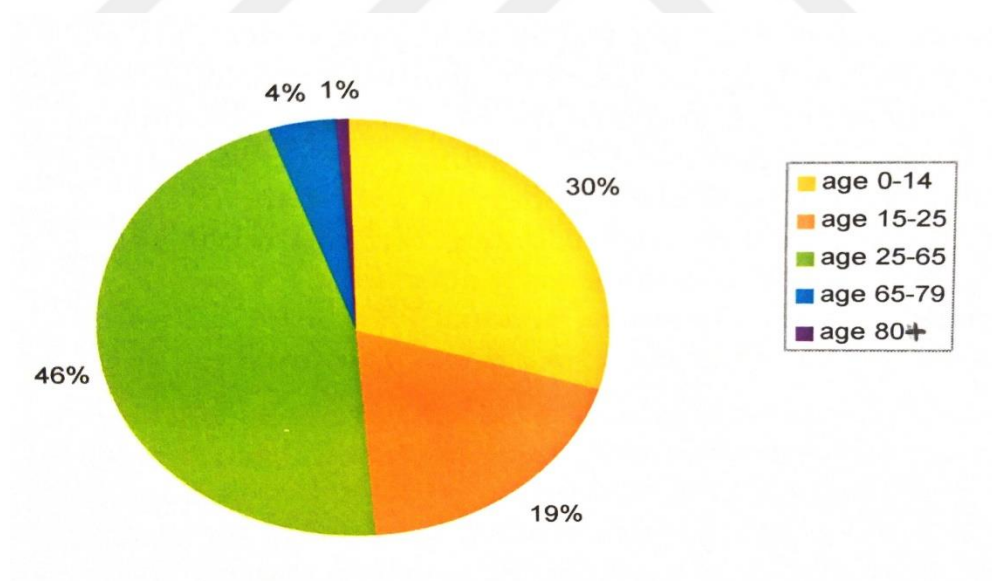


Figure 40 Social Activities in Tripoli City

Therefore, the lack of natural green spaces in Tripoli has negatively affected the social life and its relationship with nature. People feel suffocated and resort to getting out of the city to search for these spaces for hiking and camping sometimes.

Therefore, maintaining open spaces in Tripoli is one of the most important steps that must be focused on. And preparing them to be centres of attractiveness for citizens to practice their activities.

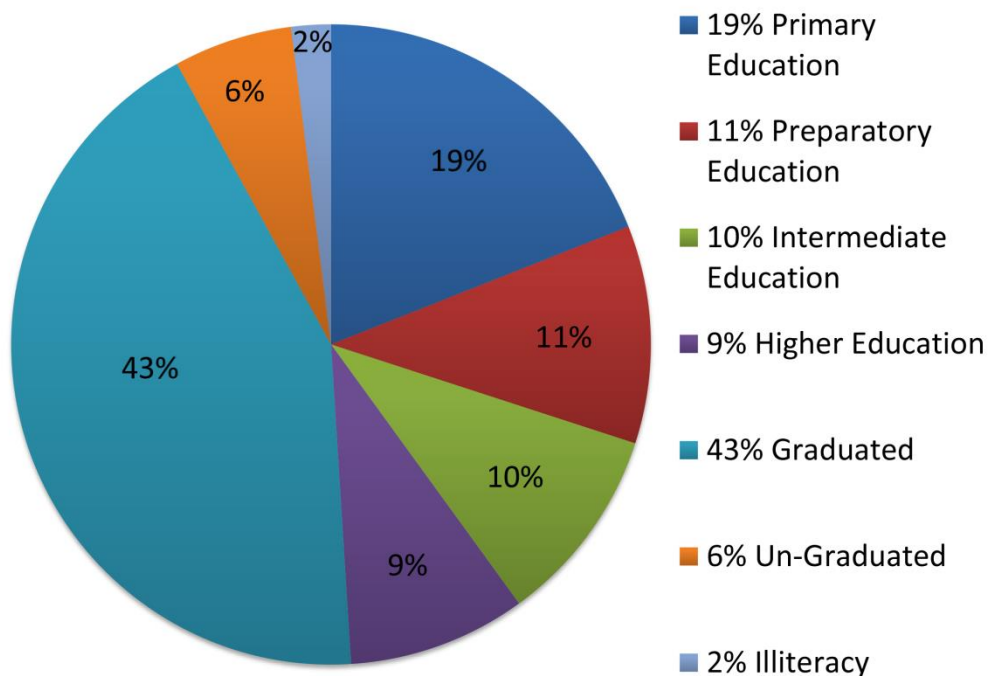
The population of Greater Tripoli is relatively young with almost 50 per cent of all inhabitants under the age of 25. Around five per cent of inhabitants are over 65 years, which is the age when most people retire. Only one per cent is older than 80 years.



Diagrams 3: Age Groups in Tripoli ©Author based on Libyan Urban planning Authority.

Education

According to the Libyan constitution, education is a principal right for all citizens and offered for free. Education is compulsory until the end of basic education, i.e. nine years, and those continuing to higher education are free to select any field of study.



Diagrams 4: Education Rate in Tripoli ©Author based on Libyan Urban planning Authority.

The education percentage in Tripoli is over 98 per cent, as it is a vital part of Libyan citizens' lives. The analphabetism rate does not surpass 2% in Tripolitania society, while it is roughly 5% in Libya as a whole.

The first 49%, which organize ages 6-25, are separated into elementary, university and higher education phases. As the image shows. The second generation, which accounts for 49 per cent who has finished and graduates 43 per cent of them, and just 6% of the overall age group between 25 and 80 years hasn't completed their university studies.

To support the goal of a sustainable environment the educational system must raise environmental awareness. Key environmental issues need to be highlighted in school curricula. Moreover, educational programs should be put in place at universities and in industries to allow for appropriate environmental training.

5.5. A Practical Ideas for The Redevelopment of The Affected Areas

Suggested

After analyzing and collecting all the information about the site, and taking ideas and principals foundations from previous studies that can be relied on, and proceeding from them to ideas for the reconstruction and redevelopment of the afflicted areas.

These ideas include different sustainable axes (environmental, urban, economic, social, and administrative) as well as defining the goal of each idea. It aims to develop a base of organizational ideas that can be used when starting reconstruction.

Table 14: Sustainable Strategy Proposals to Develop Post-War Areas.

Idea	Axis	Aim
Citizen participation	Social, Environment	• make suggestions • participate in decision making
Redevelopment Committee	Environment, Economic	• mission plan • Timetable • implementation plan
Empowering local enterprise capacity	Economic, Social	• decision-making ability • Providing specialized experts • Generate new ideas
Merging development and construction	Environment, Economic	• Reconstruction and development policy • ideas for development • Share experts and specialists
Local and international workshops	Economic, Social, Environment,	• Benefiting from countries experiences • Discussing new ideas • Discussion (before, during, after development)
Urban and architectural competitions	Social, Environment,	• Get as many ideas as possible • Create a spirit of competition and innovation • Benefit from experiences
Providing international support	Economic, Social, Environment,	• Reconstruction and development at a high level and performance. • Implementation of the redevelopment policy by international supervision.
A sustainable redevelopment policy	Economic, Social, Environment,	• A clear policy means successful development. • Auditing at all stages • Sustainable development on all fronts

One of the most important rules for reconstruction and development in the afflicted or destroyed areas due to the war is to set a clear strategy to start. The researcher has developed some ideas based on the dimensions of sustainability

(economic, environment, social), which can be integrated into these ideas and strategy with the sustainability criteria in design it when starting the stage of serious redevelopment.

5.6. Sustainable Criteria for Park Design

Sustainable landscapes development focus on creating an environment that is beneficial for both human uses and natural resource conservation in both the short and long terms. Ideally, it is in harmony with the entire environment, both above ground and beneath the vegetation and soils. More attention is focused on selecting appropriate native plants, minimizing human impacts on the environment, and on selecting other methods that will preserve the community's natural resources and character and improve the overall quality of life. Later the criteria will focus on the various components that make up a sustainable landscape, from identifying the area's natural resources to managing for better wildlife habitat.

The central parks are distinguished at the city level, as they contain areas large enough to isolate them from the city noise and attendance, and visitors usually come to them to enjoy the scenery and its accompanying activities. Therefore, you should focus on this point and design the contents of the park to achieve this main purpose, and qualify it to be the central park of Tripoli city. which we can take advantage of main criteria application in international parks examples have, that we have been mentioned in chapter two.

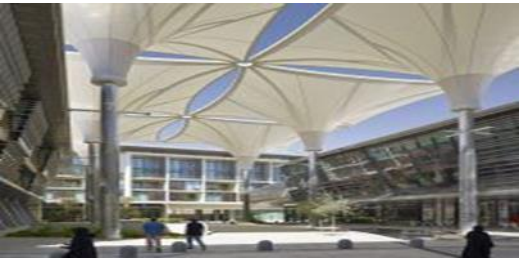
The following suggestions highlight various principles to consider when designing and landscaping sustainably. Each suggestion could be used separately for an area that has a modest budget and staff, or the suggestions can be combined to

create a landscape that protects and enhances all of its natural resources while still providing for human uses.



Table 15: Criteria and Principles of The Park Design

Craiteria	Principles/steps	application Places / elements	Examples
Natural sources	- The natural formations on the site must be incorporated into aesthetic interactions with landscaping redevelopment and taking into account simplicity in design. - Keeping high-quality soils that hold water and provide adequate nutrient for plants. and Ensure that if new soil is certified as weed-free. Good quality soil reduces fertilizer and additional irrigation requirements. - Managing groundwater immediately and strictly, limiting its use for drinking only. - Investing rainwater and managing it by taking advantage of the valley's, and collecting it from the roofs and Shades-canopies of the buildings in other areas.	- Hills - Nature reserve - Soil - Groundwater - Valley - Riane water	
Flora	- The geographical location of the city is generally characterized by fertile soil for agriculture and the mild climate of the Mediterranean so that many types of foreign plants can be a settlement. This property should be well invested. - Plant cultivation and conservation of native plants, which do not need much effort in preserving, trimming and irrigating because they are adapted to the natural climate in Libya, its important role in releasing oxygen, absorb toxic gases, improving air quality, and noise absorption. - Reducing turf to those areas which are essential for recreational and social activities use. Furthermore, turf maintenance can adversely affect the surrounding environment and require a lot of mowing, watering and fertilization. - Invasive plant species are identified and removed as far as possible. Invasive plants affect natural habitats in several ways. It grows so strongly and spread so quickly that indigenous plants are eaten up.	- Foreign Plants - Native Plants - Fertile Soil - Turf and Grass - Organic- Fertilizer	 

Criteria	Principles/steps	application Places / elements	Examples
Urban& park-landscape	• Areas for recreation and interment s grassy and green areas interspersed with attractive designs of trees and flowers. • Part of the park should be devoted to family picnics and barbecue should be allocated from the hustle and bustle of the city, where they are isolated from the rest of the facilities. To be the destination of people on the holidays. • All of these elements mentioned must be connected to a network of roads dedicated to cars, to cycling and others dedicated to walking as pedestrian paths.	• Waking area • Bicycle lines. • Cars lines. • Garden. • Fountains &Ponds. • Facilities • Playgrounds • Pathways	
Green park furniture	• Use of materials that reduce environmental pollution and carbon emissions in park furniture. like Dealing with natural resources as inputs and preserving them through reduction, reuse and recycling. So that its design reflects the level of the place and is in constable with the nature of the site. • Street lighting and squares, spotlighting on important buildings, fountains and monuments.... and others). Modern techniques must be used, such as the use of environmentally friendly LEED lighting, or the lighting poles derive energy from solar panels distributed in the site or be self-generating. • Parking spaces. Where you can take advantage of these elements by distributing solar panels in the form of car umbrellas. As it has dual functions, namely protections from the strong sunlight that characterizes the city's climate and invests it by collect this energy and distribute its supplies to the needs of the site. • Minimizing non-porous surfaces such as roads, car parks, and paved roads. and replace with the porous floor, crossroads, gravel and indigenous vegetation. Porous surfaces are used for water refuelling, erosion reduction. • Designing solar shades to facilitate rainwater collection, and distributing it in the place to protect from the sun's rays. • Segregation of waste is one of the most important points. it can be recovered and reused on site. (Fertilizers, recycled materials).	• Seats • Bollards. • Kiosks. • Benches. • Fountains. • Bridges. • Signs. • Kiosks. • Enviro-wastebaskets • Leed light. • Fountains. • Shades canopies - items.	  

Craiteria	Principles/steps	application Places / elements	Examples
Social Recreation factor	- People's interaction with the park is the social value with which the park's success can be assessed. This can be achieved by providing suitable places for gatherings such as open sports clubs, competitions and festivals, theatre performances and parties. - Encourage neighbourhoods and intimate relations among the citizens, which strengthen their sense of belonging and familiarity to their areas of residency.	- Barbecue zone - Policy station - Carnivals - Walking tours - party areas - open sports clubs - competitions - Theatre performances - Outdoor Theatre - picnics area. - Playground - Restaurants / Cafes	  
Green construction	- Designing it consumption and simulation of nature and local identity as much as possible, and not using complex shapes. - It is recommended to respect the principles of sustainable architectural design in these facilities. - The roofs buildings should be designed to collect rainwater, and control use as drinkable water.	- Building ventilation - Water management - Renewal energy - Natural materials - Recycling materials	

Criteria	Principles/steps	application Places / elements	Examples
Sustainable systems	• Use of sustainable systems in all facilities. • To provide natural lighting in the building, you can invest the sun's rays and use light tubes, instead of electric lighting. • Distribution of solar panels on the roofs of utilities or the southern facade of the buildings, the due sun shines on them for the longest time of day. • Reuse of water is known as (grey water) in irrigation and feeding artificial ponds and lakes. • Control the temperature of the buildings through the correct orientation, by adopting the green wall and roof systems. • Using environmentally friendly materials in the process of constructing buildings in the site, as an aim of reducing emissions and sustainability. • Using human waste from toilets as organic fertilizer for plants. • Using natural cooling and heating systems by using water and underground-land temperatures as a technique(Heat pump) If necessary.	• Light tups. • Solar energy. • Greywater systems. • Wind energy. • Green roofs. • Green walls. • Natural or recycling materials. • Compost toilet. • Heat pump(cool& hot).	  
Construction redevelopment area	• It is proposed to place monuments or memorial in the central square of the park, contains an identification plate of the place and mentions the goal of a diversion to be sustainable green areas. • Preserving all constructed facilities as much as possible, if not destroyed. And the pattern of using these buildings changed as a kind of challenge to the humanist sustainable architectural vision. • weapon store, which was warehouses for ammunition and missiles, can be reused and design as indoor playgrounds or indoor swimming pools. • Any historical building, natural monument, and old trees should be preserved and emerged in the design processes of the park.	• Weapon store. • Old-Administration buildings. • Soldiers Camp.	 



5.7. Park Land-Use Zoning Proposed

The area of the site was divided into several zones, in each of them expresses the most important criteria and activities that should be provided on it. We will mention the most important ones

- The construction redevelopment zone, was identified in that area for several reasons, including This area was the main part of the old camp, and several buildings were not significantly damaged by the bombing. So, These buildings can be transformed to be a source of awareness and education and cultural centres for examples. Also, there are many huge warehouses were built of concrete, which can be converted into exhibition halls and theatres.
- The natural wooded area and the picnic area were selected to be defined in the southern side, due to the availability of natural terrain and also the valley's passage from that area, which gives it a distinctive natural value.
- The Sports Zone has been identified in that area due to the area surrounding is high density populated. Where they can easily enter the sports area and do exercise daily.
- for the other areas, there is a possibility to change according to the designer vision in the future. this zoning presented only the idea of the author and it could be replaced or developed in the future.

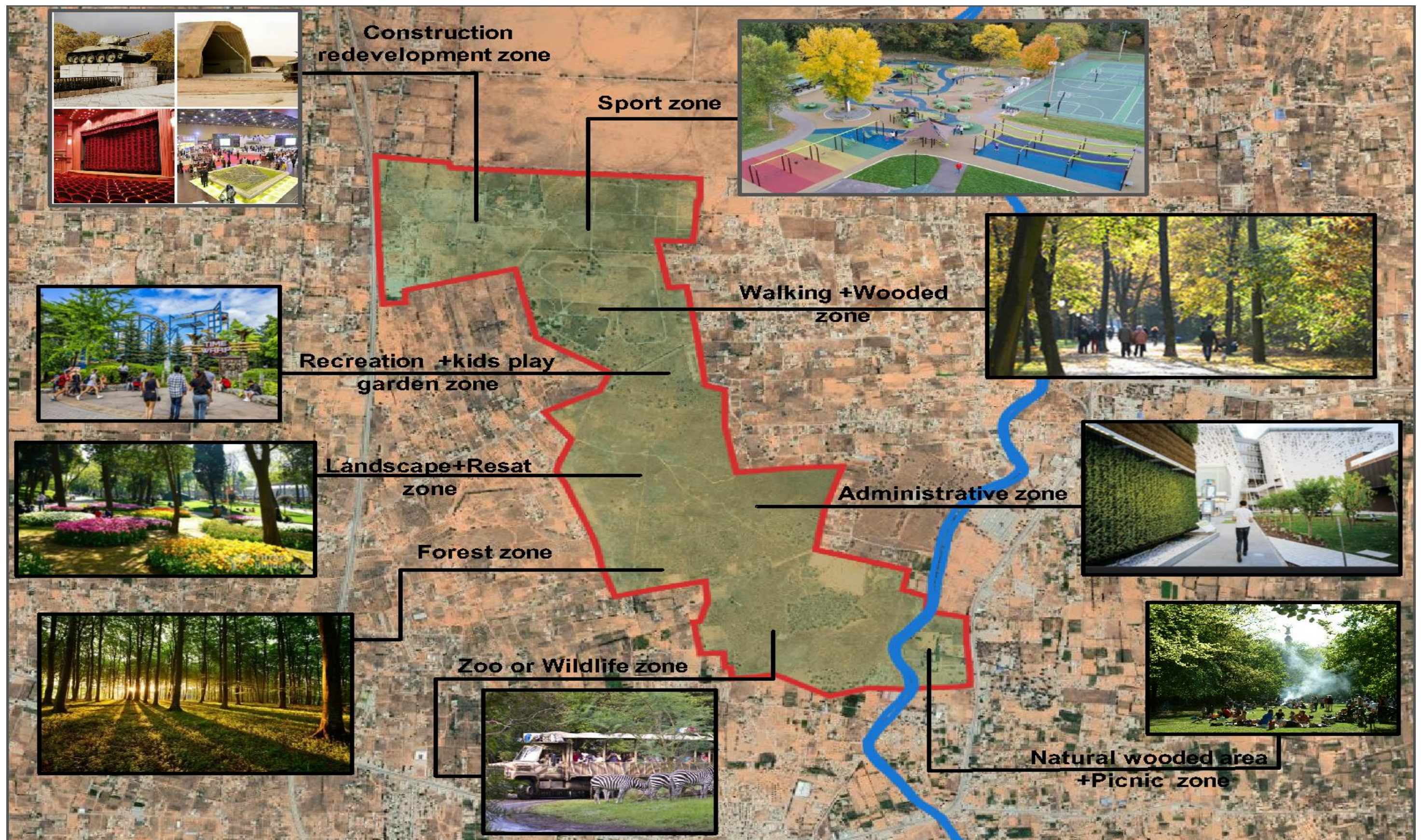


Figure41 Proposal Ideas and Criteria Zoning. ©Author based on Google Earth.

VI . CONCLUSION

6.1.Result

At the beginning of our study, we studied the concept of the Thesis study that focused on post-war development and ecological and sustainable development, as a concept and finding the strategy and the policy to applying them .

The reason for choosing this subject was for applying an ecological and sustainable landscape on destroyed military sites, as a post-war development .

In the research methodology, we used the descriptive and analytical approach, then after that, we present a proposal as a kind of develop an environmental vision and merging these sites in the urban fabric of the city, as well as, a solution of green public spaces shortage.

The research questions raised in the context of this study were evaluated and the results summarized. we found the results as follows:

The first research question: What are the concepts and key requirements, that should understand by urban planners to redevelop destroyed sites?

- The concept of post-war development and reconstruction is originally a process of participation, competition, planning and then development and reconstruction.
- The post-war development phase depends on the importance of developing a clear-cut local vision and defined development strategies and policies by stakeholders responsible for redevelopment. so thinking

for development planning for each area separate, taking into account the amount of destruction that has affected, and determining what the site or area needs from one of the available redevelopment policies, is one of the first major success points of development.

- Achieving sustainability in the post-war development stages with all its economic, social and environmental axes is the key to success.

The second research question: What is the theoretical conception of ecological and sustainable landscape development, and how can take it up in the planning of green public spaces?

The Theory of sustainable landscape is the framework that highlights biodiversity and promotes energy efficiency and renewable energy as a steward of resource efficiency and green performance to raise the environmental value of the city .That is by providing adequate green spaces for the inhabitants of these cities, and ensuring that the individual has access to these spaces open to the public. Also, confirm that the quality and the sustainability of these spaces is the main key to achieve satisfying live quality. And also to focus on the importance of planners, architects and all of the society members trend to support the existence, creation and implementation of it .Due to the impact on society on the health and behaviour of people, and also have a positive impact on the local and regional environment in general.

For the Tired research question: How can the international expertise in "ecological sites " be helpful for Libyan cities to develop the postwar areas in a sustainable Landscape way?

We reached several points, including:

- These experiments provided a prelude and an introduction to the process of applying both the concepts of redevelopment and the application of sustainable design standards in the landscape. and learned explored what suits the Libyan situation to apply in the destroyed military sites, as the stage of pos-war development.
- Learn about their strategies in redevelopment, take advantage of their pros and avoid their negativity.
- The American example was the importance of having this green space in the heart of the city as it is the lung in which it breathes most populous city in the world, and how supporting the economic situation of the city, and the interaction of society, as well as, it is having the most important standards of sustainable environmental development.
- the German example succeeded in implementing the post-war development phase and succeeded in integrating the axes of sustainability in this process, including the integration of society and the preservation and development of the environmental situation, which had an economic impact.
- where it helped take great advantage of these experiences in developing ideas and strategies for this stage in Libya while setting the appropriate standards for the Libyan situation.

According to the Fourth research question: What are the difficulties facing achieving ecological landscape development in Tripolis demolished military sites?

The answer can be summarized in the following points:

- decadent and damaged vegetation Percentage is high, which requires great efforts to reconstruct the land.
- The presence of war remnants and weapons remnants and rockets fragments that have not been removed, which should be removed carefully to start implementation.
- Lack of specialized expertise capable of removing these mines and explosive remnants and securing the place.
- Lack of previous experience in managing and implementing this type of project.
- Poor maintenance and poor conditions of wastewater treatment plants working, which are proposed to be relied upon for the site's feed. And this is considered a strong threat to the sustainability process.
- The project cost can be high.
- The possibility of exposure to non-maintenance so will carry a negative effect on the sustainability of the project.
- An increase in the seepage of seawater layers and turn an increase in the level of salinity in the land, which affects the efficiency and quality of soil for agriculture.
- The increase in desertification and creeping from the south to the north of the region.

Regarding the fifth question: How we can reduce the shortage of green area in Tripoli city?

After analysing the existing green spaces in Tripoli we found it is about 657,0401 hectares. and the area of the proposed park site reaches 722 hectares. That means if we combined this proposal with the area of the existing park can achieve 1379.0401 hectares of green public spaces in the greater Tripoli city. Also, that means it increased by 109 %, so as a result, we will obtain an increase in the per capita share to 4.2 m². It should also be noted, that this proposal could be applied to about 19 other military sites. And instead, we can ensure that the shortage of these important areas in the city is filled.

And for the last research question: What are the sustainable principles or criteria that can be used to improve the landscape of a destroyed area in Tripoli?

A criteria matrix have been set, with an explanation of the steps and principles, as well as the elements used in applying these standard and sported by some figures. it was selected based on focusing on creating an environment that is beneficial for both human uses and natural resource conservation in both the short and long terms. Ideally, it is in harmony with the entire environment, both above ground and beneath the vegetation and soils. More attention is focused on selecting appropriate native plants, minimizing human impacts on the environment, and on selecting other methods that will preserve the community's natural resources and character and improve the overall quality of life.

The mentioned suggestions highlight various principles to consider when designing and landscaping sustainably. Each suggestion could be used separately for an area that has a modest budget and staff, or the suggestions can be combined to

create a landscape that protects and enhances all of its natural resources while still providing for human uses.

In the context of this study, the mine hypothesis, followed by sup-hypothesis indicates the relation to the methodology and questions results:

- **The mine hypothesis:** "There is a possibility to turn up the destroyed military areas into gardens and parks to reduce the shortage of green areas in the city." is confirmed as being with the answer to the fifth question of the thesis.
- **The Sub-hypothesis:** "Improve the damaged land ecologically, can be addressing the harsh climate and desertification in the region and increase the greenery in the city. By using sustainability principles, destroyed military areas can improve, and Integrate within the urban fabric of Tripoli city." And "Encourage the sustainability concept in Tripoli city by applying in the demolished area and public places and passing it to the other areas in the city in the future." Are confirmed as being with the answer to the sixth question of the thesis.

6.2. Conclusion

At the beginning of our study, we studied the concept of the Thesis study that focused on post-war development and ecological and sustainable development, as a concept and finding the strategy and the policy to applying them . The reason for choosing this subject was for applying an ecological and sustainable landscape on destroyed military sites, as a post-war development .

After the study, we found that the demolished military sites can be improved and developed in sustainable and ecological vision, and merged in Tripoli city urban fabric. to be a green landscape public areas to cover the shortage and to reflect the environment, social and economic benefits on the city. by following some criteria that have been defined in the last chapter. The presented proposal idea can be implemented in each army site and it will lead to solving the shortage of green spaces in Tripoli and merging these sites into the city fabric. And It can meet all social, economic and environmental city requirements.

6.3. Recommendations

1. Raising the community's awareness of the need to maintain the sustainability of green spaces through seminars, workshop and education.
2. The necessity of the participation of institutions and the local community in the development process.
3. Management, conservation and sustainable development of destroyed lands are important due to their inside the urban land which surrounded by Residential area that makes it difficult to create new open areas inside the city. Libyan's authorities should carry out a comprehensive survey for all this land, and protect it, as well as, inclusion in the redevelopment plan.
4. The entire policy on the agricultural sector needs to be adjusted in terms of long-term sustainability. The question is how agriculture should be managed and developed so that also future generations will benefit even when the non-renewable groundwater resources, that supply the GMMR and other irrigation systems, are depleted.

5. Water sector: The desired water resources management policy should be economically viable, environmentally sustainable, and socially equitable. to reduce the water shortage and to limit the deterioration of the water quality, especially those on the coast.
6. Renewable Energy: The Tripoli region as a whole has great potential for renewable energy, both solar and wind energy, which may be utilized in many applications. The use of renewable energy resources will lead to a cleaner environment, help reduce its contribution to global warming and will also reduce oil consumption.
 - Wind Energy: The mean annual average wind speed in the Sub-region is in the range of 6 m/s at the coast, according to measurements made at Tripoli Port. This wind speed is suitable for medium-size wind turbines which may be used for pumping water and generating electricity. However, research work should be promoted to investigate wind energy potential along the coast.
 - Solar Energy: The Tripoli region enjoys long periods of sunshine and warm weather. However, thermal heating elements may not be suitable for the central parts of Tripoli because the main type of building is multi-storey houses, Solar thermal heating would be widely used in the outskirts of Tripoli, though, which are characterized by one storey buildings, Photovoltaic cells can be used for street lighting and seawater desalination.
 - Pilot research projects are recommended to evaluate the profitability of using solar energy for several uses.

All of the mentioned use of energy resource, maintain and serve the goal of creating many parks and open green spaces. This what the thesis emphasizes.

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