ISTANBUL OKAN UNIVERSITY

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DEVELOPING ECOLOGICAL URBAN PLANNING MODEL FOR AFRICAN SAHARA REGION, CASE OF ADRAR CITY - ALGERIA

A Dissertation submitted by

CHOUAIB GUERROUT

Thesis for the degree of

DOCTOR OF PHILOSOPHY IN ARCHITECTURE

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Program: Architecture

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AFRİKA SAHRA BÖLGESİ İÇİN EKOLOJİK KENT PLANLAMA MODELİNİN GELİŞTİRİLMESİ, ADRAR KENTİ ÖRNEĞİ - CEZAYİR

A Dissertation by

CHOUAIB GUERROUT

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ABSTRACT

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The aim of this research, propose an urban planning model, with taking into consideration the green infrastructure strategy and social-ecological memory as principal factors, this model also can be teak in consideration the Sahara African geography with the hypothesis that New Urbanism is a sustainable alternative to the classical planning movement. For this research, in the proposed model, it has been taken into consideration the green infrastructure strategy and social ecological memory as principal factors. The case study was chosen due to the presence of diverse urban patterns in the same urban settlement. In addition to the environmental, social, economic, and urban design problems that it suffers from.

Considering that ecological planning depends primarily on ecosystem relationships, the research focused in its first part on explaining the ecosystem of the African Sahara and its characteristics, in addition to focusing on the case study and analysis of environmental, social, economic, data.

Theoretically, ecological planning was a response to the environmental problems in European and American cities. Unfortunately, these theories did not consider the cities of the south of the world that suffer from the effects of climate change, famine, global warming, and illegal immigration. However, in addition to the lack of empirical evidence for these theories, the second part of the thesis focuses on the theoretical evaluation of the ecological planning theories and the critical analysis of similar examples in different settings.

Through an analysis of the traditional urban model, which showed efficiency in terms of urban ecological sustainability and resilience, a morphological analysis was necessary to determine the ecological factors that permitted for this system to persist for many centuries and adapt to social and political changes. In addition to considering the social ecological memory, which is an important factor for achieving sustainability in this harsh ecosystem, which this study aims to integrate it in the urban model proposed. The study relied on the principles of the green infrastructure strategy for two main factors. The first is that green infrastructure is the physical carrier of ecological memory, and the second is that the green infrastructure strategy is an emerging strategy that aims to benefit from ecosystem services in cities.

Based on the previous parts of the thesis, which relied on the theoretical analysis of ecological planning theories and applied analyses of the case study, the ecological planning model for the African Sahara cities has been determined, to be tested through the case study.

During this study, given the complexities of the urban planning phenomenon, it was necessary to rely on the available modern technologies, such as the use of the GIS system. In addition to the spatial analysis, a software application has been designed that reveals the status of the sustainability, ecology, social memory, and green infrastructure indicators of the study area with measurable parameters, as well as enabling a clearer analysis of environmental data at every point of the city.

The concluding part of the thesis explains a series of recommendations in the form of chart and model of African eco-cities. According to these models, a practical framework has been developed to adopt a communicative rationality in the current planning system and to facilitate the planning process of an eco-city programme in the field of plan-making, implementation, and monitoring. The study also aims to contribute to stakeholder engagement by developing an innovative approach that deals with the new vision of urban planning in African cities and building consensus against the obstacles to active social activities in the development of the eco-city.

Keywords: Ecological urbanism, green infrastructure, social ecological memory; decision making; indigenous knowledge; ecological indicators; water management.

KISA ÖZET

AFRİKA SAHRA BÖLGESİ İÇİN EKOLOJİK KENT PLANLAMA MODELİ ONERISİ ADRAR KENTİ CEZAYİR ÖRNEĞİ

Bu tezin amacı, Yeni Şehirciliğin, klasik planlama akımına karşın sürdürülebilir bir alternatif olduğu hipotezi ile Sahra Afrikası coğrafyasında kullanılabilecek yenilikçi bir ekolojik planlama modeli belirlemektir. Bu araştırma için önerilen modelde yeşil altyapı stratejisi ve sosyo-ekolojik bellek temel faktörler olarak ele alınmıştır. İçerdiği kentsel örüntü çeşitliliği ve çevresel, sosyal, ekonomik, kentsel sorunlar nedeniyle güney Cezayir'deki Adrar şehri modelin sınanacağı örnek alan olarak seçilmiştir.

Ekolojik planlamanın öncelikle ekosistem ilişkilerine bağlı olduğu göz önüne alındığında, araştırmanın ilk bölümünde Afrika Sahra ekosisteminin özellikleri açıklamış, ayrıca çalışma alanının çevresel, sosyal, ekonomik ve sosyal verilerinin analizine odaklanılmıştır. Teorik olarak, ekolojik planlama, dünyanın kuzeyindeki şehirlerin karşılaştığı çevre sorunlarına bir yanıttı. Ne yazık ki bu teoriler, iklim değişikliği, kıtlık, küresel ısınma ve yasadışı göçün etkilerinden muzdarip dünyanın güneyindeki şehirleri hesaba katmadı. Bununla birlikte, bu teoriler için ampirik kanıtların bulunmamasına ek olarak, tezin ikinci bölümü, ekolojik planlama teorilerinin gelişiminin teorik açıdan değerlendirilmesi ve farklı ortamlardaki benzer örneklerin eleştirel bir yaklaşımla analizine odaklanmıştır.

Kentsel ekolojik sürdürülebilirlik ve dayanıklılık açısından etkinlik gösteren geleneksel kent modelinin analizi yoluyla, geleneksel sistemin yüzyıllarca varlığını sürdürmesine ve sosyo-politik değişimlere uyum sağlamasına izin veren ekolojik faktörleri belirlemek için morfolojik bir analizin yapılması gerekliydi. Ayrıca, bu toplumun en zorlu

ekosistemde sürdürülebilirliğe ulaşmasına yardımcı olan ekolojik belleğin deposu olarak sosyo-ekolojik hafıza bileşenlerinin analizi, bu araştırmada önerilen modelin bir diğer yönüdür. Çalışma, iki ana faktör için yeşil altyapı stratejisinin ilkelerine dayanmaktadır. Birincisi yeşil altyapının ekolojik belleğin fiziksel taşıyıcısı olması, ikincisi ise yeşil altyapı stratejisinin şehirlerde ekosistem hizmetlerinden yararlanmayı hedefleyen yeni ortaya çıkan bir strateji olmasıdır. Ekolojik planlama teorilerinin teorik analizine ve alan çalışmasının uygulamalı analizlerine dayanan tezin önceki bölümlerine dayanarak, alan çalışması yoluyla test edilen Afrika Sahra şehirleri için ekolojik planlama modeli belirlenmiştir.

Bu çalışma sırasında, kentsel fenomenin karmaşıklığı göz önüne alındığında, CBS sisteminin kullanımı gibi mevcut modern teknolojilere güvenmek gerekiyordu. Ayrıca çalışma alanının sürdürülebilirlik, ekoloji, sosyal hafıza ve yeşil altyapı göstergelerinin durumunu ölçülebilir parametrelerle ortaya koyan, bunun yanı sıra şehrin her noktasındaki çevresel verilerin daha net analiz edilmesini sağlayan bir yazılım uygulaması tasarlanmıştır

Bu çalışmanın en önemli sonucu, tezin son bölümünün gösterdiği gibi, Afrika ekokentlerinin şeması ve modeli şeklinde bir dizi tavsiyedir. Bu modellere göre, mevcut planlama sisteminde iletişimsel bir rasyonaliteyi benimsemek ve plan yapma, uygulama ve izleme alanında bir eko-kent programının planlama sürecini kolaylaştırmak için pratik bir çerçeve geliştirilmiştir. Çalışma ayrıca, eko-kentin gelişiminde etken sosyal faaliyetlerin önündeki engellere karşın bir fikir birliği oluşturma ve Afrika şehirlerinde yeni kentsel planlama vizyonu ile ilgilenen yenilikçi bir yaklaşım geliştirerek paydaş katılımına katkıda bulunmayı hedeflemektedir.

ACKNOWLEDGEMENT

It was a long journey. I still clearly remember the day when I arrived in a city in the desert of Algeria, which was north of my city, and I remember the summer of 1995, when I decided to join the Faculty of Architecture, when I met professors who studied in Algerian and European universities.

I am Chouaib Guerrout. I am Architect was born in Algeria. I achieved MA degree in architecture at University of Science and Technology Oran. My experience mostly focused on ecological urbanism, sustainable architecture, and heritage architecture. I joined the city of Istanbul, the city that I love so much, which is the city where East meets the West, the city of Sultan ahmed, Fatih Sultan Mehmed, Eyup Sultan and Hagia Sophia, and Mimar Sinan, to complete the doctorate degree, this thesis is the result of many years of work. But this work would not have been possible without the support of many people, and their leader, my dear brother Hadj Mohammad, who was a strong support for me. Which is afflicted to leave life and I am far away, I have been very painful, I decided to dedicate this work to his pure soul. Also, I would like to express my gratitude to the soul of my father and to my dear mother; my family members my sisters and brothers specialty hadj AISSA Also to SS.

My sincere gratitude goes to my advisors, Dr. Bahar, Prof. Dr Azime Tezer, and. Prof. Dr Mehmet Emre Aysu.

Dr. Bahar was with me in every step throughout my graduate studies. She is a sincere mentor who wholeheartedly supported me to develop my intellectual curiosity while also advocating for rigorous research. She has helped me to turn my thoughts into a thesis and find my own voice of thinking among existing theories. She has never stopped providing critical comments and constructive suggestions. And their enthusiasm for research sets an example for life. Dr. Bahar she is a kind of researcher who I hope that they succeed and that I can work with them on an academic team. She is encouraging me to be ambitious in developing a long-term research agenda and helps me in developing scientific and academic plans. Her vision of ecological urbanism has influenced my research in many aspects.

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ABBREVIATIONS

AADL National Agency for Housing Improvement and Development

ACL Agglomeration capital

APC Communal People's Assembly

AS Agglomeration secondary

AUIC Intercommunal urban agglomerations

CES The Ground Footprint Coefficient

CFPA Centre of professional formation

COS The Land Occupancy Coefficient

DSA Agricultural Services Department

DUCH Directorate of Town Planning, Construction and Housing

EM Ecological memory

ESS Eco system services

EU Ecological urbanism

FWA French West Africa

GI Green infrastructure

GIS Geographic information system

HOZ Home Ownership Area

HUD Housing and Urban Development

INSFP Institute national superior

LEED Low Energy Electron Diffraction

LID low-impact development
LTER- Long-Term Ecosystem Research

OCD The average occupancy rate

ONR National office of reconsent

OPGI Real Estate Promotion and Management Offices

PDAU The master plan for development and town planning

PSS Special South program

RGPH Stands for General Census of Population and Housing

SAU Sectors to be urbanized.

SES Social and environmental systems

SNU Non-organizable sectors

SRAT Regional planning diagram

SU Urbanized sectors

SUF Sectors of future urbanization

TOC Class occupancy rate

TOL Housing occupancy rate

UAA Useful agricultural area

UGI Urban green infrastructure

UK United Kingdom

UNFPA. United Nations Population Fund (formerly United Nations Fund for Population Activities)

ZE Sparse area

VOS viewer is a software tool for constructing and visualizing bibliometric networks.

I. INTRODUCTION:

Today, 55% of the world's population lives in urban areas[1], and by 2050, about 75% of the population will live in urban areas, where the problem of providing sustainable energy is one of the most important challenges facing the future of society.

Rapid urban growth in the developing world is placing enormous demands on food systems. Cities expand into fertile land increasing the food needs of urban families competing for natural resources such as land and water.

Sustainable development goals provide specific objectives to be achieved within a time limit in the main major sectors, Such as health, education, labor, energy, infrastructure, environment, so in all countries.

There is no other place in the world need to achieve those goals more than the continent; Although some progress in some areas and countries is generally encouraging, the region needs to double its efforts if they wish to achieve sustainable development goals by 2030. For African States to succeed; It needs to establish effective and coordinated partnerships for the localization of sustainable development goals, to achieve the full transformation of the ecosystem to planning and implementation mechanisms at the national and regional levels, as well as the implementation of the African Union agenda for 2063 and filling large gaps in funding and availability data.

Improving the use of sustainable technologies in urban areas can play a major role in reducing energy needs in addition to reducing the effects of urban population growth on

[1] UN web site

global energy consumption and climate change issues, addressing effective solutions, and working towards finding a model for cities that are more environmentally efficient.

I.1 Problem Statement and Justification of the Research Project

The KSOUR antique centres of the Algerian Sahara located along the road of communication. Many centuries ago this settlements permitted the creation of comercial exchange between the Mediterranean coast and sub-Saharan Africa. The desert areas in the Africa are characterized by the harshness of natural conditions, but man in these areas has been adapted to these conditions. The traditional sustainable irrigation system played an important role in creating desert settlements. However, over the course of the past few years the Saharan city in South of Algeria currently lives several problems for the following reasons:

- the deterioration of the standards of living in KSAR[2], because of no existing of infrastructures: lack of energy; sanitation facilities, potable water, and roads networks.
- No adaptation of new urban pattern (extension of KSAR) to climatic and cultural conditions of habitants, especially the improvement of living conditions.

[2] Ksar or qsar (Maghrebi Arabic: قصر qṣer, plural qṣur; Berber: ⵉⵖⵔⵎ aghrem or ighrem, plural: igherman), plural ksars, qsars, ksour or qsour, is the North African term for "fortified village," from Arabic qaṣar (قصَر)

Indeed, the standards of life in the desert settlements are very harsh, therefore many villages scattered across the desert depend on bringing life and energy requirements from distant areas. This problem is very important, the morphological pattern of the residential settlements, which is characterized by the low density and spread in large areas, is a negative factor, impeding the provision of modern infrastructure, and connecting these communities to electricity and sewage is very expensive and sometimes impossible. On the other hand, these problems are linked to clear political emergencies including terrorist activity, humanitarian challenges, and migration. This focus is framed in the long-term, equally for Saharan states with fragile institutions and societies, as for Europeans and North Africans.

Significant demographic growth in the Sahara combined with unknown climate factors of high concern and a lack of response to the basic needs of the population lay the basis for exacerbating the turmoil, likely in a violent manner. Financial crises, globalization, population growth, and fundamentalist ideology are widely seen as severe obstacles on the continuing road towards a less violent world. But the greatest challenge to the global liberal peace, according to an increasingly widespread view, is the threat of climate change. Fears on this score have been expressed by, e.g., the Norwegian Nobel Committee (Mjøs 2007), the United Nations Security Council (UN 2007), and US President Barack Obama 2009 .(Theisen et al., 2013) All of this is having a major impact,. On the other hand, urban planners find a major problem in achieving the goals of a sustainable eco-city, assessing the status of these cities, and using scientific data to develop a clear vision for the future of cities in the desert of Africa.

Why choose the city of Adrar?

The city of Adrar is the most important city in the Algerian desert, the largest African country in terms of area for several considerations, historical; urban; socioeconomical and environmental considerations. The city of Adrar is an ideal case study for our research scheme due to its location in the middle of the African desert, in addition to its availability on a diverse green infrastructure that enables us to test this part of the study according to real data and problems. In addition to this, this green infrastructure is characterized by a socio-environmental link, which enables us to analyse and understand the social ecological memory and its impact and impact on urban planning through the stages of city formation. These data will enable us to extract many lessons from the case study.

Also, our research method depends on testing many data and urban patterns in the study area through GIS applications and an application will developed through our study, which supports our choice of the study case

The case study was originally an oasis based on the irrigation system of Foggara. In the past, it was an important intersection for trade caravans between North Africa, SubSaharan Africa, East, and West Africa, where its urban system developed in several centuries as a most important oasis in the desert.

It was colonized by the French forces at the beginning of the last century and became the administrative capital of the colonial forces, and after independence it became the capital of the region and witnessed many urban development plans, in addition to that it received many immigrants from sub-Saharan countries after the wave of famines that

Africa knew in the seventies of the last century for that. To achieve our goal Therefore, to achieve our main goal, which is the urban planning model, the city of Adrar is considered a very encouraging model, View of the urban pattern in the same city.

Also, Adrar city has different urban patterns, starting with the traditional city system, the colonial urban pattern, immigrant slums urban pattern, and the social urban pattern. Based on several social studies as AGP Martin(Martin, 1908) the social structure of the population of the city of Adrar is the most complex in the desert due to the social diversity.

The city mixes with many ethnicities and cultures, including traditional city dwellers, Bedouins, and residents of African and Arab origin, and some of Berber and even European origins.

As for the economic aspect: The city was an agricultural city originally, in which the caravan trade flourished, and it is still a city of transit for trade between Algeria and African countries, but the most important factor from the economic side is the beginning of the exploitation of oil and gas fields near the city, which makes this city on the verge of a great urban development.

For environmental considerations Adrar cis a major crossing point in the waves of illegal immigration between sub-Saharan Africa and Europe, which makes it the most affected by climatic changes and natural disasters experienced by African countries, which is a major source of the multiple crises experienced by these countries.

Why “ecocity model” for African Saharan settlements?

According to a recent UN Environment Programme report into emerging environmental issues, ‘the key to sustainability lies in the concept of “green cities” or “eco cities”’ (UNEP

2012, vi). The report, UNEP's preparatory contribution to Rio+20(Merk et al., 2012) supporting its work towards an ‘inclusive green economy’ (iv), distinguishes eco-cities from conventional cities on the basis of their superior urban environmental quality and liveability to be achieved inter alia through compact, mixed-used developments, lowenergy transportation, renewable energy generation and a reduced overall ecological footprint. Other international organisations, too, including the World Bank (Eco2 Cities initiative) and the Organisation for Economic Co-operation and Development (OECD, Green Cities programme) have declared the eco-city as policy goal, again defining it within the overarching concept of the ‘green economy’, or ecological modernisation (Theisen et al., 2013)(World Bank 2010)

The eco-city has become an international political priority, responding to the dual challenge of global climate change and rapid urbanization processes. In addition to the positives, it offers in the field of health, environment, and well-being, but the forms currently remain an agreement about what exactly constitutes an eco-city, various attempt to define it conceptually in general in terms of specific criteria and dimensions.

Why Africa Desert?

«Africa is witnessing increased weather and climate variability, which leads to disasters and disruption of economic, ecological and social systems. By 2030, it is estimated that up to 118 million extremely poor people (i.e., living on less than US$ 1.90/day) will be exposed to drought, floods, and extreme heat in Africa, if adequate response measures are not put in place. This will place additional burdens on poverty alleviation efforts and significantly hamper growth in prosperity, » said H.E. Josefa Leonel Correia Sacko

Commissioner for Rural Economy and Agriculture African Union Commission.

« In sub-Saharan Africa, climate change could further lower gross domestic product (GDP) by up to 3% by 2050. This presents a serious challenge for climate adaptation and resilience actions because not only are physical conditions getting worse, but also the number of people being affected is increasing, ».

According to the United Nations reports, Africa is facing a rapid increase of population. By 2050, it will be the most populous continent. It will exceed the total population of India and China, with a total of 2.5 billion inhabitants.

For the next 35 years for every day Africa need 60 000 housing unit (Benimana, 2018); The enormous growth of Africa and its need for urban development and infrastructure in addition to the need to adapted to climate change; natural disasters ; need for energy and food, all these criteria's make the application of eco-cities principals a necessity.

I.2 Research Question

Urban processes in desert cities proved unsustainable consequences of economic development and space growth, especially with desert ecosystems characteristics and the increase in water needs has led to a huge depletion of natural resources, and imitation of oil exploitation (risk of permanent water pollution in addition). Forced irrigation; often leads to poor agricultural outcomes, in addition to the general effects of human pressure on natural spaces. Urban settlements also contribute to the over exploitation of water resources and the production of wastewater, which is as difficult to manage.

Based on scientific visions and accumulated indigenous knowledge, it has become imperative to shed light on the interaction of ecological relations, in the desert cities, and the environmental, social, and economic problems.

There is a permanent social debate among different categories between those who argue to preserve the environment, resources, valuation and advocates of green jobs and advocates of development of cities, and economic growth. But both share the necessary awareness of environmental and ecological requirements.

There is a general agreement between decision makers and urban planners, about the abandonment of current urban planning model inspired from the vision of modernity; catastrophic socially; aesthetically, and no adapted to desert environments. It necessary to rediscover the heritage of ancient desert cities, which have rich knowledge not only to protect themselves, but also adapted to ecosystem and climate, by using many sustainable technics as, traditional water irrigation system, ecological knowledge, and water management. These traditional systems can be the alternative model to current urban planning pattern.

Saharan cities facing important challenges, as climate change, poverty, migration, and unemployment. In other hand have many requests as need well-being, sustainable development goals and preserving of desert ecosystem through this previous the research questions are:

1. What is the site-specification for ecological planning tools for African Saharan Region?
2. How do we define the spatial dimensions for ecological planning in A.S. Region?
3. How we use green infrastructure to support spatial dimensions?
4. How do we define the social dimensions for ecological planning in A.S. Region?
5. Can we use social ecological memory to reinforce social dimensions?

6. Is it possible to define a theoretical base for a planning model which enables transforming the technology and wisdom of ancient town planning towards planning of a new town in the A.S. Region by the combination of social ecological memory and green infrastructure strategy?
7. Can we have a system approach by using the green infrastructure factors, social ecological memory elements, and sustainable development goals that enable us to define the objectives of the ecological city in the desert of Africa?

I.3 Research objectives

The main objective of this study is a more comprehensive covering the components of ecological planning requirements together with sustainable urban development, water, and green infrastructure management under the lights of climate change impacts on African Saharan region. The research study aims to find alternative and effective strategies by looking at previous studies and different approaches. Moreover, it focuses on "ecological urbanism" and its theoretical background to define the research framework.

The concept of ecological urbanism be a radical new approach to urban development, based on the practice of ethical aesthetic design, and collaboration between naturalists and humanists to find a solution for recent and future challenges of city's growth and development on a global scale(Kellert et al., 2011). Our research goal is to define how we perceive smart growth, new urbanism, and the eco-city in relation to sustainable development; and to identify differences in these perceptions relative to two elements of green infrastructure and social ecological memory.

To achieve the urban ecological model in the African desert city, through this research, the sub-objectives of the research summarized in the following points:

1. To propose an ecological model for existing and future urban planning model in A.S. Region
2. Propose a model of ecological urban design for desert city by the help of case studies.
3. To define the importance of spatial and social factor in the ecological planning in existing urban patterns in A.S. Region.
4. To improve a decision model for implementation of ecological planning principles in A.S. Region cities.
5. Defining of goals and principles for ecological urban planning for A.S. Region cities.
6. Designing a Software application can process data; define indicators that permit us to understand the environmental, social, and economic condition in cities, in order to contribute to the ecological urban design model.

I.4 Scope of the study

The scope of our study is the ecological urbanism as an important means to supporting ecological desert settlement in the African Sahara. First, step is collecting data about the Sahara Desert «Oasis ecosystem» and analysing their characteristics. Secondly, presenting case study (ADRAR) for proposing urban ecological model in the African Sahara by the help of new technology and software applications.

This research is composed of seven main chapters apart from the introduction and conclusion parts. It begins with a theoretical framework, then examines the ecological urbanism in case study, and concludes with a model proposal along with a global evaluation. The chapters to follow describe and analyse in considerable detail the many ecological urbanism initiatives and strategies pursued by these most impressive cities.

Restriction of study:

The study mainly aims, within a specific framework, to achieve the following objectives:

1. Propose an ecological urban model processes for desert city by the help of the settlement case studies.
2. To define the importance of spatial and social factor in the ecological planning in existing urban patterns by the study of green infrastructure strategy and the social ecological memory in A.S.Region.
3. Designing a Software application can process data; define indicators that permit us to understand the environmental, social, and economic condition in cities, in order to contribute to the ecological urban design model.

I.5 Research Methodology

Our research method will be quantitative or qualitative. These methodologies include the procedures followed, as well as the analysis of data obtained. The methods and procedures used during the study, and most importantly for the specific goals and objectives of the research. figure 01 explain the research idea that depends on two main parts, the theoretical framework of the research and the case study.

To achieve the research objectives, the case study is the main research strategy within this research. Also, the strategy of analysing and knowing the ecosystem and its peculiarities in the study area. In addition to exploring relationships and developing eco-city projects across the world. The researcher's case study approach can provide a starting point for drawing clearer conclusions about cities in the African Sahara. Moreover, it provides the researcher with an open and free ecosystem to explore and understand current and real-life events and issues in the proposed fields.

The research was conducted in three stages, as shown in Figure I 1.

1. Determine the research problem.
2. Theoretical background
3. Testing the design processes of ecological urban planning in case study.

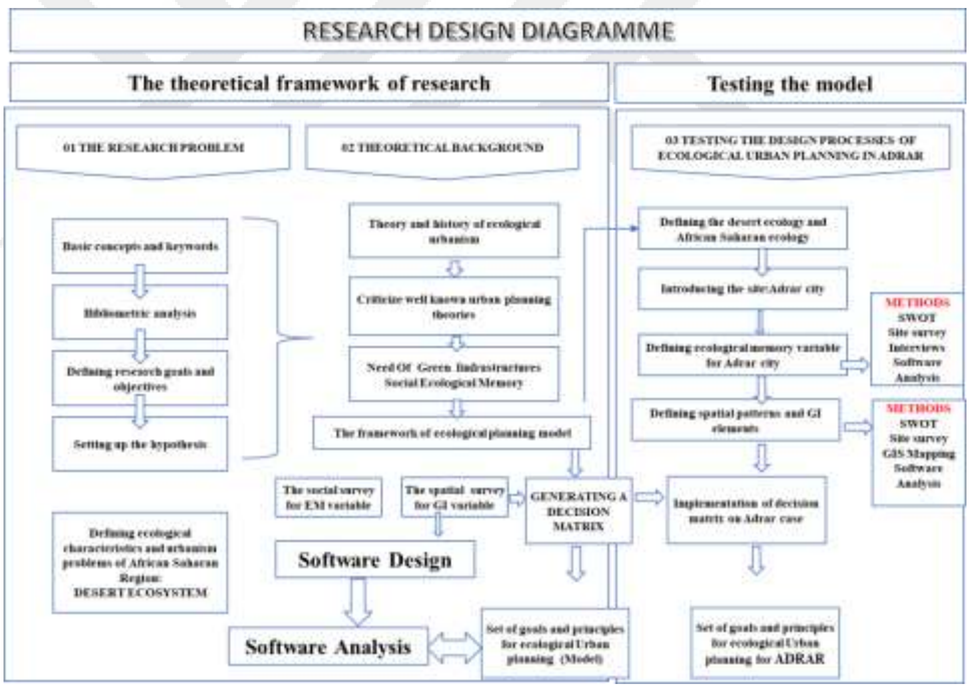


Figure I-1Research design diagram

I.6 Bibliometric analysis

This analysis aims at identification of the main trends in scientific literature characterizing ecological urbanism, based on bibliometric analysis of articles published in the OKAN e_library with using Web of Science and Scopus databases. The study period was set from 2000 to 2019. with the support of the VOS viewer Software.

The analysis included keyword count, post count, citation analysis, and field analysis. The analysis aims to clarify current research trends that address ecological urbanism. Main in the chapter is a theoretical framework for research directions, which is developed through a review of the scientific literature analysis. The result of this analysis phase is a map showing the existing relationships between key terms, research areas characterizing publications dealing with the ecological urbanism and different keywords transportation, ecology, infrastructure, urban patterns, etc...,

The co-occurrence analysis and hotspots of keywords

The bibliometric analysis (keyword co-occurrence) reveals the research hotspots (figI-4) by subject area, the ecological urbanism, and different keywords: landscape; landscape

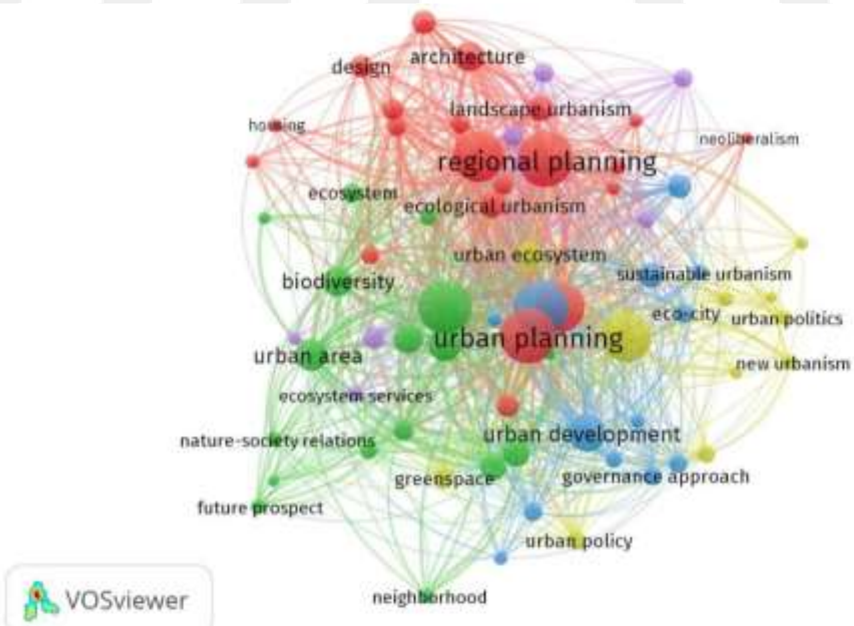


Figure I-2 Ecological urbanism hotspot keyword (Vos viewer)

urbanism; landscape ecology; sustainable urbanism; climate change, urbanization; political ecology; ecology; social ecological systems; biodiversity; agriculture; ecosystem services; city; design; infrastructure. The analysis provides us with a clear view of the strength of the association between the main keywords through the keyword “ecological urbanism». Which shows the focus of research areas and research interest through their connection to our research topic. Through the figure 1-4 Keyword’s hotspots (product by the author with VOS viewer application they are multidimensional concepts is mainly based on relationship with ecological urbanism structured around few major components: (1) ecological urbanism, (2) urban food, (3) green infrastructure, (4) ecological memory, (5) Urban Ecology and everything that targets the urban development. Today, ecological urban design theories have become very important due to the complexities of the field of study and the overlap of various scientific fields and academic interests from different fields. This systematic review, carried out specifically on eco-urban design, has provided an overview of current eco-urban design knowledge, knowledge gaps, and some

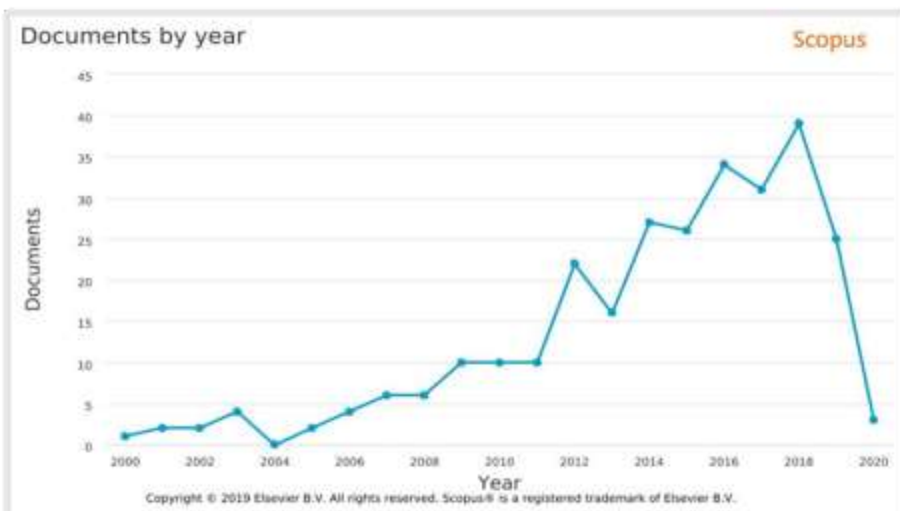


Figure I-3 Research by year for ecological urbanism in the scopus data base

developing research directions within what a new discipline is. This analyse gave us a clear concept about the areas of scientific overlap, the size of the research importance in this field. The ambiguity around the terms of research and concepts greatly affects the progress and effectiveness of a particular research area.

Search rates for publication have increased dramatically in recent years (fig I-3). But is noticed the lack of research in the African region and significantly and its absence for the African Sahara (fig I-3). This is expected to continue, especially during environmental problems and economic stagnation. Studies in the field of ecological urban design are considered according to a clear scientific proposal to provide a more accurate and effective methodology for cities in Africa, also to decision makers and planners, leading to an increase in response to various social, environmental, and economic challenges now and in the future.

The research tries to give clarification of conceptual change of:

- Ecological planning goes back to 1970's
- Eco city - 1982
- Ecological city – 1993

The clarification of conceptual change is done through bibliometric analysis .Where is relied on the Web of Science database through the analysis of scientific works and keywords for each concept and the interrelationship of concepts and the geographical and historical scope of each concept during the last twenty-five years

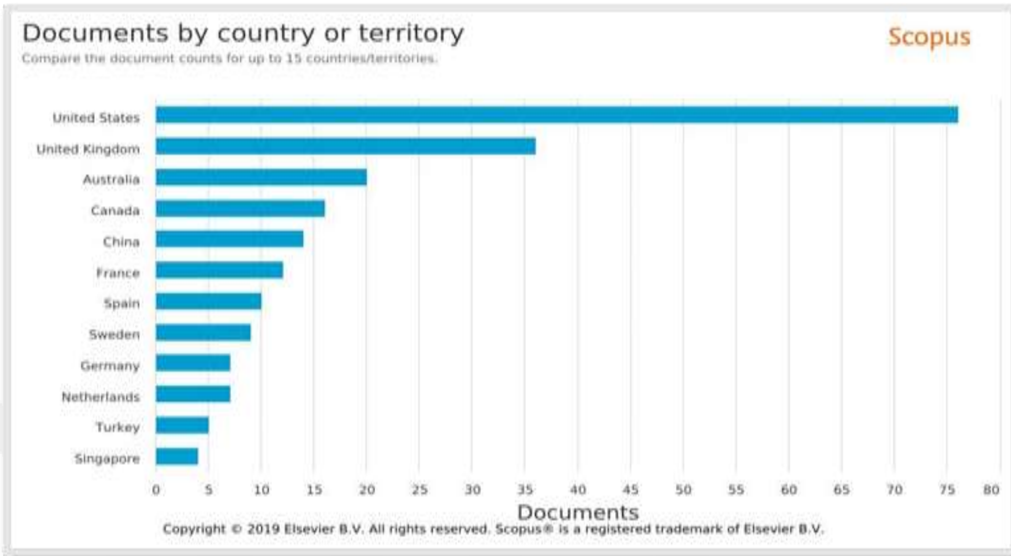


Figure I-4Document by country for the ecological urbanism

Ecological planning

A theory of ecological planning is presented which is based on the premise that all social and natural systems aspire to success. Such a state can be described as ‘syntropicfitness-health’. Understanding the process of interaction between the landscape and the people who inhabit it provides a basis for assessing the opportunities and constraints afforded by the environment, and the needs and desires of the population which can be combined to present alternative futures(McHarg, 1981).

This concept can be considered to have appeared through research papers before 1970

But through the search, is recorded a small presence in this period. The first search was in 1975 (Web of Science database) .But there was no real interest until after the special session of the United Nations General Assembly devoted to the environment (1997), when the number of research immediately after that reached 30 research publication. Which explains the concept's link to the strategies of the international community about ecological planning, the following chart explain this evolution through years

This concept has received great research interest in the United States, China, Britain, and Australia, with a huge number of research.

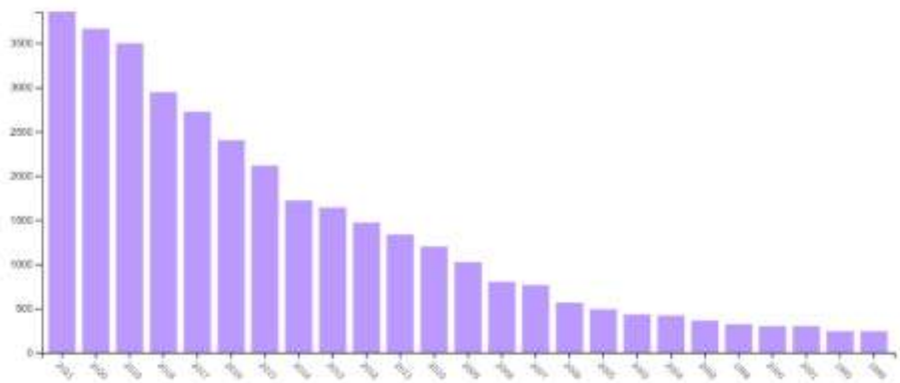


Figure I-6 Ecological planning research by years in web of science data base

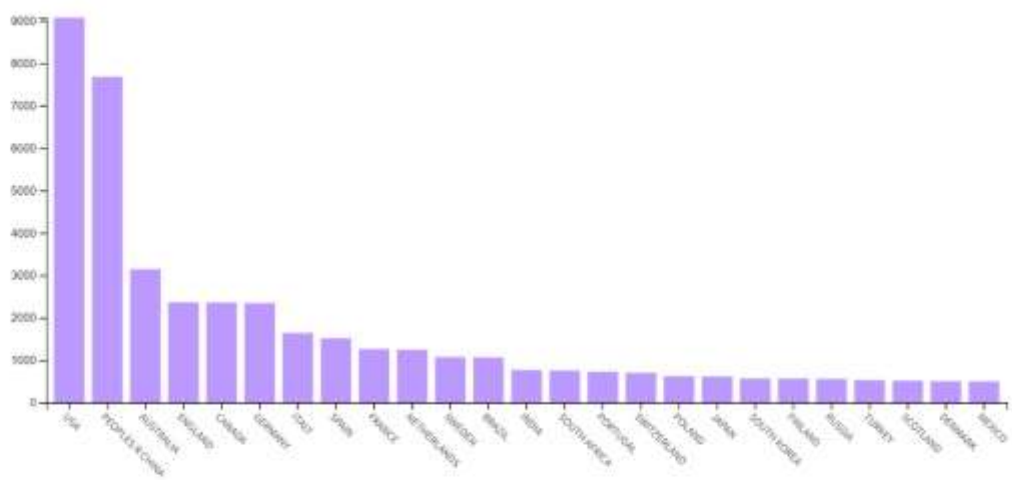


Figure I-5 Areas of research interest through the Web of Science database

But there is a great research shortage in both Africa and the Middle East. The following figure shows areas of research interest through the Web of Science database.

The use of the VOS viewer application shows us the hyperlinks between the keywords in the research papers through web of science data base, which are represented in the following hotspot keywords: sustainability; landscape planning; ecologic landscape design; ecosystem; ecological impact; climate change; evaluation method; urban planning. Which shows the strong interest in research through a global consensus for the preservation of ecosystems, landscapes, and the evaluation methods; decision making, and use of sustainability theories for more well-being, sustainable and safety cities.

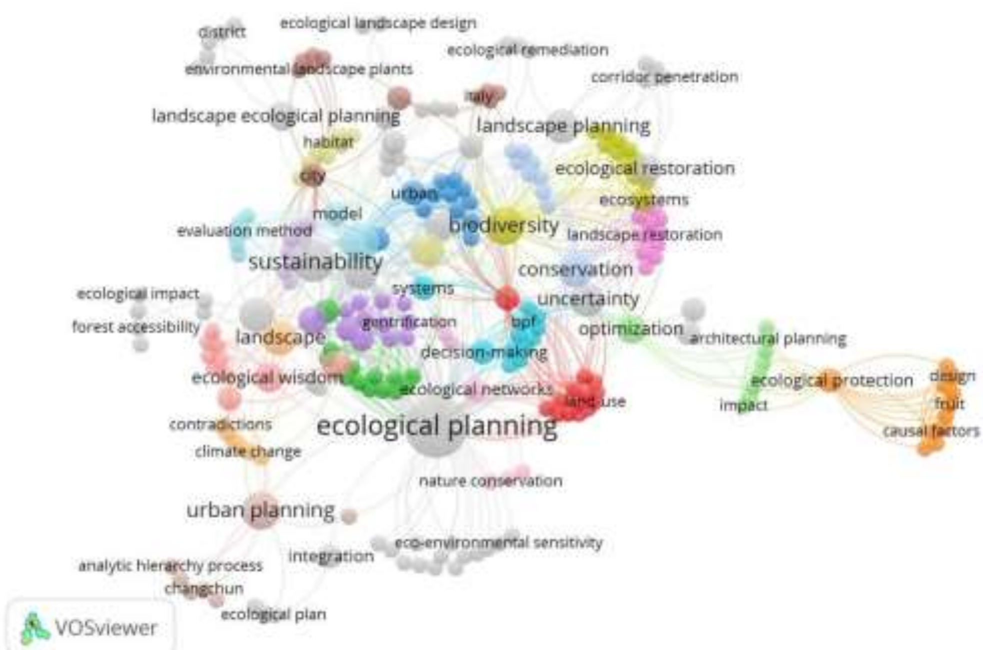


Figure I-7 Ecological planning keyword's hotspots (VOS viewer application)

Eco city:

An Ecocity is a human settlement modelled on the self-sustaining resilient structure and function of natural ecosystems. The ecocity provides healthy abundance to its inhabitants without consuming more (renewable) resources than it produces, without producing more waste than it can assimilate, and without being toxic to itself or neighboring ecosystems..(Roseland, 1997). The analysis of scientific research showed that the concept of eco-city appeared in the database of the Web of Science for the first time in 1977, but there was no significant interest in this concept until 2002, when the number of submitted research reached 30. It is the year in which the World Summit on Sustainable Development was held (2002), which shows the link of the concept of ecocity with the

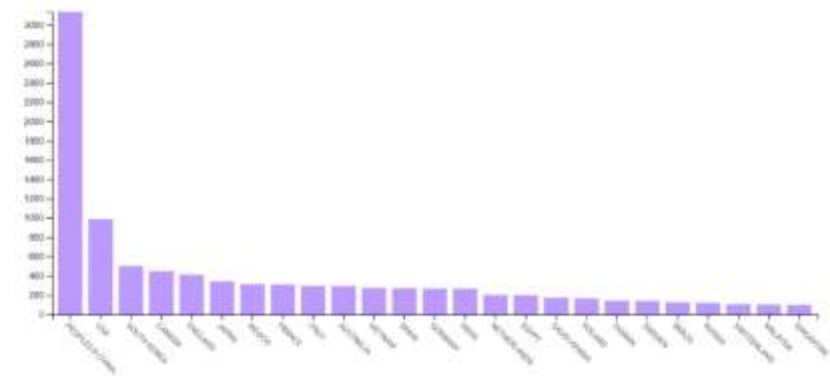


Figure I-9 Areas of research interest through the Web of Science

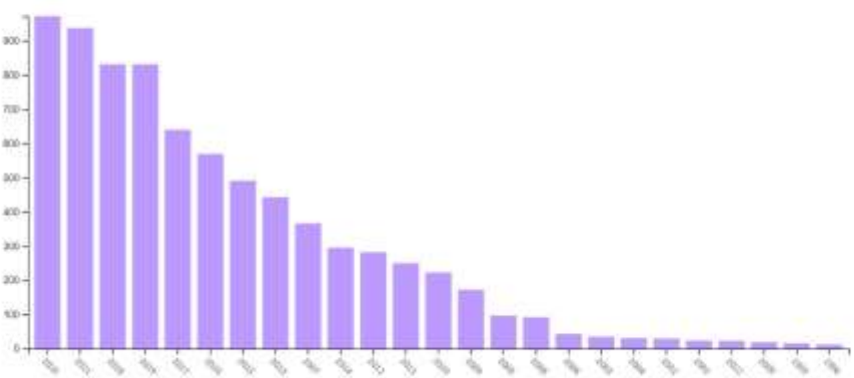


Figure I-8 Ecological planning research by years in web of science data

goals of sustainable development. The continuous growth of scientific research indicates base

the increasing global interest, as the number of research published in the year 2020 reached 972 research papers.

Research analyzes showed that 70 percent of the research was in five countries, namely China, the United States, South Korea, England, and Canada, with a clear difference of 40 percent in China alone, which shows the clear interest in the field of research for Eco City in China, despite this There is a clear interest in Europe and the Middle East, with a clear absence of Africa .

Through the figure 1-10 Keyword’s hotspots (product by the author with VOS viewer application they are multidimensional concepts is mainly based on relationship with eco city structured around few major components: design with nature; green urbanism; governance; society; local environment; energy. The analysis of the knowledge evolution path in the subject area can help researchers systematically grasp the evolution track of the subject area research, predict the development trend of the research area, and provide researchers with further research objects. In previous studies, some researchers used quantitative calculations based on the occurrence frequency or co-occurrence frequency of vocabulary or phrases that express the research content, based on the strength of the correlation between the topic words to cluster them, and draw a network of subject topics in different periods’ atlases to observe the evolution track of subject knowledge.

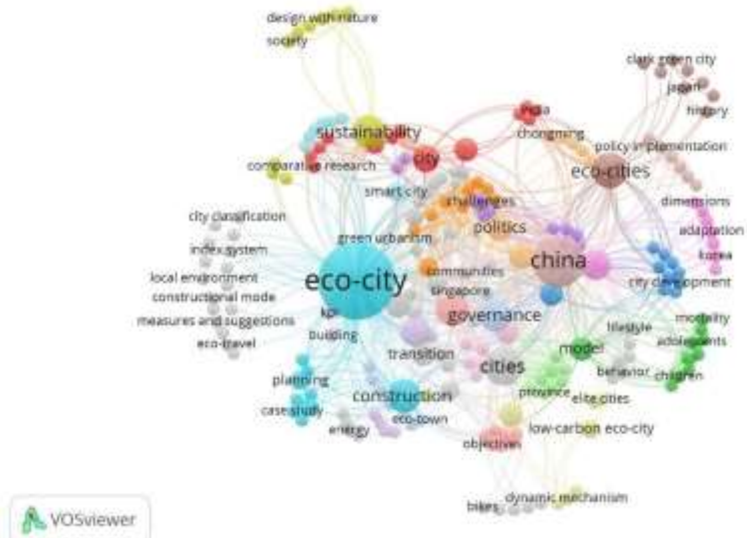


Figure I-10 Eco city keyword's hotspots (VOS viewer application)

Ecological city

Ecological cities imply the harmonious development of human and nature, the construction plans keep to the principle of avoiding environmental damage, human activities tend to maintain the ecological environment. Urban afforesting and greening have the function of improve climate, improve environmental sanitation, conserve water, avoid flood, prevent hazards, beautify environment, and save energy etc. Problems existing in urban greening

As can be seen from Figure I-11, the first research in ecological city since 1977 But there was not much research, the number of literatures in the Web of Science database was on the rise, year by year between 1990 and 2021 (Note: the main types of literatures are articles, proceeding papers and book chapters). The results show that the overall degree of research and attention in this field is increase

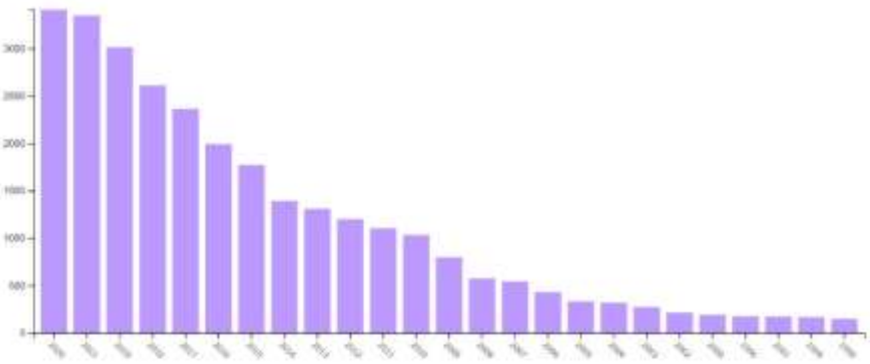


Figure I-11 Ecological city research by years in web of science data base Is noted through the analyzes of the Web of Science database, a concentration of more than 60 research centers in China and the United States.

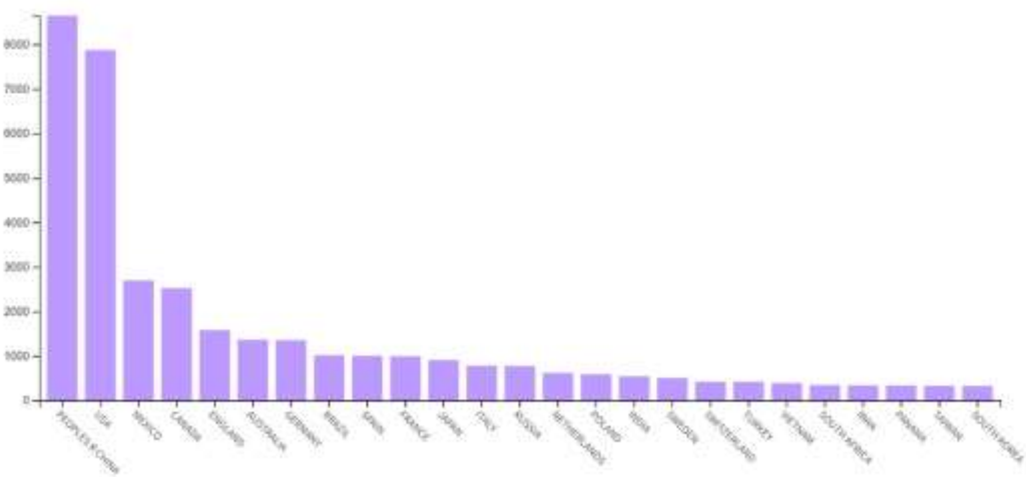


Figure I-12 Ecological planning research by country in web of science data base Through the figure 1-13 Keyword’s hotspots (product by the author with VOS viewer application they are multidimensional concepts is mainly based on relationship with eco city structured around few major components: Sustainable development; ecological footprint; socio ecological;

ecosystem services; ecological strategy; urban water resources; urban agriculture; ecological strategy; city and regional planning; green infrastructure.

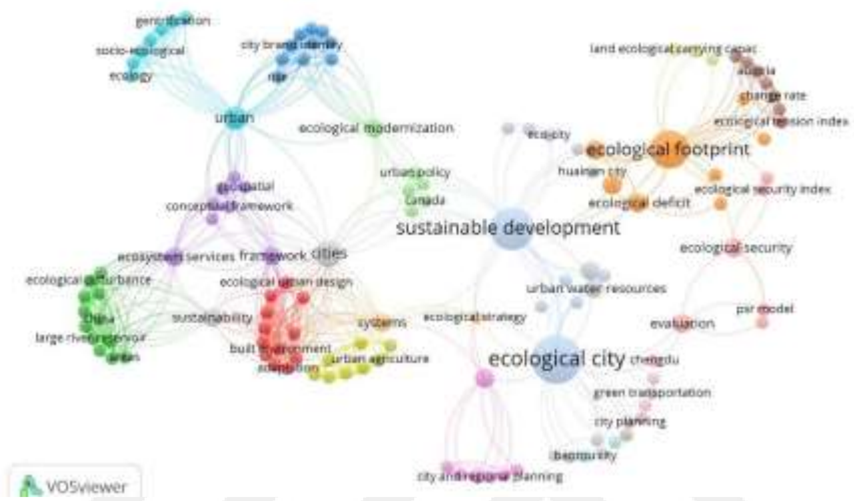


Figure I-13 Ecological city keyword's hotspots (VOS viewer

Ecological Urban Design

Urban design is "the interface between architecture, town planning, and related professions," "the three dimensional design of places for people and their subsequent care and management," "the creative activity by which the form and character of the urban environment at the local scale it devised," and "the physical design of public realm"(Madanipour, 1997). The research in the field of ecological urban design is recent compared to the concepts of planning and the ideas of eco-cities, and it gives more clear ideas about the development of the concepts of eco-cities

Despite the emergence of the concept of ecological planning in 1979 according to the analyzes of the database Web of Science, the real interest in the field of research has been during the past ten years. Fig I-14.

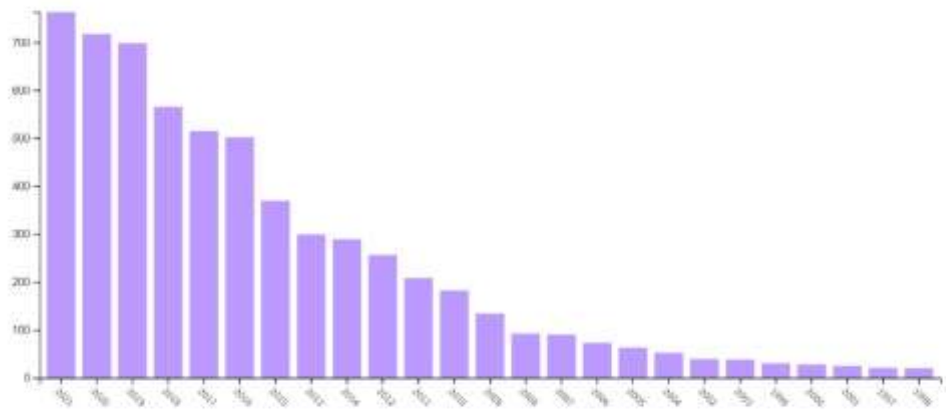


Figure I-14 Ecological urban design research by years in web of science

Through the analyzes of the Web of Science database, a concentration of more than 55% research places in China and the United States.

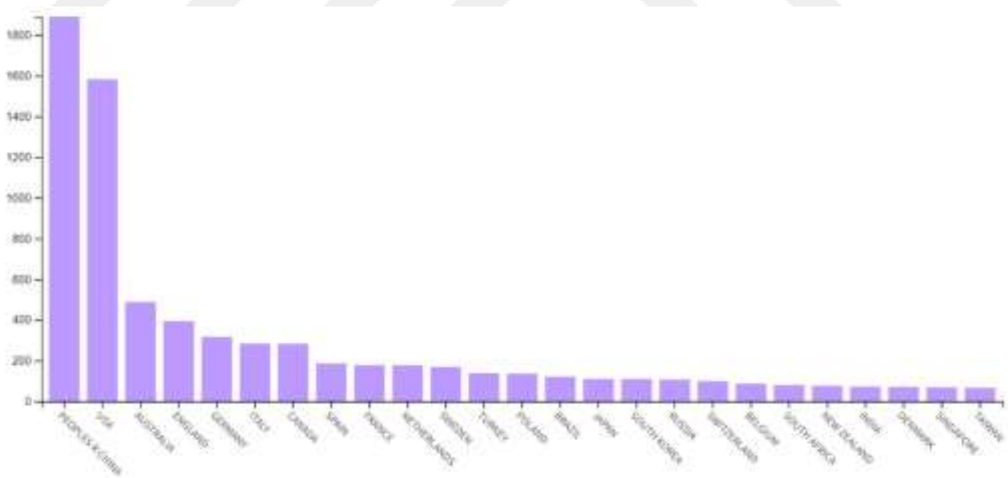


Figure I-15 research by country in web of science data base

Through the figure I-16 Keyword's hotspots (product by the author with VOS viewer application they are multidimensional concepts is mainly based on relationship with ecological urbanism structured around few major components: (1) ecological design, (2) urban design, (3) resilience, (4) ecosystem services, (5) climate responsive (6) urban landscape (7) ecological indicators. Today, ecological urban design theories have become very important due to the complexities of the field of study and the overlap of various scientific fields and academic interests from different fields. This systematic review can be considered, carried out specifically on eco-urban design, has provided an overview of current ecological urban design knowledge, knowledge gaps, and some developing research directions within what a new discipline is. He gave us a clear concept about the areas of scientific overlap, the size of the research importance in this field. The ambiguity around the terms of research and concepts greatly affects the progress and effectiveness of a particular research area.

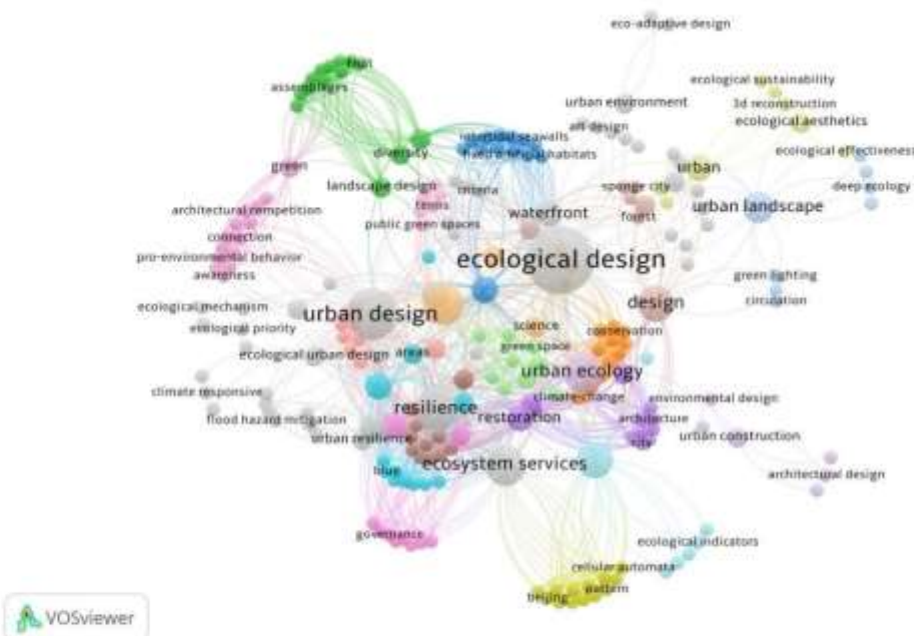


Figure I-16 Ecological urban design keyword’s hotspots (VOS viewer application)

Bibliometric analysis gives us a clear vision about the keywords of great importance and identify the search words that correspond to the field of our research and the objectives of the research.

I.7 Research Design

This research study is working to complete a descriptive survey by making use of analysis techniques to get the objectives of the study. The methodology will involve analyzing a range of primary and secondary data from the field as well as observations, face-to-face interviews, and other sources, respectively.

I.7.1 Data Sources

Primary data sources will include observation, questionnaires, interviews, and photography. Various types of urban experiences related to our research topic will be observed and analysed. Other primary data will be sourced from the government departments.

Primary data collection techniques sampling

To obtain more accurate data, especially the social ecological memory and green infrastructure in the case of the study, the study relied on technique of using random sampling is important to obtain homogeneous data. the study also relies on taking systematic samples around the study case and cases related to the research .The data collection techniques that shall be employed in addition to library research will involve the following: Written Questionnaires, Oral Interviews, Scheduled Interviews, Photography (fig I-17)

Written Questionnaires and Oral Interviews

As part of the research, and especially for the study of ecological memory, in the fifth chapter of the thesis the study conduct conversations and interviews with inhabitants and

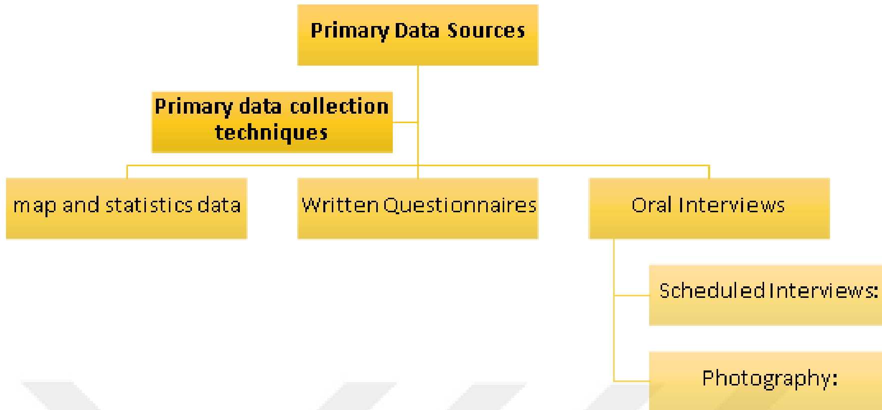


Figure I-17 Primary data recourses

farmers with the aim of analyzing palm grove, A face-to-face interview is very important, through which visual data can be captured. The interviews can also be considered a valuable tool for evaluating the integrity and value of the responses. Face-to-face interviews are a good way to obtain factual data, which is difficult for us to obtain from other sources of data. such as document analysis, these interviews have the following characteristics:

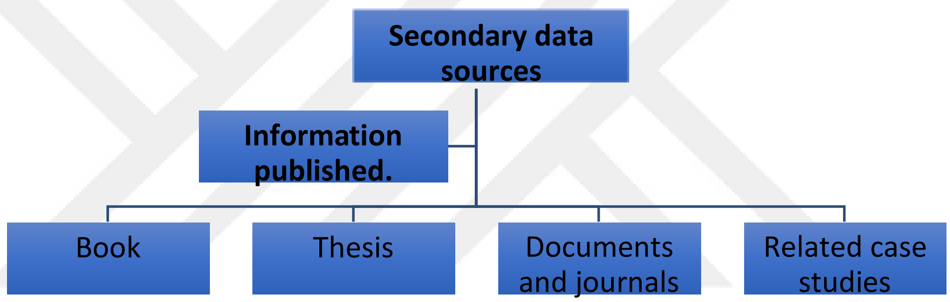
1. The objective of the discussion must be determined.
2. Determine those concerned with Questionnaires, Oral Interviews, and the number of Interviewers.
3. How to choose the respondents,
4. Determine the age group.
5. Determine the physical structure.

Secondary data sources

This will include information about ecological urbanism designs both published and non-published information. Secondary data will be collected by carrying out intensive library research and online internet resources. The review of literature will include looking at documents and journals on ecological urban design models and knowledge related to case study (I-18).

I.8 Prerequisites: requirements and the study assumptions:

To investigate the intersection of political, economic, cultural, environmental, social influences and characteristics of green infrastructure, based on the theoretical background of ecological design. Is necessary to set of data as shown in the following figure. The data



FigureI-18 Secondary data collection

collection process takes place in three stages:

1) Documentary analysis of planning documents for the case study and desert ecosystem.

2) interviews with key decision makers and residents.

3) the observation on the site is also very important and I take pictures to obtain realistic data.

All three phases that sought to facilitate urban phenomena understanding of what the issues and problems are experienced by desert cities, and what are the potential issues that could impede their future development. This section explains the rationality of the data collection methods used in this qualitative research. The choice of techniques is according to the type of design required and the space studied. Urban designers must consider the length of time of study. The following figure(I-19) shows the information and data must be obtained.

Figure I-19Data must be obtained for ecological urban design.

I.8.1 Methods of Data Analysis and Presentation

Quantitative and qualitative methods will be incorporated to analyse the information collected from the respondents through control of means, percentages and even mode. Also, SWOT analyse, Respondents‟ expressions and perceptions, questionnaires, events, behavioural observation, records will be analysed. Percentages, proportions, and averages will be employed to reach the conclusions. Data lecture will be done through pie charts, photographs, graphs, and maps. Processing and analysis will involve: Sampling technique, Sorting data, Sample size calculations.

Software multicriteria evaluation.

Through study, Software application was developed. The principle of software application is based on the study built in theoretical knowledge of ecological urbanism (Spatial patterns and GI element, Planning processes and morphology, social ecological memory) as is explain in (figure I 20). in addition to the principles drawn from the study of green infrastructure and ecological memory in the case of the study.

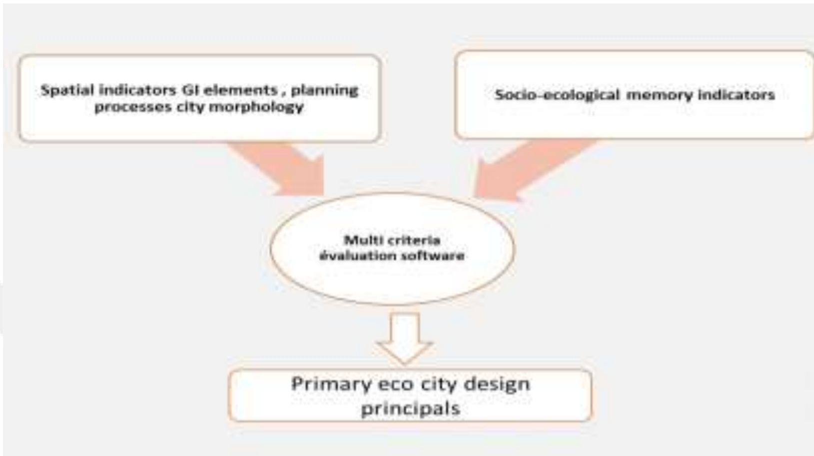


Figure I-20Application software design

The application will be realised with using of the system “windows 10”. With the compilation of database in Excel format contains 02 tables "Titres" and "Parameters". The application work principal based in two steps: the first one is opening and modifying parameters and the second one is display reports and indicators. Also, the first version of this program is in constant need of continuous revision and is likely to be tried in several cities in the future.

The main goal of this program is to provide a way to define a simple practical for Eco city with the participation of the local population, and by combining the main pillars of sustainability, also involving residents, and giving them the opportunity to define indicators of sustainability goals. Through our literature searches, it didn’t obtain a clear quantitative method for aggregating the effects of policy packages. Weight index scores serve to quantitatively express the significance of each indicator to others. While several methods have been adopted to determine the optimal weights of the indicators ,(Yang et al., 2010) . It has been argued that there are no standard criteria or methods for compiling and weighting sustainability indicators(Kahn, 2007). Usually, all index scores are weighted equally, to avoid controversy and ensure policy transparency.

However, through the Software Goals program, the study aims to work according to the logic of public participation of residents and decision-makers for the possibility of changing weights. If the Software goals program is integrated into the urban design process from the start, it can give a clear view of the weaknesses and strengths of the urban ecosystem, which allows for the identification of goals, indicators, and the possibility of further improving the sustainability indicators of any city.

I.8.1.1 Ecological planning goals Indicators

Upon our bibliometric analysis, is observed more than a thousand studies on urban sustainability consulting. The technique of identifying indicators is not only a technical process, but it goes beyond that as it includes environmental services, difficulties in objectively assessing water and accrued benefits, and addressing problems of environmental performance. All these data lead to a high degree of ambiguity in the design and use of sustainable development indicators. What are the sustainable development indicators that are chosen and who is responsible for rejecting and accepting these indicators? How are they proposed, what is the approved weighting system, and how is it measured and presented? All these data stand in the way of developing these technics. The indicators used to measure urban sustainability need in-depth study and the use of indicators is a good technique for enhancing urban sustainability. Although the analysis of the time series using these indicators provide an insight into the field of "sustainability" goals, in addition to the fact that the current indicators do not live up to the aspirations of the need for sustainability. Therefore, it is necessary to search for indicators that contribute to urban resilience. The recent focus on sustainability indicators over the last two decades is a general policy to use the indicators for. A value-free policy claim based on rational decision-making, efficiency, and concern about environmental damage and ecosystem changes to widespread attempts to monitor and evaluate trends. And the use of indicators by environmental organizations, politicians, and decision-makers to mislead public opinion.

Definition of indicator:

Fundamentally, an indicator offers a sign or a signal that something exists or is true. It aims to show a specific situation or situation. In the context of assessment, the indicator also gives quantitative data to monitor performance and measure achievement. It is essential to note that the indicator also serves to provide data on the quality of the project or activity.

Definition of targets

Targets are the quantitative objective or goal of an action, project, or programme. In other words, they are the required results while the indicators are used to quantify achievement. In other words, it aims to measure the actual results of a project, activity, or programme.

Steps for selecting indicators.

The first step: Forming a working group.

The second step: Selecting indicators and data.

The third step: Discuss goals.

I.8.1.2 SWOT Analysis methodology

SWOT Analysis is a method used a little over time to help make decisions in business projects. Since the 1980s, this technology has been relied on in many areas such as business administration and design. The aim of this analysis is to determine the opportunities of the area under study and the elements and conditions that represent limitations. The area included in the study can be clearly described and analysed accurately using this technique. The SWOT analysis aims to highlight the most important issues, problems, and relationships. Strengths and weaknesses are related to the characteristics of the region and are clarified as interior factors. Opportunities and threats deal with the region's competitive environment (external factors) (see table in following chapters). SWOT analysis can be gathered from the results of the analysis and surveys developed during the previous stage. The SWOT analysis will serve as a synthesis of the research undertaken to improve the designer's knowledge of the location. The designer can do a SWOT analysis with some typical questions, the analysis can underline strengths and provide solutions and proposals to reduce vulnerabilities and find solutions that are compatible with environmental, social, and economic data. SWOT analysis can be used in various steps during the design process: before determining the actual condition of the site, during the design process to assess project benefits in most phases of the study, and after implementation, after implementation, to assess the goals that have been achieved.

SWOT Analysis Typical Questions

Through the literature review study, Danilo Palazzo developed model of questions for SWOT analysis in the ECO City, where study tried to apply it to the case study, is noticed that the results were very impressive. Consisting of Research: Through the following table, it can observe the components of the thesis and analyses in each chapter.

Table I-1 Research consistency

	Research consistence's			Analyses				
				SWOT	Site surveys	Interview	GIS Mapping	Matrix
THE RESEARCH PROBLEM	Chapter 1 introduction:	1.	Problem statement and justification of the research project					
		2.	Research question					
		3.	Research objective scope of the study research methodology					
Scientific knowledge Ecology Ecosystem	Chapter 2 literature overview	1.	The desert ecology		X	X	X	
		2.	Physical facts about the Sahara desert			X		
		3.	introduction for case study context			X		
		4.	Saharan ksour			X		
		5.	Social ecosystem in Sahara					
Theoretical design background	Chapter 3 historic literature lecture	1.	ecological planning process	X	X	X		X
		2.	ecological planning theory	X		X		X
		3.	the various planning movements and models	X				X
Testing the design processes of ecological urban planning in adrar	Chapter 4 site	1.	Ecological factor in traditional residential settlement ecological principles in the ksar		X	X	X	X
		2.	Lecture of ecological factor in colonial residential settlement		X	X	X	X
		3.	urban factor in after independence settlement		X	X	X	X
		4.	urban factor in new extension social settlement		X	X	X	X
		5.	economic data layers		X	X	X	X
		6.	data analyses and estimation of needs of city		X	X	X	X
	chapter 5 social component of ecological memory in adrar city	1.	methodology of analyses of ecological memory	X	X	X	X	X
		2.	The dynamics of social and ecological memory in palm grove	X	X	X	X	X
		3.	General aspects of socio-ecological memory for managing ecosystem services	X	X	X	X	X
		4.	Linking memory carriers to social-ecological resilience	X	X	X	X	X
		5.	Social memory carriers	X	X	X	X	X
		6.	memory loss problems in urban patterns	X	X	X	X	
	chapter 6 spatial components of green infrastructure [ugi] in adrar city	1.	principles of urban green infrastructure	X	X		X	X
		2.	green infrastructure in the desert:		X	X	X	X
		3.	defining of green infrastructure typology, in adrar city UGI constraints in adrar city		X	X	X	X
		4.	green infrastructure practices		X	X	X	X
		5.	green infrastructure analyses		X			X
Planning concept and model projection in adrar city	chapter 7 defining planning concept and model projection	1.	defining of processes for case study model	X	X	X	X	X
		2.	model projection	X	X	X	X	X
		3.	desert eco city chart					

II. THEORETICAL FRAMEWORK OF ECOLOGICAL URBANISM

The aim of chapter is study and analyse theories of ecological urbanism and green infrastructure in addition social ecological memory and look at the extent of theoretical networks between them, the study tries to address a set of the results of previous bibliometrics analysis. The aim of literature analysis of history of urban ecology is to understand the motives and factors that caused the emergence of the need for ecological urbanism for a sustainable life and a well-off life for urban and rural residents.

Ecological urban planning is one of the most important strategies that deliver human health, social welfare, and environmental, economic, and social benefits to contemporary urban dwellers. To understand the state of ecological urban planning, a systematic quantitative review of articles on the web from science platforms was conducted through this review, is noticed a clear demand and a quantitative development in the number of research across developed countries. But is observed a clear neglect of the countries of the South of the world and Africa. Our study aimed directly to investigate the knowledge gaps identified by this review as requiring attention to the growth of research in demystifying the terminology and the limited broad understanding of ecological urban planning and giving great importance to our case study in African Sahara, which has very distinctive characteristics. The geographical and cultural context is different, and sometimes the political motives differ from one country to another, and some governments apply policies of escapism for several goals, but there is no doubt that cities today in all the world need a more sustainable life and less pollution. Our attempt to review the historical stages does not focus on the development of scientific movements from the literary and historical aspect. The study tries to explain the historical contexts and compare them with the cultural, historical, economic, and sometimes even political data of the cities of the African Sahara. All this through this chapter through compares and a summarize of all historical stage of evolution of ecological urbanism.

Ecological urbanism aims to link the theory and practice of city design and planning, as a method of adaptation, to environmental visions - the study of the relationships between living things and their environment and the processes that make up both of them - and other environmental disciplines, such as climatology, hydrology, geography, psychology, history, and art. Ecological urbanism has an aesthetic dimension, but it is not a pattern; The actions of its practitioners is differ radically in appearance although they are based on the same principle . (Whiston Spirn, 2012). Another key feature of ecological urbanism is its awareness of the size and scope of the impact of ecology, which extends beyond the urban area. The city cannot be considered a mere material artifact. Instead, it should be aware of the dynamic relationships, visible and invisible, that exist between different areas of the greater topography of urban and rural ecology. Differences between emergency situations in rural and urban areas can lead to uncertainty and inconsistencies which require unconventional solutions. This comprehensive regional approach illustrates, with consequent considerations national and global levels , the multidimensional quality of environmental urban expansion (Mostafavi, 2010).

Definition of ecological design: Ecology is a branch of science concerned with the relationships of living things with one another and their physical surroundings. Ecologists have developed standards to assess the quality or safety of these relationships within and between many types of environments. Design, as a verb, is the deliberate work of space planning and considering the aesthetics and functions of things, places, or processes. As a name, design becomes a representation of the work, often beginning as a plan or drawing. Therefore, the ecological design is the process of effectively forming the shape and operations of complex environments in a clear way that helps the structure and processes in maintaining the environmental relations of a specific area and increasing their integration if possible.

II.1 Historical foundations

More than two thousand years ago, the Greek physician Hippocrates described the influence of "air, water, and sites" on the health of individuals and communities in general. Vitruvius (circa 1 century BC), a Roman architect, explained how street design, direction, and building arrangement could react to seasonal patterns of nature (sun and wind). In a mid-fifteenth-century essay on architecture, the architect Leon Battista Alberti built on these developments, urging cities to change their sites and the nature of streets, squares, and buildings to the landscape to encourage health, protection, luxury, prestige, and the environment in cities. in reaction to clear illnesses, environmental issues of so-called "developed towns," and clear relations between urban areas and the "natural" world, the field of integrated urbanism and biophysical sciences has already started to develop in the late nineteenth century Spirn (1985), Ndubisi (2002), Botequilha Leitão, Ahern (2002), Mostafavi and Doherty (2010), Eisenman (2013).

Other researchers provide an excellent overview of this rich intellectual history. It is a collection of literature characterized by figures who left visible traces in urban and territorial planning, including Olmsted. (1870), Howard (1898), Geddes (1915), Burgess and Park (1925), Mumford (1938), McCarge (1969), Glikson (1971), Lynch (1981), and Spirn (1984). In fact, there is continuous scientific research within these historical foundations, there is a continuous line of thought that extends for a very long time :from Oldsted to Gedis, Gedis to Burgess and Mumford, Mumford to Macarge and Glekson, and Macarge to Spirin. Below, the objective of research in this part to find out how thought has evolved in the field of basic ecological planning.

There was a serious science debate about the city and its growth at the turn of the twentieth century, particularly with the multiplicity of environmental and social problems, and this time is the true beginning of scholarly thought about the modern city. Some debated whether the mission was to restore old cities or to create new "garden cities" in the countryside as a solution to a variety of problems, such as those defended by author Ebenezer Howard, whose book Garden Gardens for Morrow inspired the garden city and the revolution. Howards said (Here or anywhere we have a utopia). Geddes, a biological physician, sees every city and its environs as a single organism, a living, changing organic entity whose future should be dependent on knowledge of its geological, cultural, and social past, as well as the "processes of its present existence." Geddes proposed "regional polls" on "life as they are and wherever they have improved... towards things as they might be" to help achieve this awareness.", which will serve as a clear way for city plans and city designs specifically designed for the "personality" and spirit of "every city"(Planner, n.d.) (Geddes 1915: 138-139).it’s clearly the mutual influence between the cities of the desert and the regional ocean as a natural and social system interspersed with very complex relationships between urban residents, Bedouins, farmers, and merchants, and between geologically and climatically complex ecosystems, although the desert appears at first glance to be a cell, but through the analysis it give the impression about the strength and fragility of an ecosystem in this part of the world.

II.2 Theorical context of ecological urbanism elements:

Starting in the 1980s, around the time of the Brundtland Report[3], the expansion of the sustainability movement in the world of urbanism and biophysical research started and know a rapid and prolific growth that continues too today. Evident is the key driver of the development. Nonetheless, recent academics studies suggest that the global effect on the climate is now so large that it leads to a historical "technical and class" age known as "Anthropocene," in which natural mechanisms are predominantly marked by human activities.

In this thesis, the term ecological and urban scientist almost refers to individuals and academic researchers who, through training and professional subjective identity, focus on the function of Earth's biological and non-biological systems, circulation and flow of nutrients and resources, and other biophysical phenomena: Ecologists, archaeologists, geologists, forest hydrologists, climatologists, and other professionals work in this area. The typical focus of this scientific work has been on controlled trials and hypothesis testing, with progress described as the creation and application of new empirical knowledge about the physical world.

II.2.1 Conceptual frameworks of ecological urbanism:

Given the recent apparent interest in recent years in ecological urbanism, A diverse group of researchers divided the area, and they divided it more regularly. The most widespread conceptual frameworks include:

[3] **Brundtland Report**, also called Our Common Future, publication released in 1987 by the World **Commission** on Environment and Development (WCED) that introduced the concept of sustainable development and described how it could be achieved.

Ecological design (e.g., Orr, 2002; Palazzo & Steiner, 2012; Van der Ryn & Cowan, 2006). According to the Web of Science database, this concept is considered the oldest research concept in ecological planning. There are many new researchers with a very significant number of papers such as Zhang Y, Liu Y and Wang Y

Biophilic design According to the Web of Science database, this concept appeared in 2008. The most important researchers are: (Beatley, 2009, 2011; Kellert & Wilson, 1995; Kellert et al. 2011; Newman, 2014).

Ecological and green forms of urbanism (Barthel, Beatley, 2012; Ellin, 2006; Mostafavi & Doherty, 2010; Spirn, 2014).

Landscape studies (e.g., Botequilha Leitão & Ahern, 2002; Nassauer & Opdam, 2008; Steiner, 2008; von Haaren, Warren-Kretzschmar, Milos, & Werthmann, 2014). **Ecological planning** (e.g., Ndubisi, 2002; Steiner, 2008; Termorshuizen, Opdam, & Van den Brink, 2007; Thompson & Steiner, 1997).

Sustainability planning and urban sustainability (e.g., Childers, Cadenasso, Grove, Marshall, McGrath, & Pickett, 2015; Wheeler, 2000; Wheeler & Beatley, 2014; Wu, 2014; Xiang, 2014;).

Infrastructural ecologies (Brown & Stigge, 2017).

This literature focuses on the creation of concepts of management and philosophical frameworks for the operation of the built environment. A common method is to incorporate organizational principles about the built science and climate, including a desired potential target or condition; build conceptual observations, conditions, and/or models about such principles, which form the foundation for scientific hypotheses and impact measures; then make compulsory recommendations for study and action. They provide a conceptual context of mapping the human ecosystem's designs, patterns, and processes. Finally, utilizing the concept of social and ecological sustainability and human habitat meaning, it offers "tactical perspectives" that help ecology's incorporation into planning and design practices. And others have often used social and economic sustainability as a legal framework for ecological urbanism Similarly (Dr.Wahidmurni, 2017). “Begins with the regulatory concepts and developments of biological diversity and colonial accounts and the searchable case of "environmentally sustainable landscapes." Then they propose methods to measure the abundance of biodiversity and the consistency of ecological networks, and they build an integrated policy framework by utilizing these metrics. Finally, they provide a specific example of applying their own decision-making tool in urban planning practice, using the concept of sustainable landscape and the proposed policy context. Others used sustainability as a legislative principle as well but growing blends it with various principles. (Whiston Spirn, 2012) works on the same principle, being one of the most widely researched academic researchers. It begins with the concept of organisation, and the desirable state of ecological urbanism. Then she described the "assumptions and concepts» that describe urbanism of the world-what is to be considered the philosophical "linguistic" structure. Finally, case examples of how those principles are applied to specific locations in planning and design are provided. This method primarily utilizes experience of the world as a source of insight, rather than as a source of concrete facts for decision taking.

That is close to the approach taken by Van der Rijn and Cowan (2006) with ecological design, Ellin (2006) with integrated urbanism, Steiner (2008) (F. R. Steiner, 2008) with a living landscape, and Kellert et al. (2011) with biophilic design. Overall, these various methods represent ecology as a metaphorical approach to the Burgess approach and/or the ecological resource approach to McHarg, but each uses distinct terminology and proposes specific process and intervention combinations. Therefore, as discussed below, the degree to which environmental policy proposals have evolved meaningfully over time and what agreement remains on the basic characteristics of the sector are still the critical questions.

Despite the global scientific interest in urban ecology, the African continent was not a priority for researchers, despite its clear influence by climate changes, floods and recurrent famines, and their impact on European cities through the waves of immigration that invade Europe from east to west.

I think that through our research that tries to address the city’s problems in the Sahara of Africa through the city of Adrar in the desert of Algeria, it is considered a step towards thinking of a new approach to find more sustainable solutions for the cities of the Sahara, rich in ecological knowledge, Today, desert cities are characterized by a lack of urban resilience and poor ecosystem services.

Urban ecology is the primary scientific supplement providing a clear and comprehensive understanding of the expansion of the urban ecology. Biophysical sciences traditionally, as usual, describe the balance behaviour of the "nature" and the absence of human influence. However, more recently it has become abundantly apparent that there are few, if any, organisms of this kind. Therefore, despite the demands of contemporary existence, scientists have inevitably started to adopt a more focused approach to their research, expanding in tandem with the contemporary urban ecological extension beyond the conventional limits on humans and man-dominated urban areas. In the early 2000s significant works in urban ecology began to spread. Collins et al. (2000), Grimm et al.

(2008), Alberti (2008), Beckett, Cadenaso, and McGrath (2013) and others include excellent information detailing the goals, methods, and items of urban ecological study, including concepts, analytical structures, literature overviews, project priorities, and case studies. Alberti et al. in their 2003 groundbreaking article. He proposed "a fundamental paradigm of urban ecology ... to completely incorporate citizens into studies of habitats" (Alberti et al., 2003).

Ecological planning process:

Ecological urbanism's core concepts are cities part of a natural environment; cities are habitats; cities are landscapes; urban ecosystems are complex and inter-linked; each town has its own, lasting context; town planning is an instrument of human evolution. The definition of urban development includes urban development are a natural world. These fundamental premises form the basis for the concept of an environmentally friendly urban planning solution. The most important principles of ecological urban design are as follows:

Cities are part of the natural world: The city’s ecosystem consists not just of trees, gardens, and several natural elements. It is much bigger than that. This water could be from sources thousands of kilometres away, it is the air we respire, the soil we live in, the water we drink and move further away. and the species with which we share our environment, such as plants that come in turn through the winds, and migratory birds from other continents will transport them. It is complex between humans and other organisms' purposes, multiple activities and natural processes governing energy transport, air movement, earth erosion and the hydrological cycle. The town belongs to nature. The awareness that nature is everywhere and that everything that includes a community has a strong impact on the way the city is constructed and preserved, and on its stability, health, and health. Private everyday life and public behavior. The city as a matter of design and the strategy must be considered. The area, the suburbs and the surrounding countryside must be treated as a common and variable structure within nature, and any thinking to distinguish this framework is a minor bias in its hierarchical design, and every garden and building must be within the larger unit, and instead of ignoring it or exposing it to strange perceptions of its original role, it should cultivate the nature of the city, like a garden. Although every city is the result of certain natural and cultural data, which distinguish each city from others, all cities have changed their environments similarly. Human actions that change the natural environment are natural in all cities: the need for protection, shelter, food, water, and resources to support human institutions; Human actions compete with the natural cycles in most cities to create a model urban environment, urban ecosystems, urban hydrology, urban plant and animal populations, distinct flows of energy and resources, which are also elements required for the functioning of this ecosystem. One obvious example is what happens in desert towns, where they are part of a very dynamic environment. Recent analysis has, however, found variations, focusing on observations on mild or temperate climates at locations. these generalizations. For instance, arid cities are cooler in certain periods of the day than neighboring deserts due to irrigation and are a result of civilised activity. The core premise persists, though. The urban human behavior cannot be separated from natural activities. Cities are in the natural world.

Cities are habitats: It is time to use one of the greatest human abilities, which is the ability to use the environment for human purposes, to turn a life-hostile ecosystem into a human habitat which sustain and foster both individual and collective growth and aim to support human activities.

Cities are ecosystems: The concept of the ecosystem offers an important method for understanding the urban ecology from several aspects. It offers a basis for considering the effects and interrelationship of human activities; promotes the assessment of the potential costs and advantages of alternative enterprises; incorporates all metropolitan areas and populations, the internal nature of the community, and the systems that operate inside it; is ideal for analysing all forms of existence, from simple urban agglomerations to megacity. The urban ecosystem, like any ecosystem, consists of all living organisms that occupy it (including humans) and their relationships with each other and with their physical environment, including built artifacts such as houses, highways, and sewers, as well as water, soil, and plants that are known to be social ecological memory.

The study highlighted through the previous section the characteristics of the ecosystem in the desert oases, the deep connection between human, the natural data, the water layers, the geological, the irrigation systems, the social accumulations, and the environmental knowledge. Although the desert ecosystem is very weak, it is more complex, more influential, and influential in the systems. The other, it is possible for industrial cities to affect climate change in Africa, drought, or floods, which results in mass migration waves that impact to European cities in urban, social, and political factors.

II.2.2 Green Infrastructure

According to the Web of Science database, the concept of green infrastructure appeared in 1991. Green infrastructure is a conservation design strategy that incorporates previous planning methodologies and strategies in the United States into a formal framework that can include wider landscapes and greater planning objectives. (McDonald and colleagues, 2005) Green infrastructure is a concept that has a variety of meanings in the literature. Just as grey infrastructure refers to the city's functioning support system, green infrastructure, refers to nature's life support system (McDonald et al., 2005). The “green infrastructure” attribute refers to a landscape-scale approach to conservation planning that is driven by a wide democratic mechanism and resulting in a policy for protecting an environmental network from conservation lands. (McDonald and colleagues, 2005) If you mean something spectacular in green space you mean something green infrastructure that we like. Green space is thought to be discrete parks, with green facilities focused on interconnected networks. (Benedict and McMahon, 2002) Connected open space is critical for two reasons: The first is ecological; the second is human" (Ericsson 2006). "(Ericsson et al., 2006) Green infrastructure is in equal dignity with "technological infrastructure in conventional urban planning" in present attempts to achieve sustainable urban growth (Sandstro m, 2002).

A wider concept of green infrastructure to encompass all forms of green spaces acknowledges that green infrastructure promotes the overall functioning of the natural and social environment across various networks, or ecosystem services. Developing green infrastructure with a focus on addressing multiple services to urban ecosystems allows:

1) Understand the complexity and interaction of urban ecosystems.

2) Increasing its environmental and social performance.

3) Maximizing human benefits .(Cadenasso et al., 2007)

Ecosystem services are characterized as the benefits of natural ecosystem processes that humans provide and consume. The green infrastructure ecosystem services were split down into two groups:

1) ecological ecosystem services

2) cultural ecosystem services.

Environmental ecosystem services include rainwater precipitation, air pollution control, carbon sequestration, marine thermal island prevention and biodiversity exposure. Health and wellbeing provide cultural environmental programs, where access to green spaces and social vulnerability are discussed. An overview of how the environmental or social problems of each ecological service are discussed is given below.

II.2.3 Ecological memory and social ecological memory:

According to the Web of Science database, the concept of green infrastructure appeared in 1991. Barthel S, Folke C, and Berkes F are among the most important researchers in this field, but research in the field of social ecological memory is very limited. Memory above the individual level that stores experiences of living pasts and influence behavior of societies and groups is often referred to as collective memory The social memory of communities constitutes the variety of forms through which behaviors of people are shaped by the past, and it functions as collectively shared mental maps for dealing with a complex world. Ecological memory is comprised of the types of regional and ecological processes that will determine the future course of the ecosystem. History also covers indigenous fires as well as administrative practices.

There is little environmental awareness in places that lack biodiversity like villages, in regions controlled by invasiveness, and in volatile environments. An inner part of ecological remembrance consists of the biological legacies of the remnants of the neighboring animals. The external part is supported by more defined fields of operation. Typically, urban landscapes occur as a network of roads and buildings linked by pathways as patchwork of ecosystems. It is particularly important to understand how the residue functions as spots and corridors in urban environments. The researchers realized the potential impact these residues make on the future role of the environment, while determining their importance, to promote the use of the precautionary principle.

Social ecological memory.

Social ecological memory is a form of collective memory that carries knowledge and practices related to environmental management . (Ernstson et al., 2010)Many urban ecologists consider pockets of ecological social memory to be gardens and palm grove in urban settings that have preserved traditional skills and experiences related to growing food and directing urban environments over time. Many community gardens have been identified as a tradition that evoked "home" memories. The social memory of communities constitutes the variety of forms through which behaviors of people are shaped by the past, and it functions as collectively shared mental maps for dealing with a complex world. Adaptive management and resilience social-ecological systems requires the “capacity to learn from past experiences and employ strategies to contend with future events” (Colten et al., 2008) contends that it is through participation in social communities and engagement in social practices that collective learning and generation of knowledge and meanings occurs. Learning that occurs through intergenerational encounters and knowledge exchange is in turn important for sustaining the social practices of these communities. This form of social learning is increasingly recognized as a key component of adaptive management and “building resilience” in social-ecological systems (Muro & Jeffrey, 2008). While there are diverse understandings and definitions of social learning in the literature(Reed et al., 2010), situating learning in social interaction and participation affirms the processes of scaling up learning from the individual to wider social units in which collective learning and generation of meaning can occur (Wegner & Bargh, 1998). However, instrumental, or communicative learning in social situations may not necessarily lead to transformational changes in attitudes, behaviors, norms, or understandings (Reed et al., 2010). Transformative social learning requires active processes of critical self and system reflection through an iterative process of multiple loop learning that examines actions and reflects on the assumptions and values that underlie knowledge and learning processes (Keen et al., 2006) . These latter forms of understanding it necessary in contexts experiencing rapid social-ecological change and in which adaptation aimed at maintaining current system dynamics become undesirable or untenable (Lof 2010). In these contexts, there is a danger that system robustness in fact constitute a rigidity trap, with general resilience – the ability to cope with and positively respond to change and uncertainty – sacrificed in place of specified resilience to a specific disturbance such as fire(Nykvist & Von Heland, 2014).

II.2.4 Urban agriculture

Urban agriculture is a relatively recent trend through academic definitions, according to the Web of Science database, the first research dates to 1979, with a clear increase in the number of research every year. There are other literary references that say the first French geographical accounts of (intra- and peri-), urban agriculture (UA) were published on Central Africa in the 1960s, scattered and isolated UA surveys by individual social scientists(Egziabher, 1994), have gradually been giving way to institutional projects led by multidisciplinary teams. As a result, more and better information is now available on a larger number of regions, countries, and cities around the world. Over the same period, public initiatives pioneered by few local and national governments have been followed by more widespread awareness on the part of local authorities, in their regional and global fora, for the growth and potential of agriculture in and around cities. More urban governments are now seeking to exchange policy and technical experiences to better deal with a spreading phenomenon in their own city. but there are many ancient cities that knew this tight system of rules, such as Istanbul through the system of bostans, and palm oases in the Sahara of Africa, but these systems today have many problems. As there is very little work in it. Urban agriculture can be described as the cultivation of fruits, herbs, vegetables and animal husbandry in cities, a process that entails many other complementary activities such as food processing and distribution, food waste and rainwater collection and reuse, education, regulation, and jobs of residents. Incorporating urban agriculture into individual communities and neighborhoods as well as how cities operate and manage.

II.3 Ecological planning models

Ecological planning, as a discipline and occupation, is very developed and has exercised since the early 20th century when the emergence of ecological urbanism are relatively recent concepts. The sustainable ecological community projects can be seen as a continuation of urban planning and architecture movements that have tried, beginning at Ebenezer Howard's Garden City Movement, to create liveable and environmental-friendly cities from the early 20th century. The study tries to present this section to present important urban planning movements that contributed to the eco-city sustainability model.

This included a debate on the transformation of ecological planning as the philosophy of sustainability emerges.

The aim of this part of research is to answer to the following main questions:

What is ecological movements sustainability criteria?
How have ecological planning values and guidelines changed over time?

Have the ecological planning movements been able to fulfil their promises and have more than a century of research and practice in the field of ecological planning that has led to the development of an acceptable urban pattern from the point of view of sustainability?

This retrospective study enables one to explain any movement's achievements and weaknesses, highlight challenges that impede ecological planning's primary objectives and understand the key issues that should be considered in the future. Previous planning campaigns were blamed for not knowing what planning societies they preceded, and not recognizing the causes of a trend that could serve to benefit from the experience, both current and future, that will promote a prosperous eco-city. This study was also significant, as future population growth in urban areas in developed countries is expected to occur approximately. This does not only include countries like China and India but will also include African countries where the heading 'urbanism' already covers several innovations. These innovations should benefit from previous movements' successes and mistakes to be geared towards more viable.

II.3.1 The Garden City movement

The problems associated with urban overcrowding, in the wake of the Industrial Revolution, made Howard think of a way to combine the benefits of rural and city life (Daniels, 2009); (Howard, 1946) . His vision, which was a mixture of the best features of the city and countryside, was a constellation of new, independent and independent cities surrounded by a green belt and located around a large city (Bergman, 2011); (Howard, 1946); (Wheeler, 2004)). Each of these new circular cities was divided into six wings, each designed to accommodate up to 5,000 people who were working there as well. Howard's proposal to divide Garden City into several pavilions can be considered one of the first efforts to introduce the idea of an eco-city into the planning context.

Implementation and criticism

However, the original concept has been retained and now promoted and practiced in a changed way, consisting of complex, mixed-use, low incomes, and partly autonomous communities. The UK community planning association, for example, released in 2013 a guide for councils to develop a new wave of city parks. in 2013 (TCPA, 2013). The plans put forward by its successors reiterate key features of the City of Howard Garden, including spacious green spaces, single-family condo, and street styles. This is still prevalent in the traditional pattern of development in suburbs, which is widely attributed to suburban expansion and unrestricted urban growth. About social reform, while the objective of Howard was to set up societies to meet the needs of the different social groups, the experiments in Garden City did not meet the needs of the poor workers who were negative. Because of the high cost of purchasing the property needed for this purpose (Gillette, 2010), the Green Belt is being overlooking a major component of the Howard concept [81]. Although Howard's ideas have been widely diffused, they have not been in a specific regional context despite their positive aspects, but this does not prevent him from benefiting from the positive environmental experience and from seeking to manage the social cohesion provided by the green infrastructure as well. This model considered nearer in principle to the oasis, although it came in a different ecological and temporal format. Although the garden City seems to be ideal from an ecological point of view, its design, which focused on the approach of the regions, made it live in a lot of problems in the field of social communication and social problems, which it was obstacle for the development of this city.

II.3.2 Eco-city idea

Initiatives to incorporate the ideals of sustainability into community planning have been popular around the world since the beginning of the century. The roots of these efforts date back to the beginning of the 1980s, when the sustainability idea was developed, and Richard Record proposed eco-cities that consider the ecological ecosystem of the region. Urban ecological initiatives are based on the concepts of urban metabolism and sustainability and therefore have a wider scope compared to previous movements (Holden & Li, 2014) (Tsolakis & Anthopoulos, 2015). In addition to the typical challenges mentioned in the previous sections and the challenges of climate change and resource limitations, the word 'our preparation' applies to the numerous movements which have been created. Much of Eco City, Eco-City, Eco-District, Eco-District, Garden City, Anywhere City, Green City, Flexible City, etc. are increasingly being literature. Size, space, social, and political contexts, the construction form, and data variation in urban ecological evolutions. Many of the characteristics of ecological culture were promoted by earlier trends. The integration of green and / or omnibus infrastructure, such as intelligent grids, water treatment systems, solid waste systems, solar technology, net electricity builds, realtime information transport, e-work, technology use and ecological social memory is a distinctive characteristic of the ecological society. As an example of urban ecological initiatives, Figure II-1 shows the town of Masdar (Figure II-6). The project can be seen with clean technology like solar panels and evaporative cooling tower. Carbon discourse is dominant in all urban ecological movements. The focus on low-carbon cities gained better momentum after the Kyoto Protocol in 1997 recognizing the vital role cities can play in reducing energy consumption and associated greenhouse gas emissions (Joss et al., 2013 (Gaffney et al., 2013). In addition to echoing the principles of minimal ecological footprint and living in harmony with nature (Pow & Neo, 2015; Yu, 2014) (Zhou, 2015), Any urban ecological campaigns prioritize the construction of independent corporations with transparent economic sustainable business policies and strategies (Pow & Neo, 2015). The emphasis on local farming and urban planting is an example of this. Urban environmental schemes also act as centres of excellence and live labs for awareness generation, education, and testing of advanced green technology, if successful, can later be widely disseminated and shared with other projects through existing networks created for this purpose.

Figure II-1 Masdar city (Cugurullo, 2013)

Implementation and criticism

Four distinct types of urban ecological projects are listed in the literature with respect to the form of development: Greenfield; Brownfield or infill (such as Dongtan, China), constructed on reclaimed land (such as Covidien, China, for instance); Salt Region, United States; Urban retrofit (such as Dongtan, China); Gus et al. (2013) research found that many eco-city projects worldwide are filled or urbanized (Joss et al., 2013). An analysis of LEED-accredited ND's projects in the field of energy and environmentally friendly architecture for animal production showed similar findings showing that more than 50% of the projects were built at locations brown fields.

The urban environmental projects of South Korea are like the projects of Chinese, except they are more focused on information, connectivity, and environmental technology. Among other items, Japanese ecocities aimed to revitalize the economy, improve recycling of materials, increase civic engagement, enhance understanding of the atmosphere, and improve social justice in cities. Other Asian countries such as Indonesia, Vietnam and the

United Arab Emirates have also used ecological urbanism. Some urban ecological projects have been criticized for prioritizing the economy over other dimensions of sustainability. Some governments consider building urban ecological projects a "symbolic investment" necessary to enhance the city's economic competitiveness (Bell, 2015). This has brought more attention to the economic aspects. For e.g., Masdar City focuses primarily on economic aspects of sustainable development at the cost of social dimensions. Issues such as integration and attachment were not considered well, so fears were expressed about the failure of the project in the event of an economic recession. In environmentally friendly English cities and Indian eco-cities the lack of balanced accounting of sustainability dimensions has also been identified.

While urban ecological schemes tend to be comprehensive and minimize intra-city inequality, the fact that on the ground this is not proven through neglecting a thorough vision in several projects is often criticized. While 10 percent of the units in the Chinese city of Tianjin Eco-Singapore are set up for inexpensive housing, the occupant can live in the ecocity as a prerequisite. In the eco-city are just high-tech businesses, meaning they are highly educated professionals with decent wages to afford standard accommodation. Caprotti (2014b) questions the social success of eco-towns and describes them as islands of wealth in an ocean of poverty. A clear social discrimination and likewise, the eco-city of Covidien is described as a wealthy island separate from the hinterland (Joss & Molella, 2013). One of the major reasons why urban environmental programs are not addressed is the effect of business mechanisms.

Since the turn of the century, there has been a global spread of initiatives that attempt to integrate the principles of sustainability, the good use of ecosystem services, and the utilization of green infrastructure to preserve the environment and reduce disaster risks. As a comprehensive term, ecological urbanization refers to the various movements that have been developed, which have been considered in developing green and grey infrastructure and which have considered the four principles of Green-Gray Integration Multifunctionality Connectivity Social Inclusion. Many of the advantages that environmental civilization seeks to obtain from green infrastructure. A key feature of environmental urbanization is the incorporation of green and / or ubiquitous technologies such as smart grid, water treatment systems, solid waste management systems, solar technology, zero net energy buildings, real-time transportation information, e-work, and so on. But despite the elevated objectives of the ecological city, it was unable to meet its aimline aims, as in many cases, the ecological memory of what had been made of it without a spirit system was not considered. Masdar in the United Arab Emirates noticeably it was limited to special categories of peoples, certain commentators articulate this as a fantastic city, even though the designers have sought to integrate social links and maintain ecological diversity.

Finally, there are signs of limited success in urban ecological growth in utilizing the larger ecosystem beyond the limits of emerging communities. This can be partly explained by a fragmented method of urban, regional, and domestic planification. For instance, while the Ferrari World High Energy Park and Multifunctional Centre in Yas Island are attempting to promote low-carbon growth, it is promoting unrestricted consumption. Coordinated actions are therefore required to achieve prosperous communities in different industries and industries.

II.3.3 African eco city experiences

Africa is considered the poorest continent in terms of resources and the most growing population. This growth constitutes a real concern for decision-makers

Thinking about sustainable development is very recent compared to the urban history of cities but thinking about preserving resources and the ecosystem is long before that. The Algerian experience in the seventies of the last century, in building a thousand agricultural villages, considering the availability of oil funds, is a proactive vision for sustainability goals. The Rwandan experience through the eco-city of Kigali is also considered a pioneering experience. The research tries to clearly explain the process of ecological planning through the African context.

1. Agricultural Village Houari Boumediene, Abadla, Algeria:

President Houari Boumediene has initiated a project to develop 1,000 farm Socialist villages over 10 years after Algeria's independence. These villages could be built such that the precarious living standards of farmers, who already were marginalized by society, could be improved in a vast rural environment, and developed along the lines of domestic operation. The aim was to encourage the presence in the home of villages around the countryside and to make it possible to create and live together those who earn their living from the soil. This requires a modern and constant lifestyle for this people and, thus, more than just accommodation, importing the spaces and activities necessary for farming, from education to health care and Community life.

Figure II-2 Agricultural village detail 2(Bofill & James, 1988)

Though the planned houses were no longer temporary or disposable, Taller de arquitectura held true to the Bedouin traditions and worked to construct the building, using its materials, and reproducing the distinctive arrangement of living space based on the Algerian culture closely associated with the vernacular practices of the region. The question was to give farmers a dignified life, in proximity to their lands and to contemporary means of operation. The socialist Soviet model certainly influenced the building of the so-called settlements, but to achieve and last the initiative had to incorporate the local culture of the region and social traditions. These towns were created far from moral and western regulations in architecture (figure, II-2), from which Algerians wanted their freedom, and after a lengthy colonial rule marked by bloodshed and slavery, they want to begin a new beginning.

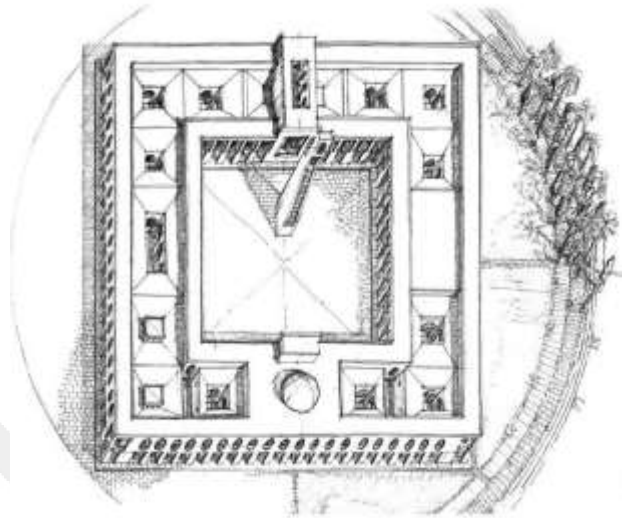


Figure II-3 Agricultural village   detail source

In this sense, a farm village in the South-east was constructed by Taller de Arquitectura. Installing an urban primary built on a combination of one-family homes offers countless opportunities to keep process costs down, in a limited and sequential manner. The selected geometric figures, drawn from Arab and Mediterranean styles (figure II-3), are intended to construct a cluster in the first installation for two or three dwellings around a courtyard. A community of many neighborhood blocks throughout the district, thus preserving the ratio of the built-up area to the open spaces. As in all Arab cities, a wide central square is the venue for market and gatherings, holidays, and glasses, and a crucial centre expressing the region. (Figure, II-4)

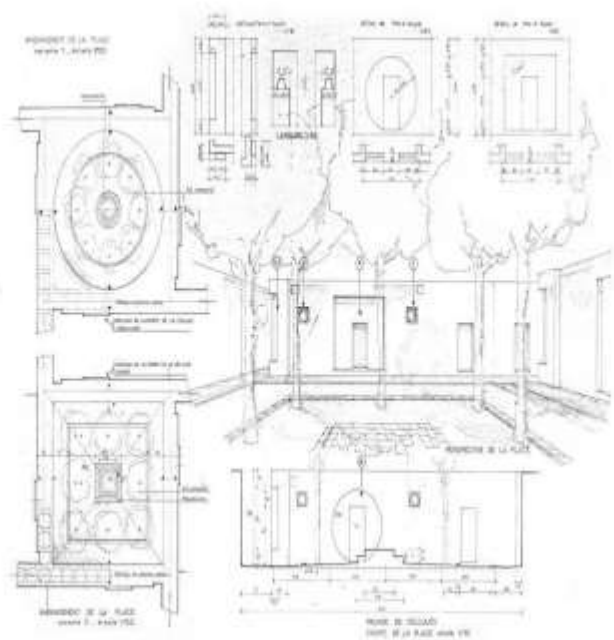


Figure II-4Agricultural village Details source ((Bofill & James, 1988))

The mix of single-family homes provided endless options for the composition of the urban core which had not yet been confined and serialized to keep operating costs as minimal as possible. —The geometric shapes selected, drawn by convention from the Arab and Mediterranean, allowed for the first grouping by a courtyard of two or three dwellings to compose a block. —To group a few blocks a district and different neighborhoods, an area, were comprised of, with the share of the built space being retained continuously to open public space (figure II-6).

Figure II-5Agricultural village map source google map

Implementation and criticism

The idea of agrarian villages in Algeria is a pioneering experience, but its neglect of the social aspect and the involvement of society in the planning process is one of the most important factors and the failure of this experience.

Not considering the expansions at the long and medium levels make the expansion of these villages unacceptable, these villages were far from the places of work and cultivated areas, which made the economic factor for which they were established, a reason for their failure.

As for the example, the influence of the national road passing by the village as a strong economic factor was clear, so neglecting the natural and social data is considered negative.

Kigali Green City

Kigali Green City is a groundbreaking concept for tackling new urban growth problems. The cities of Africa are fast expanding. The United Nations anticipates that the continent will increase its population by 2050, and half of this will be in urban areas. This movement is a threat and a chance for many people to come into the city to find better jobs and living conditions. These patterns must not exacerbate deprivation, poorness, and the depletion of the world.

The first green city in Africa is a living plan. Sustainable, cost-efficient, green, and inclusive urban living. A life-pleasant place. With the first "Green City" initiative in Africa, Rwanda focused on putting Wakanda into existence. The city will include environmental clean small factories, electric cars, affordable housing for the environment and interconnected craft centres for Kenyans, the Gassapu District, and Kigali, covering an area of 620 hectares, and will cost $5 billion. This city aims at obtaining a full infrastructure Preventing climate and air emissions, including clean technologies, hybrid cars, electric biking and bicycles, solar energies, sustainable waste disposal, biogas stations and urban forests. He added that the project represents a standard for showing the feasibility in Rwanda of green cities and detecting components that can be repeated by green technology and innovation in green and climate-resistant urban construction for secondary cities around the world. The construction primarily uses local building materials to make houses more economical and environmentally friendly. Revenue holders, instead, would be set up in the proposed town to empower low-income holders. In fact, part of the green town is assigned to people with low incomes."

City goals

Act as a blueprint for sustainable urban planning linking affordable housing to adapting and mitigating climate change. Set criteria in Rwanda and Africa for decent housing and sustainable urban growth. Improve the capacity of government authorities and other stakeholders to implement relevant urban planning and housing concepts Build a group model. In Kinyinya Hill, Kigali, a neighborhood where residents experience a social and economic advantage while reducing their environmental footprints will be shown in an inexpensive home. Engage and make a difference by responding to one of Africa's greatest problems of tomorrow Green Urbanism Set criteria for sustainable urban planning and green housing strategies in Rwanda and Africa. Design an urban space that promotes social cohesion, equality and inclusion and provides much-needed affordable housing for lower income groups. It is intended not only for the city but also for its residents to transform the project. The proposed neighborhood would consist of houses, business spaces and light industrial areas. Schools and hospitals, like athletics and green fields, are just as critical as leisure areas. The green city of Kigali has the view that green housing should be for everyone, especially for the poor. It will provide people with much-needed housing. The project seeks to prove that building green is not a luxury, but a requirement and it aims to shift the stereotype that green thinks is costly.

The basic objective of this city is: GREEN-BLUE Network Strategy, zero carbon buildings, Sustainable transportation, Automatic water, urban heating island, Zero Carbon Timeline, Affordability, Environmental and social impact, Women and youth, Climate change.

Implementation and criticism

The Ronda experience is a pioneering experience in the field of sustainable cities. Although the experience is new, but there is a lack of social awareness, which constitute an obsession for project supervisors despite the steps taken to raise awareness. Nevertheless, the experience and plans prepared for it are considered a good step for a real start for the ecocity in Africa.

II.3.4 Evaluation of ecological planning models

In this section of the study since the beginning of the 20th century ecological planning movements have shifted. Planners attempt for more than a hundred years to address the challenges posed by upregulating economic development, city environmental issues and climate change. In addition to two African cities, four cities were analysed, and both came during the independence wars. The key features of these different movements are summarized in table 3-1 and table 3-2. As stated in the section Roads & Resources, Table 3-2 contains a variety of sustainability requirements, as well as green infrastructure and ecological memory factors as important factors in our study, which demonstrate how they are integrated into the basic principles of selected movement.

The ecological planning focus on public spaces and quality of life to cover different topics of sustainability including inclusiveness, climate adaptation and resource management. Carbon control is successful (by urban planning modification and green infrastructure integration). These strategies to create attractive communities vary from each other both in terms of historical origins and the techniques, priorities and behavior suggested. While many of these ideals and qualities have been repeating in various trends, some arose at the end of the 20th century because of growing environmental issues and sustainability. Since then, massive transformations have been undertaken in the basic structures that shape towns and neighborhoods in general. The consequences of climate change and the spread of urban planning in some developed countries have received greater interest. Moves that come under the general heading of environmental culture and have arisen to address these problems. Ecological modernity is built on previous movements by, inter alia, using green and comprehensive technologies everywhere, developing strategies to use resources intelligently and efficiently, encouraging field development and infrastructure development focused on CO2 and low carbon development, focusing on climatic resistance and performance verification, despite this, the planners did not clearly articulate to perform and evaluate green infrastructure and ecological memory.

The second observation is that there is an overlap between the different movements. These movements share some common denominators in terms of the circumstances that led to their emergence and the goals they were seeking to achieve, which are the same conditions that African cities live today and even the last two examples in Algeria and Ronda were After the two countries out of wars. Garden City are also important in the evolution and evolution of subsequent movements. A comparison of early moves indicates that new planning movements have been rejected in some cases, like their precedents. This confirms previous findings in literature (Tallinn, 2005). However, it seems that new movements (traditional environmental and new urban) have learned to avoid this error by taking advantage of the potential complementary benefits gained from synergy between previous planning cultures.

The third observation is how effective the selected movements and examples have met their commitments and whether over a hundred years of study and experience have contributed to a clear picture of a healthy city in urban planning. With the small number of cases analysed in the findings of this review, the data to address this question is contradictory, and further cases from each movement should be addressed in prospective work and whether they have fulfilled the sustainability requirements in Table 3-7. This part of the thesis indicates that environmental planning movements have had limited success in achieving their initial goals. The main issues to achieving community resilience are

Howard values for the development of effective, self-confident, and equitable communities. There are two main reasons for this misconduct: the first is the market impact which has always been a barrier to the full achievement of the aims; the second, the fact that in certain situations, such as Masdar City, the targets are rather impractical for planners, but in the meantime, they have no choice but to look at them, not committing themselves to green infrastructure. The creation of diverse and egalitarian communities is an essential aim which no campaign has successfully accomplished. In the updated literature, developers must know the possibility of developing the 'rich islands' which do not support communities. The inability to construct equal communities stems mainly from a complex 'origin dilemma outside urban planning and the construction of materials.' To tackle this issue, more coordinated efforts across diverse industries are required.

Table II-1 Main features of different ecological city planning examples

Item	Garden City	Eco-city	H Boumediene city	Kigali city
Geographical focus	EU and NA	Global	Africa desert	AFRICA
Main inspiring condition	Crowded City	Climate change	Social problem	Social problem
Proposed density	Low	Medium-high	Low	Low
Street type	Curvilinear	Hybrid	Radial	Flexible grid
Street connectivity	Low	High	High	High
Transportation	Private	Multi-modal	Private	Multi-modal
Promotion of integration with **the broader landscape**	Yes	Yes	No	Yes

Incorporation of ubiquitous technologies		No	Yes	No	Yes
Carbon foot printing & low- carbon development		No	Yes	No	Yes
Attention to climate resilience		No	Yes	No	Yes
Involvement of international governmental or quasi-governmental bodies		No	Yes	No	Yes
Assessment tools for performance verification		No	Yes	No	No
Green infrastructure facture	Green-Gray Integration	No	Yes	No	Yes
	Multifunctionality	Yes	Yes	No	Yes
	Connectivity	Yes	No	Yes	Yes
	Social Inclusion	No	No	No	Yes
Ecological memory	Participation	No	Yes	No	No
	Reification	No	No	Yes	Yes
	External sources	No	Yes	Yes	Yes

Table II-2Degree of incorporation of sustainability related criteria in the studied movements

Themes and criteria		**Garden City**	**Eco-city**	**H boumdien Algeria village**	**Kigali city**
Social	Inclusive community (demographic profile, affordability, etc.)	¬			¬
	Community facilities and civic spaces			x	¬
	Local vernacular, culture, heritage, identity	×		x	**x**
Economic	Housing and job proximity	¬		x	**x**
	Self sufficiency			x	**x**
Environmental	Location and site selection (site sensitivity)	×	—	—	¬
	Resource management (clean and efficient Energy, water, materials, waste etc.)	×		x	¬

	Environmental protection (ecology, biodiversity, etc.)	×		x	**x**
	Green space				¬
	Sustainable transportation within the neighborhood (public transit, cycling routes, etc.)	×		x	¬
	Certified sustainable buildings and communities	×		x	¬
Institutional	Public consultation and stakeholder engagement	×		x	¬
	Sustainability education (innovation, research, and development)	×		x	¬
Design	Internal street Connectivity	×			¬
	Accessibility				¬
	Compactness	×		x	**x**
	Mixed use	×		x	**x**
	Site layout (energy efficient design)	×		x	¬
	Green infrastructure (photovoltaics, rainwater harvesting, etc.)	×		x	¬
	Ecological memory consideration	**x**	x	x	**x**

¬ indicates compliance	**× indicates non-compliance**	**M indicates mixed evidence**

II.4 Conclusion

Ecological urbanism; necessary to achieve sustainable development. Through this part of the thesis, the study attempted to address four different planning movements with two examples of two experiences from Africa. The urban ecology is more distinguished in comparison to other movements by the most recent movement, which highlights its important contribution to the adaptation and mitigation of climate change. Community growth as an opportunity to build more resilient, sustainable, and sustainable urban areas should be considered by planners and policymakers. Eco-efficiency and resilience were still required in these inventions. One important conclusion of this analysis was that there is a disparity between public lecture and environmental planning, despite some signs of progress in meeting objectives. While the most recent effort to solve challenges linked to rapid environmental changes, energy concerns and urban adaptation is environment modern culture, past problems such as social equity, social ecological memory and disaster mitigation were not completely discussed. The updated literature mentions some explanations for this discrepancy between philosophy and the implementation of environmental planning. The over-reliance of the planners on material and technical determinism was a common critique. While environmental planning campaigns vary according to their context, both movements have tried by concrete design to revolutionize the status quo, focusing on urban changes. Everyone did not understand that the mechanism of transition could not be easily managed. "The behavioral impact that stringent official inspections will eventually contribute to is difficult to be expected." The physical and technical solutions to social challenges and avoiding them should be aware of the limits.

In this part the research did not address all the movements related to environmental planning. Only major planning insights (mainly in Europe, North America, and Africa) were investigated as an environment similar to our case study. Through literary and realistic study for the cases studied, the principles of ecological urban planning summarized in the following figure.

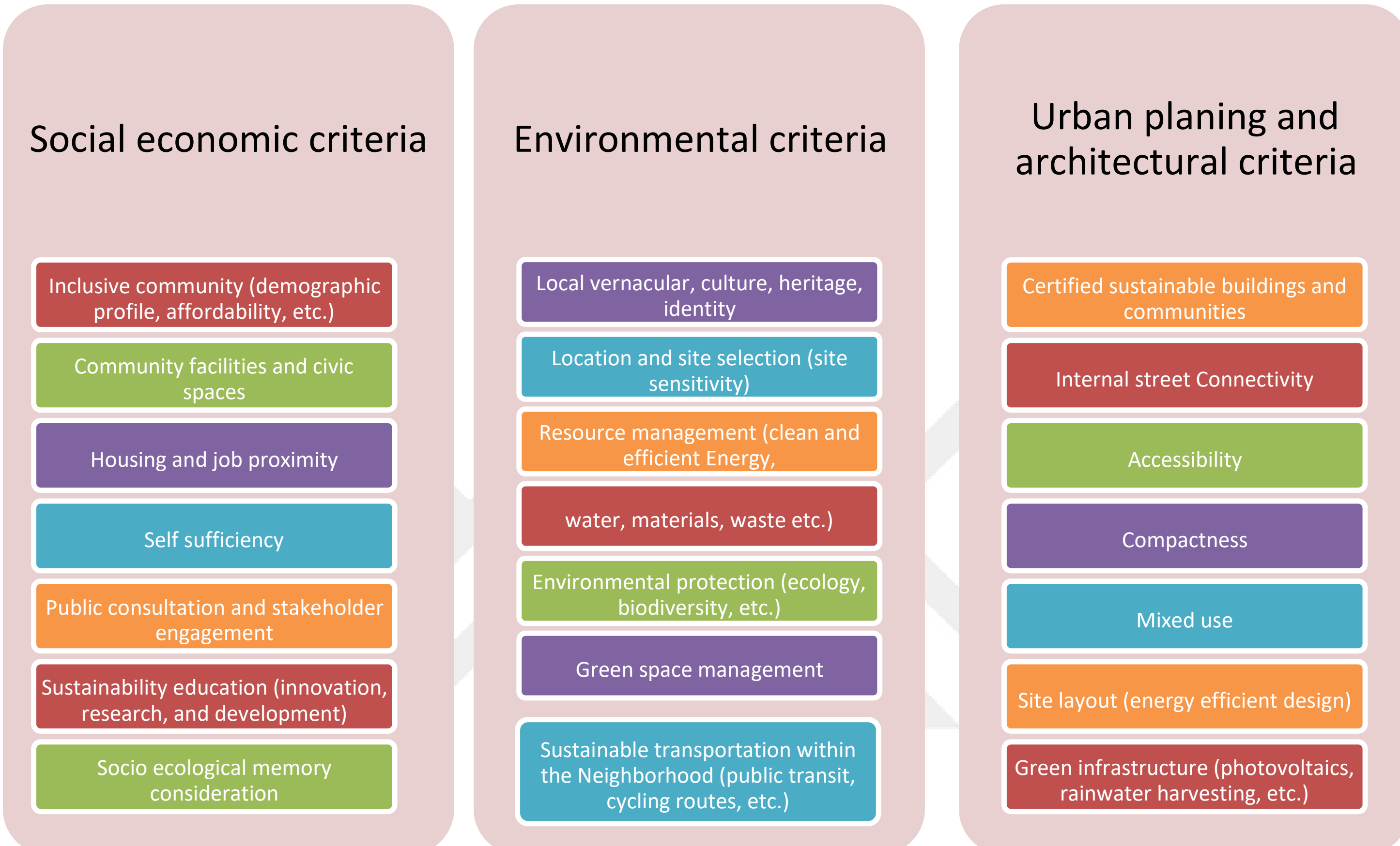


Figure II-6 Principals of ecological planning criteria

III. DEFINING AFRICAN DESERT ECOLOGY FRAMEWORK AND INTRODUCTION TO CASE STUDY

III.1 The Desert ecology

The objective of this chapter is defining the desert ecology. Scientists divide ecology into seven organization levels: ecosystem, organism, population, community, biome, landscape, and biosphere.

The desert is a barren wasteland with rare biological diversity and unfavourable to most living organisms. This is the prevailing definition for most people, but the truth is the exact opposite, as the desert can be sandy, rocky, dry, icy, and even snowy land with terrible biological diversity. The name Sahara comes from the word desert in the Arabic language. The Sahara Desert located in Africa and is the largest sandy desert in the world, and it is generally the third largest desert in the world after Antarctica and the Arctic. Over an area of more than 9,400,000 square kilometres (3,600,000 square miles), covering most parts of North Africa, its area could be the size of the United States of America or China.

III.2 Physical facts about the Sahara Desert

Highest point Emi Koussi: 11,204 ft (3,415 m) - coordinates 19°47′36″N 18°33′6″E Lowest point Qattara Depression: −436 ft (−133 m) - coordinates 30°0′0″N 27°5′0″E Length: 4,800 km (2,983 mi), E/W, Width: 1,800 km (1,118 mi), N/S Area: 9,400,000 km2 (3,629,360 sq mi).

The figure III-1 satellite imagery showing the Sahara Desert

Figure III-3A satellite imagery showing the Sahara Desert. Sources google earth

Thousands of years ago, the Sahara Desert was not always what it is now. It was a fertile area for lakes, water and, rivers crossed the region,. Modern technologies such as satellite imagery have identified rivers that have long since disappeared about two million years ago, and modern mapping and measurement methods show that the desert varies in size from year to year and this is related to climatic factors for each year. The average precipitation in this desert region is very little, reaching 10 cm per year or nothing at all for many years in some areas, and some areas witness severe floods. According to the temperature, it can reach 55 degrees Celsius or even more in the hot season between the

Figure III-2 Mountain desert source internet

Figure III-2 Showing Sand Dunes in the Sahara Desert months of March and May, while in the cold season it can even be below 0 degrees Celsius in some areas (high altitudes).

III.2.1 Defining desert ecosystem dynamics

Many people consider the desert to be areas devoid of life, but the truth is that these areas harbour geographically rich ecosystems, that cross the deserts of our planet along two margins parallel to the equator. One of the largest deserts is the Sahara, at 25-35 degrees latitude in the northern hemispheres. And Southerly.

A desert biome is considered climatically the sum of all arid and severely arid regions of the world; Biologically, as ecological areas that contain special animal groups, plants. The animals have adapted to survive in this environment, from the physical side, as large contiguous areas with wide expansions of bare soil and a distinctive low vegetation cover, has been adapted to the climatic parameters.

III.2.2 Desert Ecosystem Processes

There are arid ecosystems in which the pulse-reserve paradigm is sufficient for understanding the relationship between rainfall and primary production. However, even in the simplest desert ecosystems including those characterized as hyper arid, there are ecosystem components that do not behave as predicted by the pulse-reserve paradigm. The conceptual model with soil as the central unit affecting water availability to plants could be applied to most ecosystems including ecosystems in mesic environments. The complex nature of desert ecosystems and indeed all ecosystems is derived from the species differences of the organisms that make up the living components of the system. Those differences include species of soil microbes at one end of the size spectrum and elephants and camels at the other end of the size spectrum. The species inhabiting arid ecosystems have evolved adaptations to the conditions of the environment in which they live. There are species-specific responses to both the abiotic and biotic environment. Different species of plants respond differently to large and/or small precipitation events. Animals are not only consumers of primary production but must be considered as regulators of rates of ecological processes (Chew, 1974). Animal species not only influence landscape structure, but some species also directly or indirectly affect soil properties thereby modifying materials cycling and resource distribution. Biotic interactions have modified responses of species to the abiotic environment. For example, competition is extremely important as a determinant of water-nutrient availability patterns of plants. Herbivory affects carbon allocation processes and morphologies of plants which in turn changes the interactions of plants with the abiotic environment. It has been suggested that competition is most important as a force organizing community structure only in "crunch" years, for example, years when critical resources are in short supply (Weins, 1977). Species interactions such as competition and predation can uncouple the critical resource threshold from direct linkage to rainfall and result in lags in critical ecosystem processes. It is essential to understand that differences among desert ecosystems are based on the long evolutionary histories of the species that are the living components. Conceptual ideas such as functional groups of plants and animals are constructs that help us organize generalizations about the role of a group in ecosystems. While generalizations are necessary for basic understanding, the variance encountered in all ecosystem studies occurs because of species differences.

The ecosystem can study without reference to geographical boundaries. However, the limits of ecosystems made by other environmental data such as soil quality, vegetation type or water areas. The boundaries of these units coincide with the boundaries between soil types, or they may simply reflect changes in cover and composition of the prevailing vegetation, which prevents to define these boundaries. Watersheds and other landscaping units can be divided into patches or mosaics based on boundaries defined by groups of structural characteristics. Since the rates of ecosystem processes are determined mainly by the biosynthesis and quantities of abiotic materials, we must consider these limits if we want to understand the processes within ecosystems. Given the complexity of relationships in the desert system, we will define our ecological study of the desert in the «Oasis ecosystem». Defining patch boundaries is necessary to study how the transport of materials and the movement of living organisms and human systems across these boundaries contribute to the functioning of the landscape or geographical area. Due to the relative homogeneity within this unit, an ecosystem according to this definition of a landscape unit is equivalent to "habitat type" but with the caveat that the abiotic environment features were integral parameters in the ecosystem characterization. However, many important features of desert systems involve more than just exchange and feedback between organisms and the abiotic environment. The desert systems environment must also address population and societal processes such as competition and solidarity. It is important to keep what structures within our monitoring framework allow (for example, population processes, societal processes) separate from the boundless world of ever-escalating flows.

III.2.2.1 Composition of Sahara landscape ecosystem and case study context The figure III-4 explain the composition of Sahara landscape ecosystem is very special, this composition is composite by the following elements:

Figure III-4 Ecosystem of the Sahara

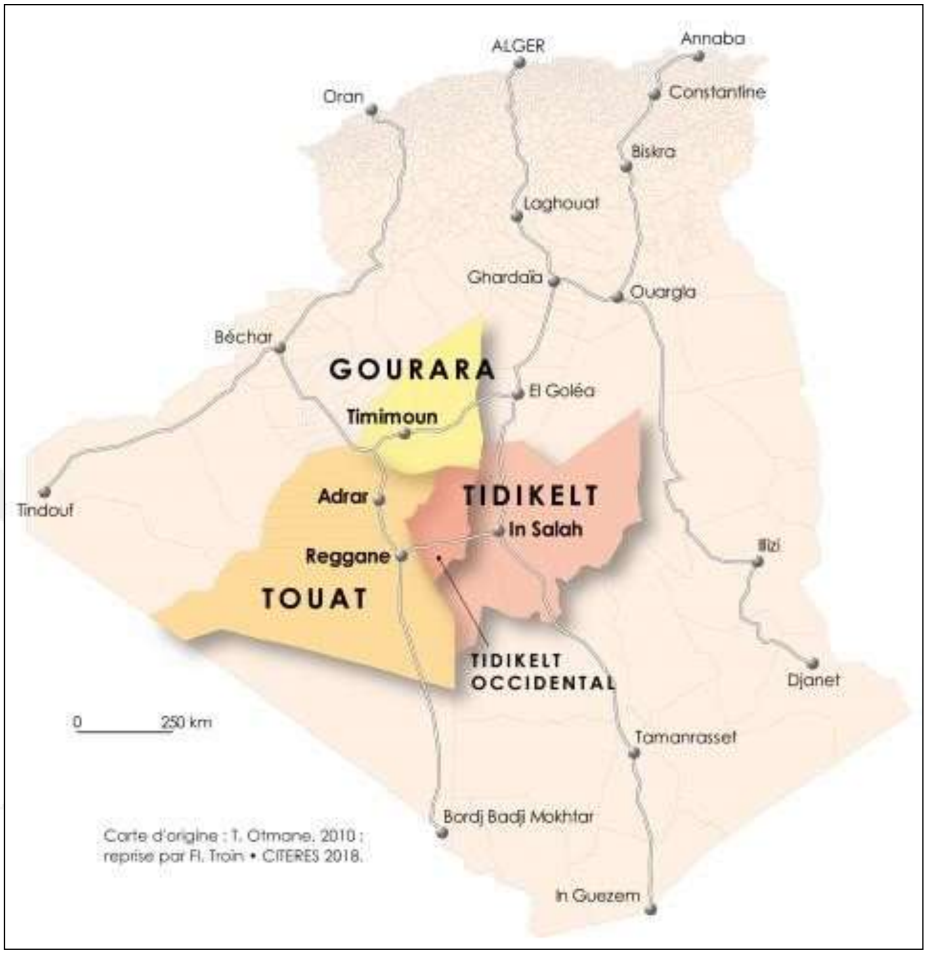
1. Sebkhas: large saline depression, rest fossil of a large lake, compluvium of erg waters and mountains.
2. Inselberg: hillocks of erosion, formed by residues of the dismantling of a plateau and emerging remained as composed of more weather resistant rocks, or formed by the accumulation of sediments along the edges of the great eras of rain lakes.
3. Dunes pyramidal created for the presence of converging winds. This dune it is existing in 18 km in oust of Adrar city.
4. Cordons of dunes shaped by the constant winds in our case study this cordon it between erg and city of Adrar.
5. Wind-carved depression (deflation). The water from the underground river's comeback to the surface and evaporating deposits salts, between Adrar city and Oued Messaoud this phenomenon it can be observed in different points.
6. High temperatures and hot dry winds dismantle wear away the humus unprotected by vegetation. Denuded soils on the effects of solar radiation, wind and erosion are violent.

7. Oued: an over fossil river a sporadic flow or underground. Oued Messaoud, one of the longer Ouled's in Algeria, their sources starting from Morocco to the Tanezrouft in South of Algeria this Oued permitted for the long time to the caravan of commerce to move between Mediterranean cities and sub-Saharan cities.
8. Strong wind currents create high pressure and dissipate the clouds.
9. Surface water, not retained by the soil, have impetuous and intermittent regimes, that erode the mountain walls. The large number of debris transported, not disposed of by the lack of an outlet to the sea, can be seen on the same course of rivers, forcing them to constant changes of direction and fragmentation in many riverbeds. It determines the complete disintegration of the hydrographic network and create closed basins where water is destined to evaporation.
10. Underground aquifers contained in porous layers. They originate from precipitation in the mountains even thousands of kilometres away or are fed by infiltration of the floods of the wadi. They come together, at times, to very deepwater table surfacing waters. Adrar city situated in the border of the intercalary continental underground aquifer.
11. Oasis along wadi use for water supply underground streams and sporadic floods.
12. The accumulation of sand, reworked by the wind, is the erg, the great desert dune area.
13. Oasis in the erg can reach, through the excavation of circular craters, shallow water table where the roots of trees draw water directly.

14. "Pinnacle" of settlements exploits the water absorbed by capillary porosity of limestone and conserved in natural seeds cavity.
15. Oasis on the edge of sabkha capture, through imposing hydraulic works, underground water converging on the ancient lake dried up and they subtract the evaporation on the bottom of the saline depression.
16. Hamada: tabular rocky desert. we can observe a long hamada between TADMAIT plateau and Adrar city.
17. Reg: tabular stony desert. Where Adrar is situated

III.3 Introduction for case study context

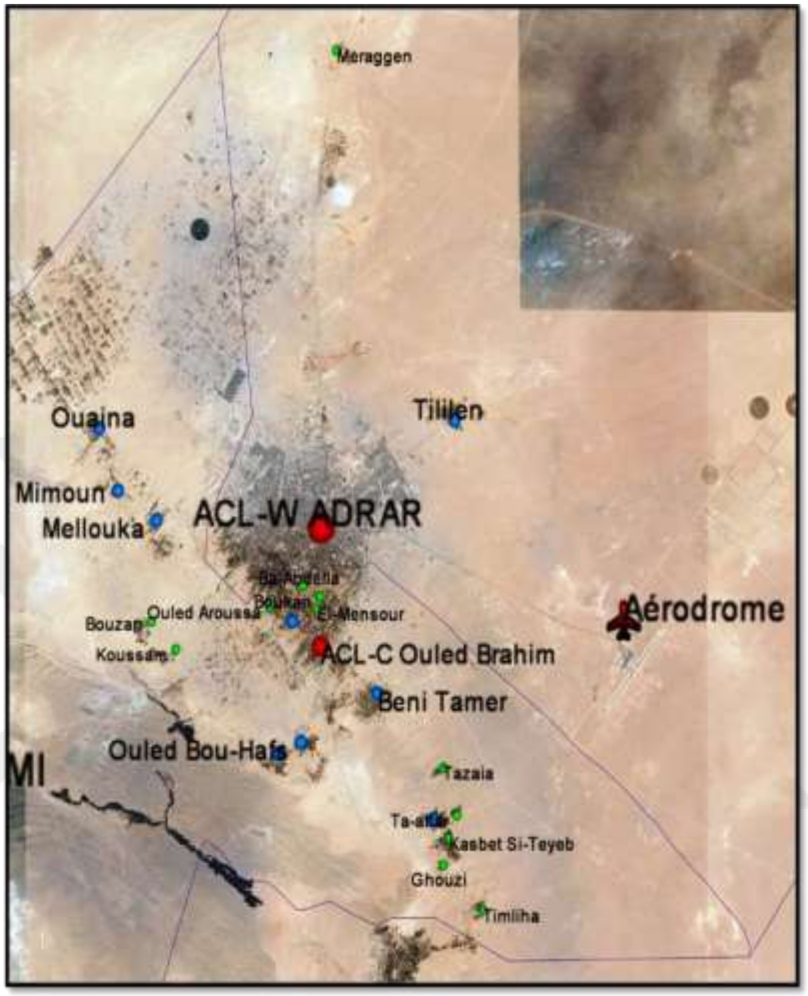
The department of Adrar covers an area of 427,968 KM2, or almost 18 % of the National territory (figure III 5), for a population estimated at 443,936 inhabitants at 31.12.2012. The density is 1.04 inhabitants / km2. It has four distinct natural units: the Gourara in the north of which the city of Timimoun is the main city, Tidikelt in the Southeast framed by Aoulef, Tanezrouft around the region of Bordj Badji-Mokhtar and in the middle the Touat where the Adrar city is located, as the main agglomeration of the department.



Adrar situation Algeria MAP (Otmane & Bendjelid, 2018)

Adrar city includes the two communes, Adrar and Timmi as well as several Ksours belonging mainly to the commune of Timmi. (Fig II-6)

To appreciate the place of city in its territorial context, it is preferable to take the entire Touat region as a reference and identity space. This region covers an area of 205,650 km2 and has 12 municipalities located along Oued Messaoud. These are Tsabit, Sbaa, Bouda, Adrar, Timmi, Tamentit, Fenoughil, Tamest, Zaouiet Kounta, In-Zegmir, Sali and Reggane.



FigureIII-5Situation of the Agglomerations source (PDAU)

III.3.1 Adrar ecosystem:

Adrar natural environment is part of that of the whole Touat, which is nothing more than a series of vast depressions in the South-eastern extension of the Saoura, which constitutes its area of spreading. This vast corridor is bordered to the Southwest by the dune area of Erg Chech whose dunes can reach up to 30 meters and further to the northeast by the Western Erg also formed by long ridges of sand. This primary base is constantly moved by the winds.

This depression, which extends over more than 170 km in length, is marked by various more localized, discontinuous depressions on the old Oued Messaoud route. It is the quintessential foggaras development area with more than 130 KSARs. The feeding of these oases is based on the layer of the interlayer and partly on the surface layer supplied by the waters of the erg or the various wadis. The recent development of boreholes and wells is carried out thanks to the use of the aquifer of the interlayer in an increasingly deep way. This exploitation of the aquifer has enabled the development of irrigated perimeters mainly on the hamada plateau with the pivot system.

The abandonment of the oases is due to the conjunction of the land status of the land in joint possession and the lack of maintenance of the foggaras and therefore their death.

Roughly, the monotonous relief of Adrar settlement consists of a plateau (vast hamada) whose surface is constantly subjected to intense wind erosion. Its outer edges are steep and sometimes gullied. The geological formations which constitute this plateau are essentially the series of the inferior continental Cretaceous interlayer. Erosion terraces constitute the second component of the relief, occupying a significant part of all Touat, of ancient and medium quaternary origin, these terraces are distinguished by the intensity of the erosion factors. The wind contribution terraces make the transition between the erosion terraces and the Sebkhas, depressions formed by gypsum-saline deposits and clays in the shallows downstream of the palm groves.

The relief:

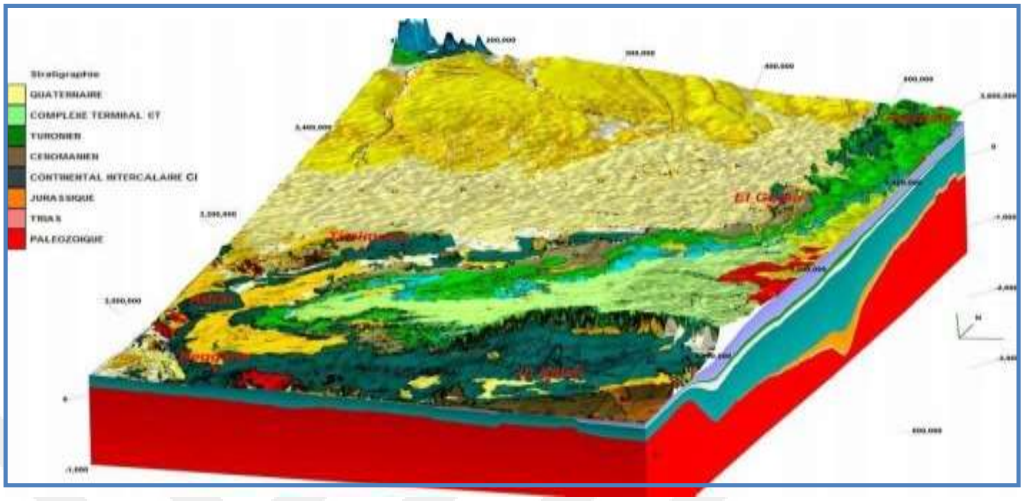


Figure III-6Geological map draped over hydrogeological diagram of the Adrar region (BENHAMZA, 2013)

Adrar city situation implanted into the whole of the relief forming the TOUAT globally, the elements that make up the latter are as follows. Fig III-6

Plateau: They cover very large surfaces whose geological formations are the lower Cretaceous series (intercalary continental) which rests in unconformity on the soft which facilitates the erosion of the relief on the edge of the SEBKHAS we find the eroded primary massifs.

Erosion terraces: They were formed during the Old and Middle Quaternary. They are distinguished by the nature of the rocks, the formations, and the intensity of the erosion factors. From Plateau TADMAIT towards the South, the terrace narrows because the Oued Masoud, losing its power, eroded the soft sandstone less, than its alluvium during the Middle Quaternary.

Aeolian input terraces: these formed at the break in the slope between the erosion terraces and the SEBKHAS during the recent Quaternary and the present period. They represent a steep edge; and there are located most of the palm groves.

• The SABKHAS: they represent the lowest points and belong to the old beds of Oued, very wide, they are eco-plural deposits, saline gypsum. The SEBEKHAs of TOUAT are generally supplied with water from the Albian aquifer, from the mid-Pliocene hamada and probably by irrigation water from palm groves.

The erosion surfaces correspond to the lower Cretaceous base or the top of the primary with a quaternary eco-floral filling; at the edge and in the centre of these depressions can appear fragments of primary massifs.

III.3.1.1 Water resources

Hydrogeology: The study area is on the grip of the western sub-basin of the northern Sahara. According to a study by the National Water Resources Agency of Adrar (ANRH), the so-called "Continental Intercalary" water table is the only exploitable water reservoir in the region. It is solicited by foggaras, traditional wells and boreholes. It is an Albian-age sheet that is contained in a clay-sandstone ensemble, which rests on primary soils (impermeable soils) covered. at the level of the Tadmait plateau by the marl-limestone series of the Upper Cretaceous. It is a sheet of fresh water that flows from the Saharan Atlas. This aquifer outcrops in the region and its supply are provided by the floods of the wadis descending from the Saharan Atlas and by the exceptional rains. It is about a hundred meters thick.

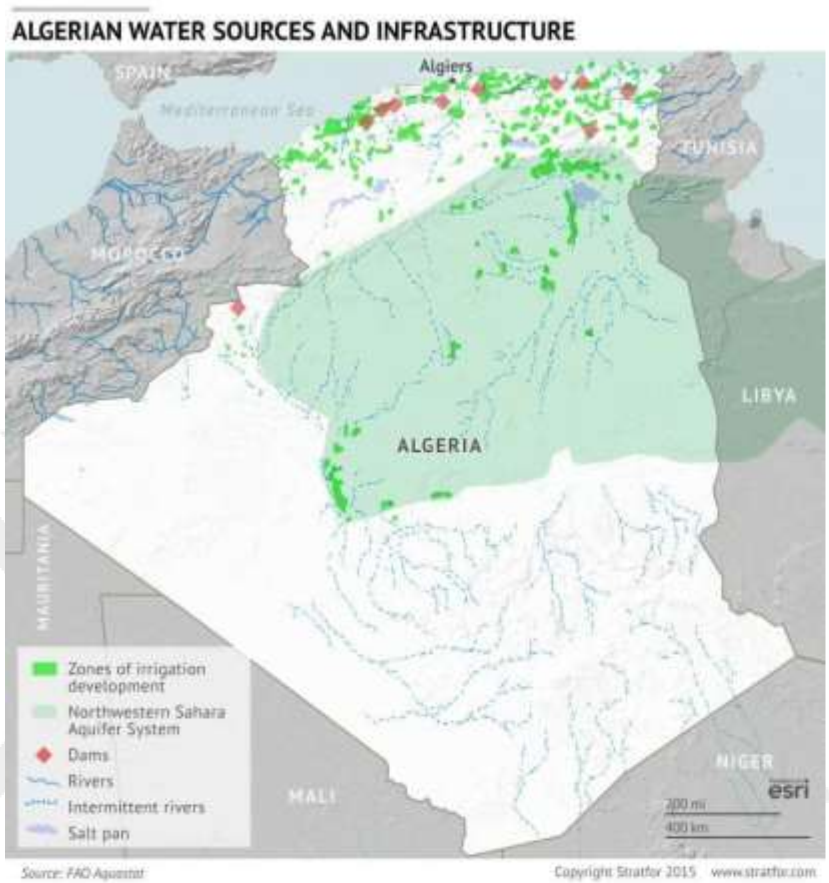


Figure III-7Algeria water resources map (Piedra et al., 2019)

A piezometric map established by the National Resources Agency Adrar hydraulics (ANRH) is shown in Figure III-8 and Figure III-9. According to this map, the elevation of the water table at the level of the zone of the seismic campaign of Sbaa is between +250 and +275 m (compared to the sea level) with a flow of groundwater from the East to West. According to the 1999 ANRH surveys provided in the inventory of irrigation wells, the depth of the water table in relation to the natural terrain is between 1.2 and 14.2 m. The elevation measured in the aquifer boreholes is thus between +120 and +493 m 2 (above sea level) with confirmed east-west groundwater flow.

The Sahara is not devoid, contrary to appearances, of hydraulic resources. There are currently two large aquifers which represent the bulk of Saharan water resources. These aquifers, like the oil fields, owe their existence to the lithology of this Saharan shield. Indeed, the sedimentary series which cover the basement have made it possible to perpetuate these resources to this day.

ADRAR region, is up of the aquifer, known as the intercalary continental (known as the Albian aquifer), its immensity both in terms of spatial extension and in terms of volume, was discovered as for the continental terminal, from when deep drilling techniques were mastered. The increased knowledge of these two aquifers is notably the result of petroleum exploration, which began in the 1950s, and which led to the exploitation of several deposits, including that of Hassi-Messaoud (1956). At the level of its spatial location, this aquifer, covered from north of the Saharan foothills from the Tunisian coast to around Bechar, it is limited to the South by a straight line which starts from Reggane to In-Amenas, to partially lead to Tunisia and Libya. Its average depth is 1000 m; however, it is exposed in the region of Adrar and Timimoun, which was for a long time the only area to benefit from it. The water used would correspond to "water fallen during the rainy periods of the quaternary". The capacity of this reservoir is estimated at 60,000 km3, which allow a long-term vision of its exploitation. However, many questions remain, however, as for its renewal, it seems to be supplied by water flows arriving from the Atlas and the Saharan foothills. The vastness of the resources is a very real fact, but there is the problem of their exploitation, the drawdown of the water table and their treatment, which creates many difficulties for their use for agricultural purposes or for human consumption. For a long time, the oasis has used the foggaras system, which gives access to a groundwater higher than the oasis to be irrigated, and which conducts water by simple gravity. But more and more people are using wells, including for irrigation.

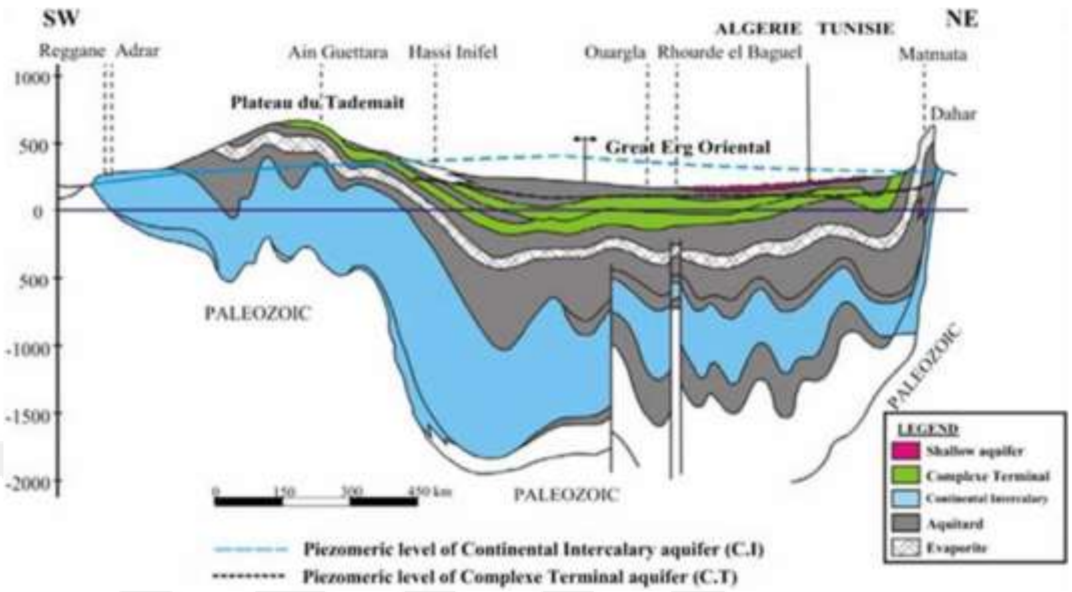


Figure III-8 Piezometry level of continental intercalary aquifer (Boualem & ACHOUR, 2016)

Pivot irrigation is an imported American technique for vast areas of development, the creation of which meets the objective of food self-sufficiency mixed with a desire to revitalize Saharan agriculture where the cultivation of wheat is very adapted to the Saharan type of climate. In conclusion, we can say that the conditions imposed by the natural environment are not advantageous, but the ingenuity of the inhabitants has made it possible to adapt to the constraints. The resources contained in the subsoil (gas and oil) come to somewhat compensate for the handicaps of the environment. It remains to be admitted that aridity conditions human and economic life in this space, despite all human and economic efforts, the climate dominates, nature creates.

III.3.1.2 Climatology

The Algerian Sahara corresponds to the fallout from Hadley's cell, we find them at the same latitudes on both sides of the equator, we can name as an example the Thar desert in India or the Great Victoria Desert in Australia. This type of desert is one of the driest areas on earth. These areas are characterized by low rainfall on average less than 200 mm per year, or much less locally and depending on the period. Djilali Sari in his work (D. SARI, 2001)(Djilali, 2001), cites as an example the precipitation minimums for the meteorological station of Bechar which reached 33 mm between 1970 and 1979 and 22 mm over the period 1980-1989.

In Touat, the annual distribution of precipitation rarely exceeds 100mm, which classifies this space on a bioclimatic level in arid or even hyper-arid regions. Most of the precipitation is localized over time in the cool season.

Climatologists are used to distinguishing the northern margin of the Algerian Sahara, which corresponds to the piedmont area of the Saharan Atlas, where rainfall is higher, in the order of 100 to 200 mm annually. This is due to the ultimate wet currents having crossed the morphological barrier which constitute the two massifs of the Tell and the Atlas, but these are relatively marginal residues which only slightly alleviate the constraint of aridity. The further you go, the more the precipitation becomes scarce.

To this extreme weakness of precipitation, there are several recurring phenomena since the beginning of the 1970s: the increase in the dry season, the increase in the frequency and intensity of droughts. The Sahara is characterized by an alternation of two relatively well marked seasons. A Saharan winter runs from November to March, with cool even cold nights. And the summer which exceeds six months in the Saharan space, is the real season of stopping the vegetation. The “tyrannical aridity” of the Sahara is reflected in the constitution of a typical landscape, which arises from a virtual absence of vegetation and fauna, a life grouped around the oases, and a type of culture able to withstand the aggressions of this type of climate.

Precipitation:

Precipitation map of the Sahara Desert (Table 1-II) and (figure III-10) reveals that the bulk of the desert receives less than 100 mm rainfall each year. Precipitation increases gradually Southward across the Sahel region approaching more than 500 mm annually at the Southern sub-humid tropical savanna. The precipitation gradient is calculated as about 1 mm/km across the eastern Sahara-Sahel boundary and about 2 mm/km at the western Sahara-Sahel boundary at Mauritania. Sahelian precipitation occurs during summer season. The north-western section of Africa represented by Atlas Mountains receives more precipitation (> 400 mm/year) than the rest of the desert. Winter precipitation dominates at this region.

The rainfall is extremely low. As an example, the annual average for the period 1975-1984 is 12 mm for Adrar and 10 mm for Timimoun.

These averages sometimes hide occasional rainfall anomalies. During the same period, at Adrar, in January 1975, 19.8 mm and 19.6 were recorded in March 1982. For the rest of the year, the rainfall fluctuated between 0 and 6 **mm.**

Table III**1-**Average precipitation (HAMMOU ALI et al., 2014)

rat	total	2000	1999	1998	1997	1996	1995	1994	1993	1992	1991	1990	1989	Year
18,59	223,1	10.4	37	17.5	48.3	11.2	12.2	38.5	38.5	16.1	10.3	12.2	9.4	P (mm)

Temperature:

Like all the municipalities of department Adrar city is characterized by high average temperatures (Table III 2): continental desert climate, a large temperature range and negligible rainfall. The temperature varies between 8 ° C in January the coolest month, and 45 ° C in July the hottest month, with a monthly or daily thermal range reaching 22 ° C, the temperatures undergo rapid variations in the courtyard of the same month, and even during the day.

Table III-2 Average temperature in Adrar city (HAMMOU ALI et al., 2014)

Season Temp	autumn			Winter			Spring			Summer		
Month	S	O	N	D	J	F	M	A	M	J	J	O
M max	29.8	32.8	25.4	21.6	20.3	23.8	27.8	32.2	36.2	42.5	44.9	44.3
M min	23.2	16.4	9.5	5.6	4.5	7.2	10.8	15.6	19.3	24.8	26.8	26.7

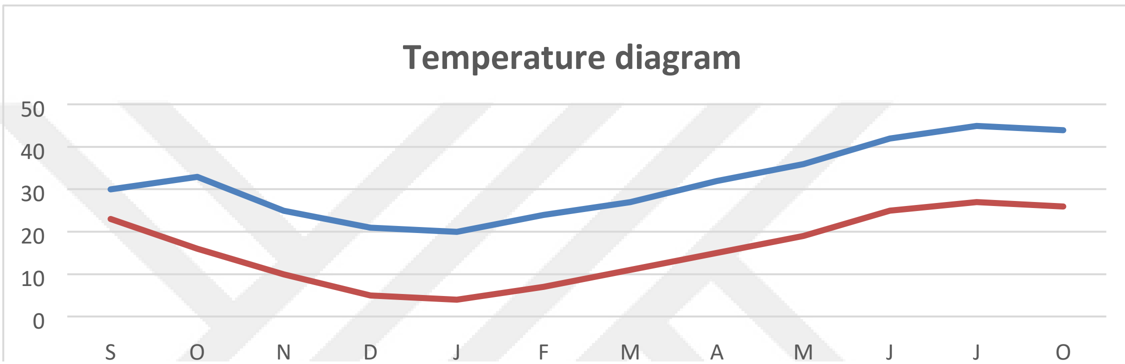


Figure III-9 Temperature diagr~~am~~ Adrar cit~~y~~ ~~(H~~AMMOU ALI et al., 2014)

Humidity:

In such climatic conditions where sunshine dominates throughout the year, the relative humidity can only be reduced, thus making it possible to withstand the excessive heat. It does not exceed 9% from March to October and can reach up to 50% in winter in January. Freshness and humidity are to be found in the microclimate of oases.

Sunstroke:

In general, the daily sunshine in the Adrar city is quite high ranging from 7 to 8 hours in winter and from 10 to 11 in summer. This duration of sunshine has an influence on the growth and development of certain plants (excess chlorosis).

Evaporation:

The monthly average is: 436.9 mm, for an annual total of 5003 mm. It is indeed a very high evaporation during the year with a summer maximum and a winter minimum, respectively 104.4 and 723.8 mm.

The winds:

The frequency of the winds in Touat is very significant throughout the year and in particular winds whose speed is higher 5 meters / second which can cause sand winds, with a frequency of 50% during the period going from May to September. Winds between 1 and 5mJs are less frequent. For Adrar the prevailing winds are from north-east north, except in July and August, where they are from east and north-east with a frequency of 25% for the north-east sector and 16% for the north sector. These natural data are considered very positive if they are used in the production of renewable energy.

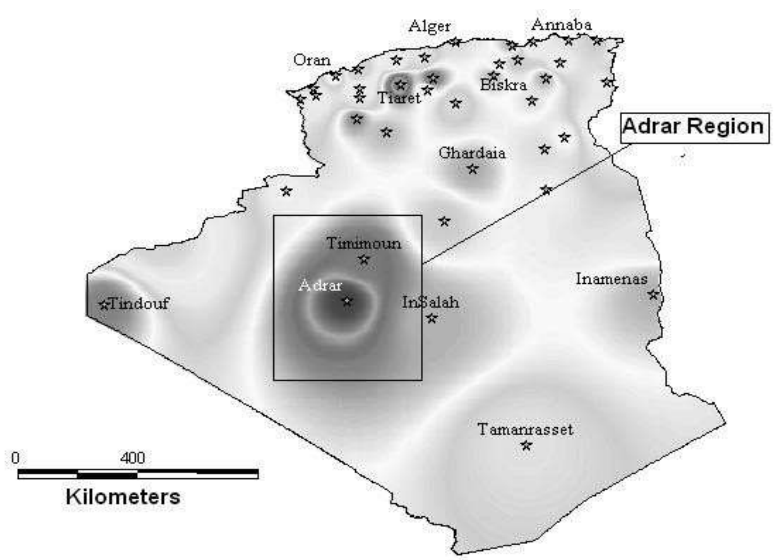


Figure III-10 wind speed map of Algeria (Djamai & Merzouk, 2011)

III.3.1.3 Flora:

Figure III-11Tamarix aphylla (on the left) Acacia tortilis raddiana (on the right)

The vegetation in the department of Adrar is divided into two types, an agricultural vegetation (figure III-11) and a second spontaneous (figure III-13). Vegetation of an agricultural nature is represented by the Oases (former agricultural perimeter irrigated by the Foggara) and the new development lands (modern agricultural perimeter irrigated by boreholes). This vegetation ensures agricultural production in the region in the form of various products, cereals, vegetables, fodder, medicinal plants, and condiments. So much for the spontaneous vegetation of pastoral value, especially for camel breeding

Figure III-13 Palm grove plant

Figure III-13 Desert Cloquinate

III.3.1.4 Fauna

Saharan fauna is adapted to the desert environment and develops its own strategies to resist the heat and the lack of water. Mammals are well represented by cuffed sheep (mountain areas), gazelles (open spaces, wadis and regs) (figure III-15), fennecs, jackals,

Figure III-15 Fenec in Adrar region

Figure III-15 Gazell in Adrar region

hares, and small rodents such as hyrax, goundis, jerboas ... etc. whose traces are easily observed. The oryx and addax antelopes are endangered.

III.3.2 Social and economics ecosystem in Sahara

To understand the dynamics and transformations affecting the desert today, it is imperative that understand all the broad based and, defined social and natural data. Because in the logic of areas where the population is Bedouin, in their essence, they change at times to urban areas, is noticed that there are people who live in some months of the year the life of the Bedouins and in the rest within the cities, which indicates many networks, intertwined flows narrated by the circulation of men Wealth, ideas and culture: Return to the centre of the Sahara Desert, renewal and purification before a new start. If the desert, today, for the inhabitants of Europe, is beautiful landscapes and areas of tourist barrenness, then culture plays on existence and mobility, and time and place, which are constantly facing infinity: the culture of historical depth derived from the dawn of humanity, therefore it must be developed a clear vision of the relationship between flexibility social impacts to try to account for the diversity and accuracy of contributions.

III.3.2.1 Desert and degradation of desert areas

The desert is a breathing system, this life is a dynamic ecosystem in which the lives of plants and animals are intertwined. The ecosystem of the desert has a rich ecological memory. is a legacy and remembrance that is priceless in the evolution of humanity: Art and archaeology, ethnology, and architecture. Historically the desert has known by the adaptation to climate change and the inventions that men have devised to respond to these shifts to meet basic human needs; irrigation techniques systems in agriculture, in the past habitats and oasis cultivation have been able to provide appropriate responses. Today, even with the richness of this system, it showed fragility, especially in its environmental, cultural, and social aspects.

III.3.2.2 Nomadic and sedentary

The desert is a walking, movement and non-stop space that expresses long-distance caravan journeys and shorter movements associated with grazing. The origin of the desert man is a Bedouin, in constant movement between certain points of life dimensions, through the networks that connect them. Water points are one of these.

The desert economy is also that of the oases, providing spaces for a sedentary lifestyle and habitat. Hence, the traditional organization will be based on a specific link between oasis cultivation and caravan movements, between the settled population and the Bedouin population.

This system was subjected to many attempts to change during the colonial period to control the resistance, for example through the establishment of the indigenous law. About political forces, the nomadic population is elusive and cannot be controlled, and their movements are of an illegal and illegitimate order. These powers lead to Quadrature, Record, and Control. In addition, oil production and the purchasing power of its employees result in a commercial economy that engenders economic development and is often artificial and modern urbanization.

The social system in the desert suffers from many problems, as extreme poverty, hunger, disease, and suffering., the Sahara Desert itself is the land of different peoples, often in conflict for their livelihoods. Each social component of this social system has a different culture. The position of women is not always good, where children and women suffer more from the effects of climatic and social changes, violence, and wars. The social system in the desert needs a more in-depth study

III.3.2.3 Sustained demographic growth

One of the most disturbing phenomena is undoubtedly the large demographic growth in desert lands. This growth has two sides. On the one hand, it results from the development of specific economic activities. On the other hand, it thrives in keeping the locals in place.

The role of primary resources and energy resources in developing the desert should not be underestimated, especially since their exploitation is accompanied by a large military and security presence. The discovering of resources turned oases and Bedouin economies upside down. It is essential to the countries that possess it, providing most of its wealth and import potential. For example, oil guarantees the economic development of non-desert regions and the population in these countries: it allows the purchase of grain, dairy, and sugar products for the entire population. Thus, oil revenues finance countries such as Algeria, Libya, and Chad. These productive activities of national interest help stabilize the population in production areas, especially in the neighboring oases, by transforming them into real urban centres, enjoying the intensity of usual urban activities and jobs. Yet, paradoxically, local jobs are generally insufficient in relation to the needs of the increasingly qualified youth and population. This urban development was mostly achieved by importing western architectural and town planning models. Under pressure and urgency, cities have suffered from the dual legacy of the colonial military paradigm and modernist mass urbanization, unsuited to local environmental and climatic conditions. In the utmost degree of self-satisfaction and neglect, architectural modernity has turned its back on local balances, whether historical (abandoned Ksours) or environmental (water management). Additionally, this formal emergency city planning has also been coupled with the development of informal or illegal buildings to respond to an influx of residents.

III.3.2.4 Adrar demographic data

Table III-3The distribution of the population (Trache, 2011)

Common	Population 2008	%	Rate of increase	Estimated population in 2013	%
Adrar-Timmi (Adrar city)	78328	Compared to the department: 19.5	Adrar: 4,2% Timmi: 1,35%	88 828	19,6
Touat region	201945	Compared to the region: 38.7%	/	228 267	38,9
Total department	399 714	100	2,6	452726	100

The distribution of the population shows that the rural population in Adrar represented 3678 inhabitants. in 2008, that is 4.6% of Adrar total population. This ratio is significantly lower than that of the department average which is 7.3%.

Compared to the Touat region (5927 Rural), Adrar city recorded a proportion twice the average for the region, 4.6% against 2.9% thanks to the importance of rural residents in the commune of Timmi (2439 rural).

Table III-4Distribution of the population in 2008 (Trache, 2011)

Common	Population 2008	rural	%	Agglomeration rate
Adrar city	78328	3678	4,6	95,4%
TOUAT REGION	201945	5927	2,9	97,1%
TOTAL DEPARTMENT	399 714	29463	7,3	92,7%

The urban framework of 2008 highlights a conurbation between Adrar and Timmi and as a result Adrar moves from the urban division acquired in 1998 to the upper urban division with an urban growth rate of 4.87%. It is the only city in the department to reach this level. In terms of densities, ADRAR agglomeration is in first place with 11,7 ha / km2 for Adrar and 3hab / km2 for Timmi, an average density of 17 hab / km2. This is of course a gross density because the high concentration of the population around 25 Ksours gives higher real densities.

III.3.2.5 Strong trend towards urban areas

In a desert where the living conditions impose to population to residing in same areas, it is normal that the concept of sparse area is used with care. The interesting question that needs to be clarified is, how a high concentration of population can lead to an urban lifestyle, that will eventually wipe out the oasis one. By examining the distribution of the population by dispersion, is noticed that apart from the city of Adrar, no other secondary agglomeration or KSAR has reached the population volume, nor the criteria necessary to reach the rank of city.

Table III-5Agglomeration rate (Trache, 2011)

Adrar	63 039	504	1 239	64 782	98,1%
Timmi	3567 (Ouled Brahim)	7 542	2 439	13 548	82,0%
TOTAL	66 606	8 046	3678	78 330	95,4%

The so-called sparse population represents only an insignificant part of the population, or 4.6%. In addition to the city of Adrar, have 11 KSARs of the commune of Timmi which are the main localities which shelter the agglomerated population.

- Household size

According to the results of the 2008 RGPH, the population of the two municipalities is estimated at 78,328 inhabitants, made up of 2,130 households, i.e., an average household size of 5.4 people. However, the size of households varies according to the dispersion; it is 5.6 in the municipality of Adrar, 6.2 in the municipality of Timmi and exceed 7 people in the sparse area.

III.3.2.5.1 Educational level of the population

The level of education of the population highlights clear differences between the two municipalities. That of Adrar seems to stick better to the national average while the commune of Timmi records significant differences on the scale of Adrar city but on the scale of the department, this commune profits from more favourable percentages. These percentages seem better for those without instructions (21.7 against 26.9) and for those with primary, secondary, and intermediate levels.

Regarding the level of education of women, the differences between the two municipalities are maintained and worsen even about secondary and higher levels. In the municipality of Timmi, the percentage of women with a higher education level is low compared to the total population of the municipality and it is lower than the average in the department. It seems that there is a correlation between this percentage and rurality.

III.3.3 Social and Economic Characteristics of Adrar

The oases in the Algerian desert effectively show how people managed to escape hostile conditions. Over the centuries, an effective and sustainable irrigation system has been in place that has allowed oasis residents to live in extremely dry conditions while respecting the special characteristics of these unstable ecosystems. However, over the past few years, desert oases have been experiencing strong demographic growth coupled with intensified agricultural production. In this particularly fragile environment, oasis residents tend to abandon traditional knowledge regarding water resources. Also, modern techniques for pumping water from groundwater sources dry up the groundwater reserves in an irreversible manner. For this reason, it is recommended to rehabilitate the daggers, the traditional irrigation system, in Southern Algeria.

Trade routes played an important role in the emergence of oases, as gold routes linking African countries such as Ghana, Mali and Senegal were distributed to the northern cities, and other fractions were distributed. In areas where water is available. The desert is rich in several types of Ksours distributed in many areas called valleys such as the valley of the gutter, Zeban, wool, and Touat in the far west of the desert, ... etc. However, the difference was very minor on their urban level because the design was similar and featured:

The concept of centralization, where the centre is usually a mosque or a market.

- Its circular shape is consistent with the hill on which it is built. Many Ksours are built on small hills.
- Urban tissues depend on a network of broken and sinuous lines for natural, environmental, and social causes.

The KSAR is always located in the heart of the palm grove or next to it, to make the most of its economic, social, and environmental benefits.

- Use of local building materials in all construction operations.
- Other features coming soon.

this research is interested in the relationship of this important urban design and architectural heritage to the environment and how to deal with various environmental elements such as high temperature, low humidity, sandy winds, dry winds (Sirocco) ... etc.

III.3.3.1 Data of economic sectors

The economic and social development of a territory is dependent on the performance of basic infrastructure, road, energy, communication, facilities. In Adrar city, the basic infrastructures that exist are numerous whether they are of local, regional, or national importance. Some are just crossing it; others are aimed directly at it. The efforts made by the public authorities in recent decades have made it possible to provide most human settlements with access infrastructure, structuring facilities, and socio-urban amenities.

III.3.3.1.1 Energy and renewable energy

Energy is one of the key elements in the growth of agriculture and the economy. One of the most renewable energy options is renewable energy There are limitless, renewable, and unrestricted sources of electricity. In comparison to conventional energy sources, they deliver various environmental and economic benefits. Wind energy is currently considered cost efficient and what technical advances make conventional power generation technology to compete with. The generation of electricity in Algeria relies mostly on fossil fuels, which in a country abounds in natural gas. Algeria has been implementing an aggressive policy to promote and grow renewable resources in countries since 2010. (Such as a plan to boost renewable energies, approved by the government on February 3, 2011, with the goal of generating 40 percent of total energy consumption from renewable energy sources by 2030. The plan would replenish the existing country's biggest supply of electricity with the use of fossil fuels (natural gas and oil) through other energy sources including solar power and wind energy. Geography Algeria offers a wide range of benefits to large numbers of natural resources. Algiers should benefit not only to satisfy the growing need for electricity but also for environmental reasons from its clean energy potential, including wind- and solar energy, geothermal energy. The growth and living standards of the city of Adrar led to a sharp increase in the energy needs that Sunelgaz could not do without difficulty due to the dispersion of the difficult climatic conditions in the fractures and the high costs of connections and connections. And the issue of energy has been a source of citizen protests in many times, whether electric power, which becomes in the summer is not enough, especially at peak time, which also causes a lack of refueling, especially in the summer, and puts pressure on transportation, which has an impact on transportation Public transportation and personnel.Today, despite some difficulties, the energy situation has improved significantly. The average electricity rate, which was only 70% in 1998, now exceeds 95%. At the state level, but per capita consumption remains significant, the network is as follows:

Table III-6 Consistency of the energy network (*Fr @ Www.Sonelgaz.Dz*, n.d.)

Designation	Length in km
ELECTRIFICATION	
- Low tension	2564.092
- Medium voltage	3597.590
Total	6161.682
GAZ	621.880

Adrar city has a substantial energy network (gas and electricity) with a connection rate higher than the department average:

Table III-7Connection rate in the Adrar city (*Fr @ Www.Sonelgaz.Dz*, n.d.)

Commune	Number of households connected to electricity	Number of homes connected Gas
Adrar	19262	5229
Timmi	635	331
Department	97814	6416

In 2008, connection rates in the municipality of Adrar were 98% for electricity and 28.5% for gas. For the municipality of Timmi, they are respectively 98 and 2%.

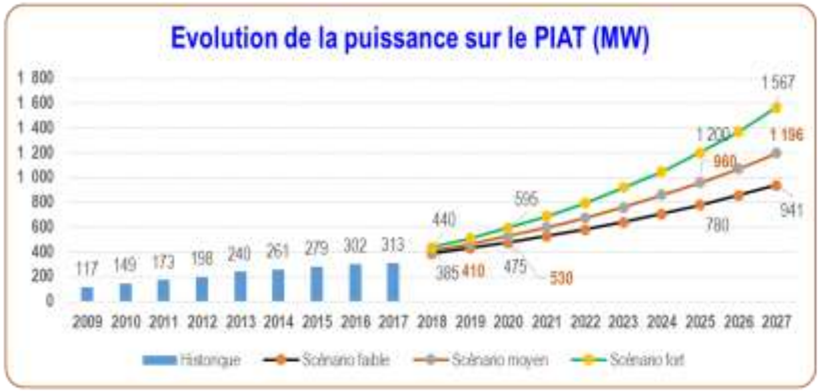


Figure III-17 Evolution of demand (Maximum power demand in MW) (Fr @ Www.Sonelgaz.Dz, n.d.)

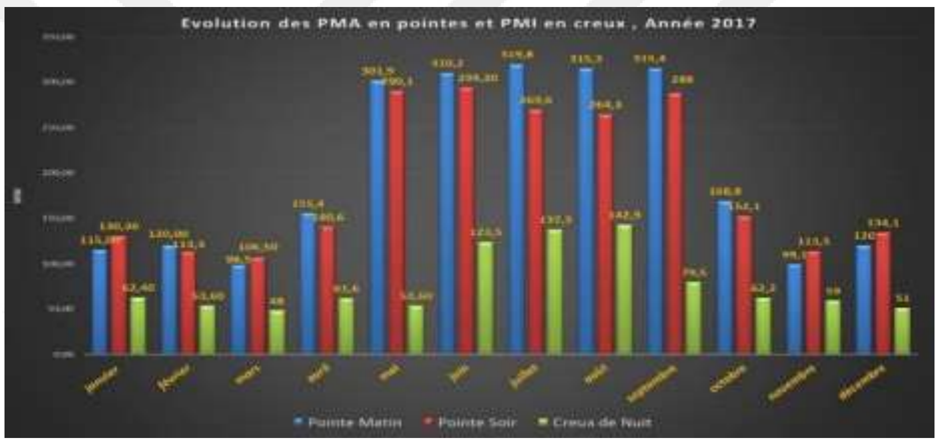


Figure III-17 Evolution of demand (Maximum power demand in MW) (Fr @ Www.Sonelgaz.Dz, n.d.)

III.3.3.1.2 Agricultural activity

The second pillar of the foundations of economic development is certainly agriculture, the development of which remains inseparable from the potential offered in soil, water, labor, and investment. Through its dynamics, agriculture is at the crossroads of rural development, land use planning, food security and agri-food issues.

Former and main economic activity of oases, agriculture has been changing rapidly in recent years. It is characterized by the emergence of new farming and irrigation systems, with the coexistence of a traditional agricultural sector and a so-called modern sector.

The new oasis farm is evolving more and more in an environment where the market is a determining factor. It constitutes production capital and a source of income. Traditional farming, for its part, fulfils several functions insofar as it continues to constitute a local supply source of agricultural products, a source of climate softening and a place of relaxation and vacationing (ecological function) for the inhabitants of ksours and cities.

In fact, the two systems are subject to the same logic and operate in the same economic environment. In terms of performance, the traditional system seems to suffer certain delays linked to several factors (aging of the oases, land, and water problem, silting up, low productivity, etc.) and it is thus condemned to evolve towards new economic rules and social. The availability of water does not seem to arise in either the medium or even the long term, provided, however, that this very low-renewable resource is managed in a rational and economical manner and that the two systems coexist. Despite some regression, agriculture in the Adrar continues to employ many workers and provide appreciable quantities of products. Government efforts to consolidate agricultural gains in Adrar are not new today. A 2008 DSA report quoted in the SRAT reveals that the total agricultural area in the department remains around 337,650 ha with only 40,863 ha of useful agricultural area (UAA) of which 21,760 ha are devoted to the implementation value and 19,103 ha for the oasis sector.

The number of operators for these two types of crops is 22,443 and 1,076 for breeders. The objectives set for the campaign (2008/2009) are the exploitation of 2,600 ha for cereals under the pivot, 6,202 ha of palm groves, 2,100 ha for fodder crops, 50 ha of protected crops, 5 140 ha of market gardeners, 150 ha of pulses (lentils), 790 ha of industrial crops (peanuts) and for condiments (coriander, caraway, cumin, green anise), making a total area of 17,222 ha. In the framework of the special South program (PSS) agriculture has carved out the lion's share with the kitty of 218 billion centimes intended to strengthen this vital sector by the injunction of several projects like the electrification of the perimeters of setting in value, the construction of agricultural tracks, the maintenance of wells, the strengthening of foggaras, etc. In 2013, the figures found in the monograph show for the department that the SAT is 366,077.16 ha and that the SAU covers 35,806 ha, a slight decrease compared to 2008. At the Adrar city level, there are potentials that it is important to highlight:

Ground potential

As expected, the SAU sector to urbanize in Adrar city represents barely 8% of the SAT total agricultural superficial and less than 1% of the total area of the municipalities. Compared to the department, the share of SAU is of 11,7%, but Adrar city has a quarter of the irrigated area.

Green spaces system

Commune	***S.A.T* total superficial**	***S.A.U* sector to urbanize**	***Irrigated area***	Reclamation agriculture **agricultural**	
				Superficial attributed	***Superficial Real* Reclaimed**
Adrar	43358,5	1857	1606	7692	**1301**
Timmi	5150,8	2341	2188	3190	**1263**
Total	48509,3	4198	7394	10882	**2564**
% Compared to the department	13	11,7	25,4	11,9	**13,3**
Total department	**366077,16**	**35806**	**29038**	**91212,5**	**19196**

Table III-8Ground potential (Hadeid et al., 2018)

Green spaces constitute a green heritage of great ecological importance and social(Idda et al., 2017). They are local constitute a major component of cities (Oueslati et al., 2008). The city of Adrar as a Saharan city has known in the last few years a remarkable revolution in terms of urban green spaces the map in figure III-21shows the green and agricultural spaces of the city of Adrar. The climate of Adrar is aggressive, with little and little rainfall associated with temperatures very high especially in summer, therefore, planting and maintaining everything that is landscaped is really considered adventure in the most extreme conditions, given its value for human being. In this region, green spaces resort to the use of irrigation well controlled and an obligation, generally it is the drip system that is retained.

Our study found that the soil of urban green spaces is basic, is characterized by a sandy-loamy texture and low organic matter which makes its capacity low water retention as the irrigation frequency becomes high to satisfy the needs of the vegetation. The floristic study by the exhaustive inventory made it possible to find forty-four species distributed over different botanical families. This study shows that the green spaces of the city of Adrar are dominated by the Fabaceae family who represents more than 25% of all installed species. The remains of the species spread by other families with a small percentage. The composition of the biological spectrum of the green spaces studied, shows a predominance

of phanerophytes, following the diagram: Phanerophytes> Chamaephytes> Hemicryptophytes> Geophytes. The species inventoried in this study belong to several biogeographical types: North Africa, Tropical, Saharan-Mediterranean, Mediterranean, Africa-Europe, African, Saharan, Endemic, Eurasia, and the Far East.

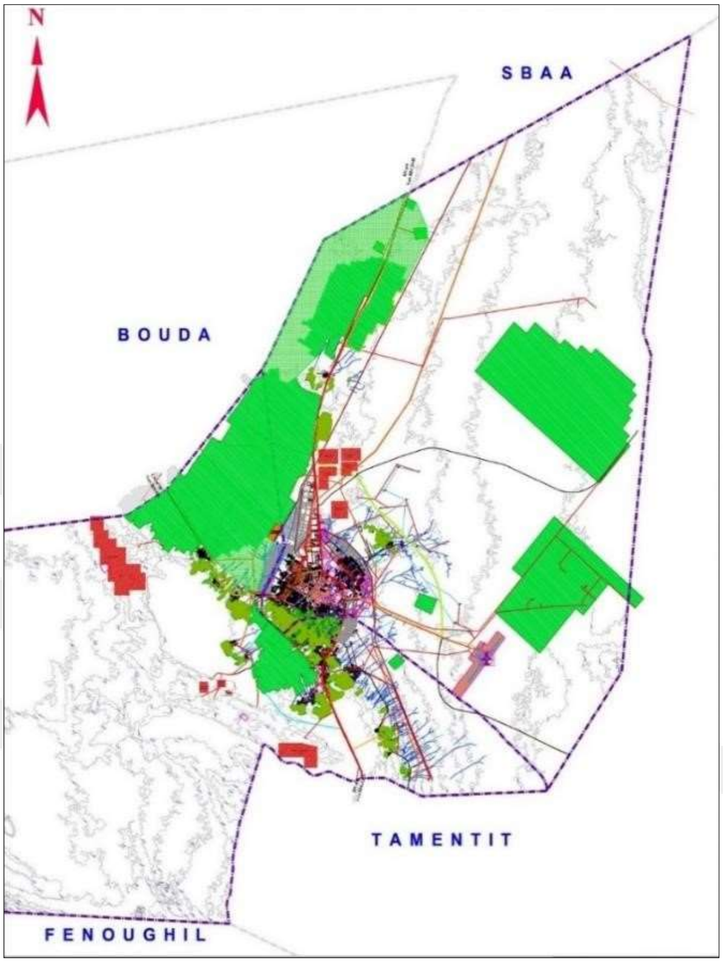


Figure III-18 Agricultural activity space Adrar city
(Large-scale map in the appendix(A-1))

The biogeographic spectrum of the alignment species of the city of Adrar is dominated by Asian species with a percentage of 33%. In second position the Mediterranean type species and those of tropical America with 22 and 21% respectively. In third position the species of Africa origin with 17%. From here we extract the great danger that the composition of green spaces can pose to the ecological memory of the city.

The city of Adrar, which is characterized by low rainfall associated with very high

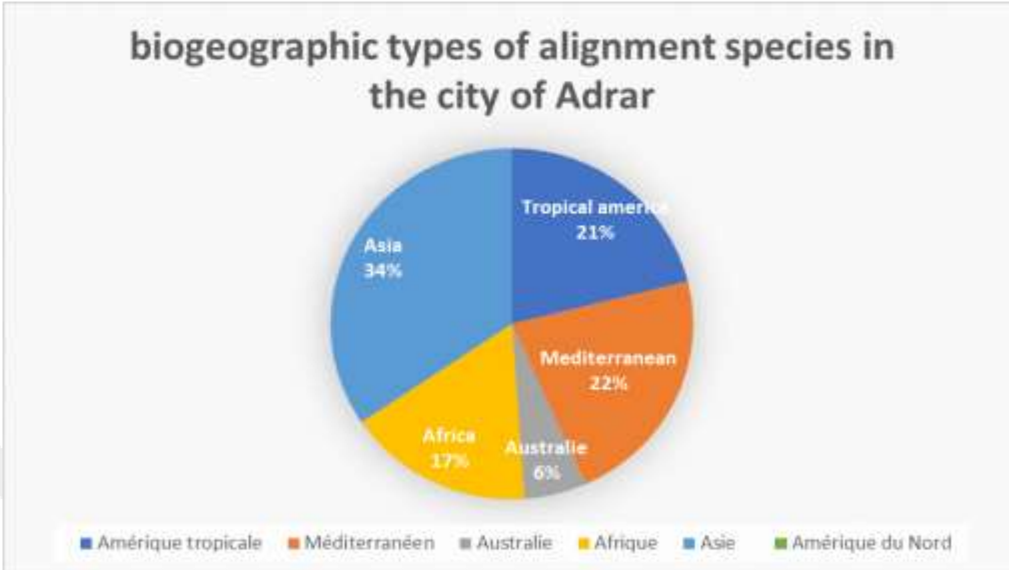
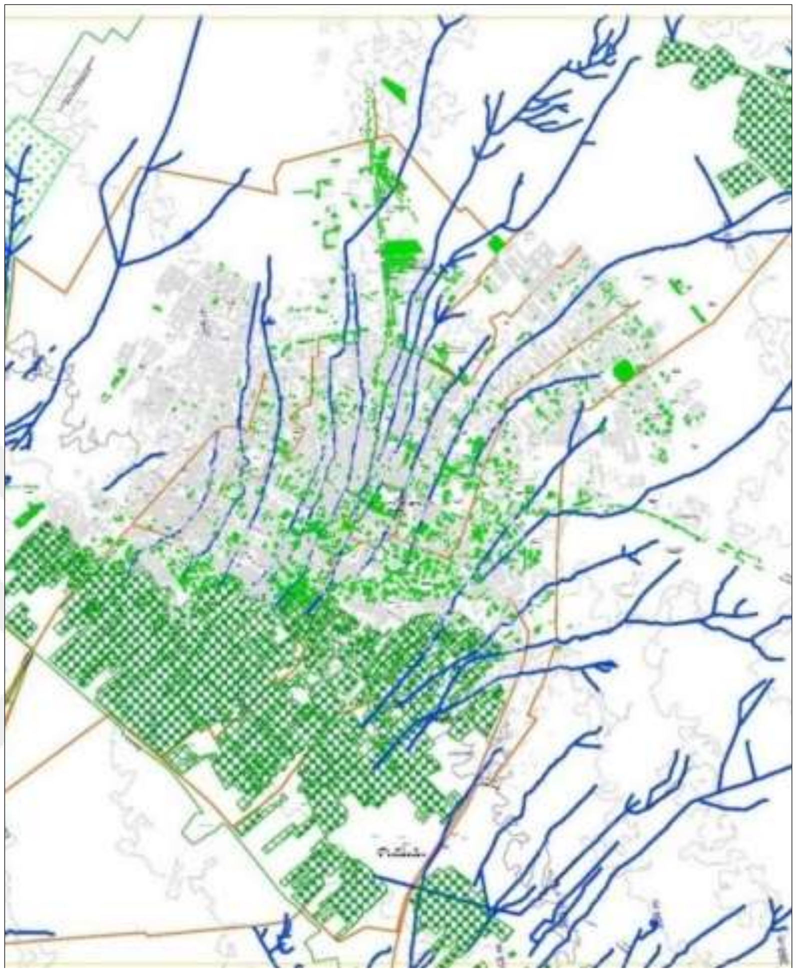


Figure III-19 Biogeographic types of alignment species in Adrar city temperatures, especially in summer, has experienced a remarkable revolution in urban green space in recent years .As shown in the builder diagram in the figure III-22 In this study, the floristic inventory of alignment trees and shrubs made it possible to count 39 plant species grouped into 26 botanical families. The most important families are that of Rececaceae. This be linked to the good adaptation of the species of this family to Saharan climatic conditions.



FigureIII-20 green spaces in Adrar city (Large-scale map in the appendix) (A-2)

Most alignment trees and shrubs are made up of evergreen species (74%). Thus, the biogeographic types of the species are dominated by the Asian species with a percentage of 33%. The rich flora is average for urban areas and low for the peri-urban area. The generally acceptable level of biodiversity in certain areas, which reflects the diversification of range species in the town of Adrar (figure III-22).

The floristic difference between them better reflects the importance of the anthropic factor in planting and in the management of green spaces.

Figure III-22 Alignment species in Adrar city 1960

Figure III-21Green space 400 logs Adrar

Water potential

It is basically an interlayer drill used. Foggaras, which are constantly declining, nevertheless offer volumes that are still subject to evaluation, especially in traditional oasis areas. Characterization of operating systems In Adrar, different operating systems coexist with water:

Foggaras irrigation methods

The oasis must be in a gorge or at the foot of a rift, below the depth of the underwater source, for the device to function. The Adrar oases are all found underneath the Tadmait plateau, where the groundwater source runs. Upstream from the oasis, the first wells are drilled. The gradual sloping of the galleries slows the flow, preventing the water from carrying the soil along with it, which would cause the galleries to erode. This ingenious system uses gravity to transport water all year long. The foggaras' building materials are sourced from the local region. Stone blocks are removed, a cementing mix of clay and straw is mixed, and palm trunks are used to consolidate the underground galleries. The galleries are 2.5 kilometres long on average, with vertical wells every 20 to 30 meters to aerate and fix the foggaras. The foggaras allow water to be transported passively, relying solely on gravity. Water is collected underground and flows under the earth, preventing evaporation, until it reaches the oasis and flows through an open-air canal (seguia). Water arrives at the oasis via the seguia and is collected in a small triangular basin (quasri).

The water proceeds to irrigate the oasis thanks to a stone system in the form of a comb (kesria). In response to differences in water supply, the group convenes a? water assembly, where decisions are taken about who receives how much water among those who own water rights. Everyone has the right to exercise his or her water rights and demands. The water deciders are then in charge of water distribution.

Foggara Architecture

The interpretation of the complex universe of the oasis means reading an ancient history up to the origins of civilization and allows you to discover a mysterious treasure of secrets. In the oasis, every place, every architecture, and element are full of meaning and the poverty of the materials as well as the sobriety of the signs, transmit a complex ideal charge without formal redundancy. The continuous adaptation to the difficult environment makes the architectural style essential which is expressed through pure elements: raw earth, light, water. The whole structure of the inhabited area, the shape of the houses-built side by side, the underground passages instead of the visible ones, the contiguity of the terraces and the apparent absence of entrances, responds to the logic of safety on the one hand and of well-being on the other, to keep the rooms cooler.

The verdant oasis, with the people living in the fortified villages, does not have a spring that gives life to palm trees, palm grove, palm grove. The water that flows in the open channels is an invented water. In some Saharan oases there are no springs but draining tunnels (foggara) that collect the water preserved by the sand or in the rocky cavities of the subsoil through an immense network that functions as a condenser. There are thousands and thousands of kilometres of tunnels that are found under all the deserts of northern Africa and that communicate with each other, bringing to the surface a water that has condensed, perhaps, in a very distant place (figure III-23).

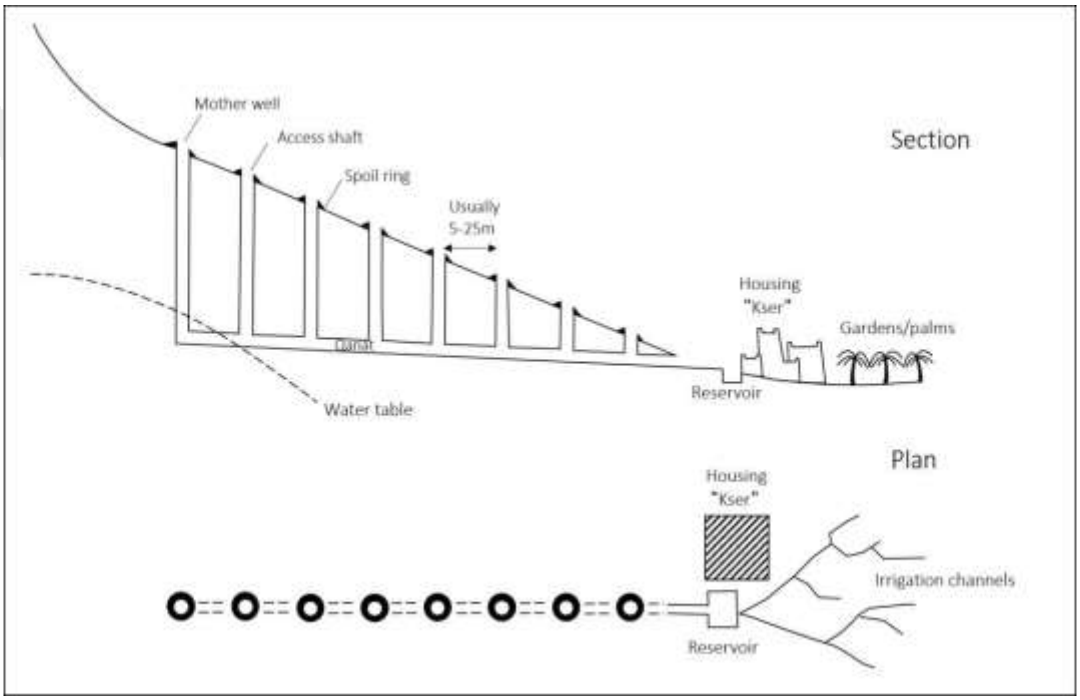


Figure III-23 Foggara Map

Traditional water as blue infrastructure

Topographic data, geological characteristics and environmental characteristics are of great importance for the collector tunnel work and the multiple types of these hydrographic systems are determined by the different geographical variables. The water supply system differs for each individual hydrographic tunnel because it is the result of a very complex relationship with the ecosystem that determines the periodic and seasonal supply of water in addition to the climate data. Collection tunnels also change with specific and basic characteristics such as the difference in water and soil, and the distinction between filtering and transportation components of the tunnels. Collector tunnels are very different; The water flows very slowly to the bottom of the tunnel, which increases its volume. It is not submerged in the aquifer, and the upper portion often drains through its walls and crosses the part of the land where the exchange between deep water and surface saturation water is greater. There are many variants of the drainage tunnel technology; Seasonal and climatic changes that change the ratio between the transport and filter sections in each individual tunnel also depending on the type of tunnel. The environmental context includes humid ecosystems, with variable amounts of water, and ecosystems with extremely dry conditions. The terms "wet" and "dry" refer to surface conditions and refer to the presence or absence of free water. In fact, in deserts, water is found in the atmosphere to a minimum and is not present on the surface while in soil. However, this water does not always originate from deep aquifers: the atmospheric water cycle occurs both at the surface and underground.

In fact, the atmosphere does not end where the air meets the earth but continues in the depths of the earth where continuous exchanges occur between the air and the subsoil and this circulation, when the temperature drops significantly, leads to condensation of water in the ground.

Drainage tunnels intercept these exchanges and interactions and produce water. Desert - piles of stone appear on the surface, generated by pits residues in the vertical air column, underground layout of foggara. The tunnels absorb and condense moisture from the top, and they capture and condense it from the bottom, which helps raise the water table. Vertical shafts regulate air exchange and act in conjunction with the dug tunnels as filter tunnels and condensation chambers. Sand helps maintain adequate atmospheric pressure for the tunnel to absorb water; When the air is saturated or semi-saturated with moisture, slight differences between the indoor and outdoor temperature are sufficient for condensation to form. In arid regions, extreme differences such as temperature between the surface, subsoil, day, and night are crucial, but even every point in the shade, every slight difference in temperature can lead to the formation of condensation. The circulation of the underground hydrosphere of tunnels is managed by the work of filter surfaces, stones, roughness, and air wells.

The way water is formed is influenced by the condition of moisture or drought on the surface. In general, in mountains and in places rich in moisture, voltage affects the capture and supply of spring water, whereas in extremely dry environments where there are no sources of surface water, filtration is carried out by capillary absorption along the tunnel path. Water, both from the surface water table, from the subterranean flows of the valley and from the atmospheric humidity is greater. Drainage tunnels fall into four major ecosystem classes: mountains, hills, lowlands, and depressions.

The agriculture production:

Date palm cultivation is the structural element common to all oases, and there is no space where the cultivation of the Fennecs is absent. Even if the dates are not always of good quality, the presence of palm groves offers other advantages: the microclimate of freshness, the reduction of evaporation within the oasis, and a set of stepped crops.

The new irrigated areas are elements of cultural diversity, but above all the engines of market cultivation development that build relationships with all regions of the country.

Tomatoes and cereals from Adrar and Touat are found in most Algerian markets. Oasis products can be competitive if transportation costs are more favourable.

With the development of desert cities and the increase in the standard of living of the population, the demand for agricultural products increased dramatically, which required diversification of products and larger quantities to meet the demand. This directly affected the cultivated areas, energy consumption and means of transportation. The green house culture is developing to market different products (zucchini, peppers, salads, peppers, etc.).

Recall that in the Southwest region, most of the resources and volumes produced are largely realized in the department of Adrar. Indeed, in terms of agricultural production, it is the source of more than 75% of agricultural products. Regarding animal production, it holds 62% of the region's livestock and produces more than 75% of the meat. A large part of agricultural production comes from palm groves and traditional oasis agriculture which currently suffers from problems of siltation, lack of maintenance; added to this the fragmentation of farms, the aging of farmers and land issues. The 2013/2014 campaign gives us an overview of the quantities produced in Adrar.

Traditional palm grove

Cameline farming

Green house

Traditional agriculture

Animal production

Horses’ production

Figure III-24 Agriculture production of Adrar city

III.4 Urbanisation process of Adrar city

Colonial settlement from 1901 to 1962:

It is recognized that the Touat is dominated by the city of Adrar which borders this entire area, as well as the rest of the department. Adrar plays a role of command and administrative supervision, his promotion in 1974 to the rank of department, allowed him to benefit from a broad economic development program, characterized by the implantation of important regional facilities (Airport, university, hospital, national road ...) and diversified productive system (industrial activity zone, development of agricultural land), it is called upon to balance the regional territory as regional support capital, hence the importance of refining these urban functions within the tertiary sector. It brings together an urban population estimated at 63,039 inhabitants in 2008, In 03 times the population of the second most important city in the department, namely Timimoun (22,086 inhabitants). Historically Adrar, the modern city, is born, facing the Ksours, to the French occupation of the Touat region between July 1900 and February 1901. Long before it was a real commercial crossroads between the North and the South which will stimulate great movements migration with Arab penetration from the second half of the 10th century. From this period, migratory waves followed one another to the rhythm of the events which shook the Maghreb, a continual alternation of phases of lull and isolation and external conquests, until colonial penetration.

60 years after the colonization of Algiers in 1830 French army occupied Tamentit and transferred the administrative capital in Adrar and create new city of ADRAR Neighborhood of adghagh KSAR French colonization gave to Adrar another role, with the ignorance of Tamentit.

The figure III-23 taken in 1920 shows the first note of the colonial city by the establishment of a garrison north of the ksour, followed by small colonial subdivisions which will generate a movement of urbanism of this oasis space whose vocation was until then agricultural. The ksour of Adrar very rapidly after independence switch to tertiary activities generated by government investment. Indeed, the administrative promotion of Adrar to the rank of capital of the department in 1975, for the reason of a new administrative division, allows him to acquire new functions, typically urban. These will give a new face to the Adrar ksour both socially and spatially: rapid spatial growth accompanied by a functional and structural decline of the ksour as well as intense immigration. Thus, from 4,468 inhabitants in 1966, the city increased to 28,580 in 1987, 43,142 in 1998 and 63,039 in 2008 and to more than 100,000 today. It can easily guess the impact of these many social, economic, and spatial changes on the components and organization of the city.

The Plan of Departure due to Rongieras was established in 1929, and it was the only one to have been elaborated on the whole of Touat before the Second World War. This means that the first French installations from 1900 to 1928 were limited to the bare minimum, without a comprehensive prospective plan. The approximately 131 ksour recorded in 1947 represented a population of 40,632 natives and 70 Europeans over a territory 210 km long and 10 to 15 km wide. The oases of Timmi had 6,779 inhabitants and Adrar about 3,000. Zaouiet Reggane had 4,017 and Zaouiet Kounta 5,629. Adrar, which united almost all Europeans, was already the main city57. The current authorities count 340 000 inhabitants living at 70% in 294 ksour, Adrar having more than 100 000 inhabitants in the year 2020. The figure III-26shows maps of the city's evolution stages. Beginning before colonialism and during the colonial period until today

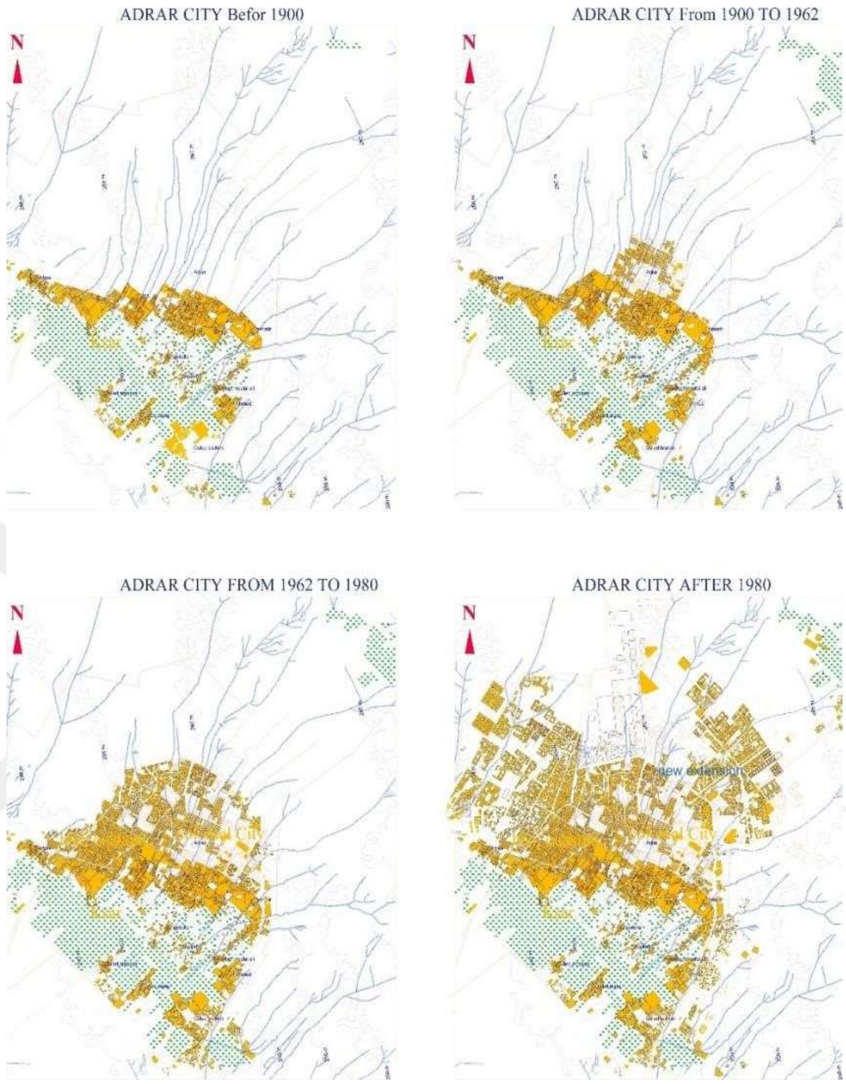


Figure III-25 Evolution of Adrar (Large-scale map in the appendix) (A-3)

Urban Morphology and Monumentality:

The memory of the place has evaporated a little, and it is not easy to know exactly what the KSAR of Adrar looked like when the troops arrived and the first planned developments of the colonial operation. the kasbah, the foggara line and the paths leading to the neighboring ksour. The trident, formed by the tracks along the (native) cemetery to the east, the great mosque and the old KSAR to the west and the bisector along the small mosque and forming the western alignment of the Laperrine place, it can be the essential elements of the overall composition of the plan. (figure III-27)

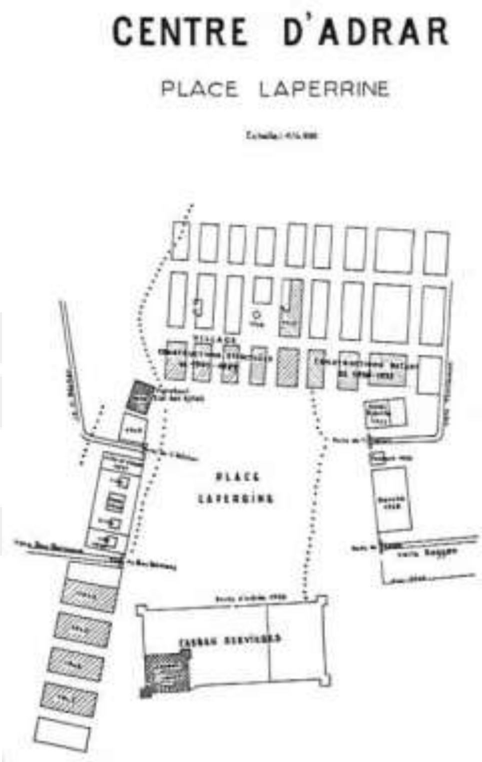


Figure III-26 Centre of Adrar, place Laperrine, 1900-1953 (Godard, 1954)

The point of convergence of these tracks corresponds to the e stablishment of the residence of the head of annex on the side of the palm grove. The northern part engages the urbanism towards its most official and monumental part. It will also be one of the most important initial planned extensions of the colonial city. The eastern part is the main communication route with Tamentit and the South ksour to the Southern part will be rather residential with the approval of the proximity of the palm plantation and the gardens. To the west finally will be the friction with the native power and the local population. It is on this side that will take place the schools doing the counterpart to the zaouïa. Exchanges with the oases of Bouda (Hassi Bou Bernous Road) seem to have strongly contributed to the supply of the city foodstuffs.

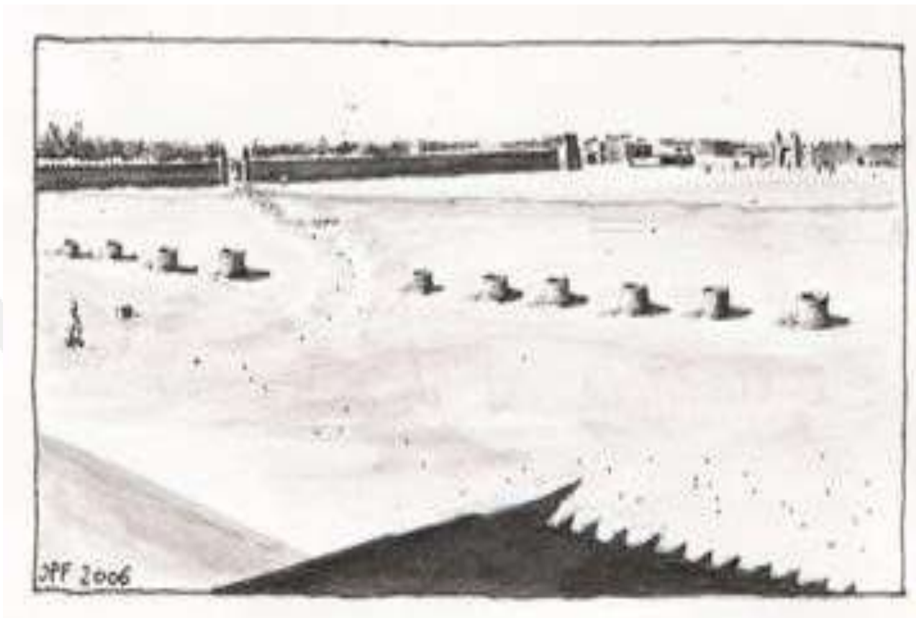


Figure III-27 : Foggara of Adrar (Frey, 2014)

Place Laperrine, which will become the field of manoeuvre and the centre of the nascent city, will offer a frontal clearance to the monumental facades of the most important institutions of colonial power: the Casbah Servières (named after the general who took the city) will be equipped in 1928 with a monumental entrance with a drawbridge overlooking the square, the schools will have their entrances, the commercial alignments under the

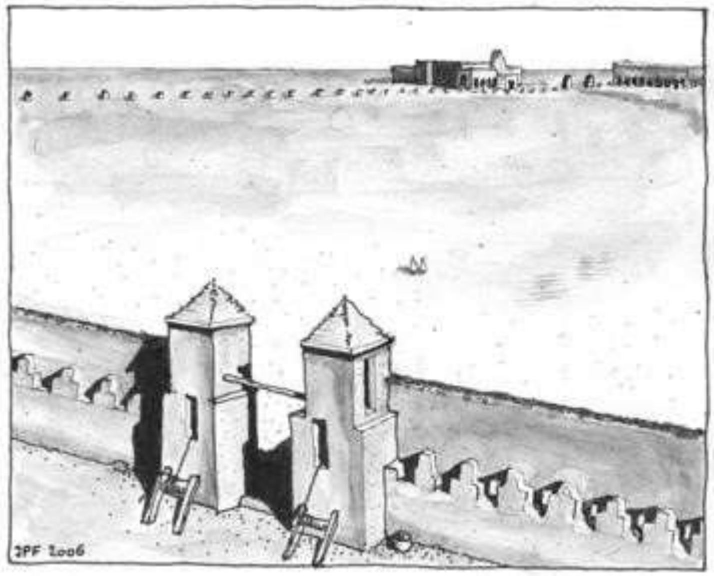


Figure III-28 Door of Casbah Servières (Adrar) (Frey, 2014)

arcades as the beginning of the new regular urban fabric will be as their natural extension by their architectural homogeneity. (figure III-29)

In the same spirit, the covered market, the fondouk, the hotel, as of the rest, but a little behind, the barracks, will start what corresponds, at present, to a zone of facilities along the roads still strictly controlled, (figure III- leading to Gourara and, further South, to

Figure III-29 : Adrar square 1929

Aoulef and In-Salah or Reggane. Hotel Djémila was destroyed and replaced by the hotel Touat. (figure III-30)

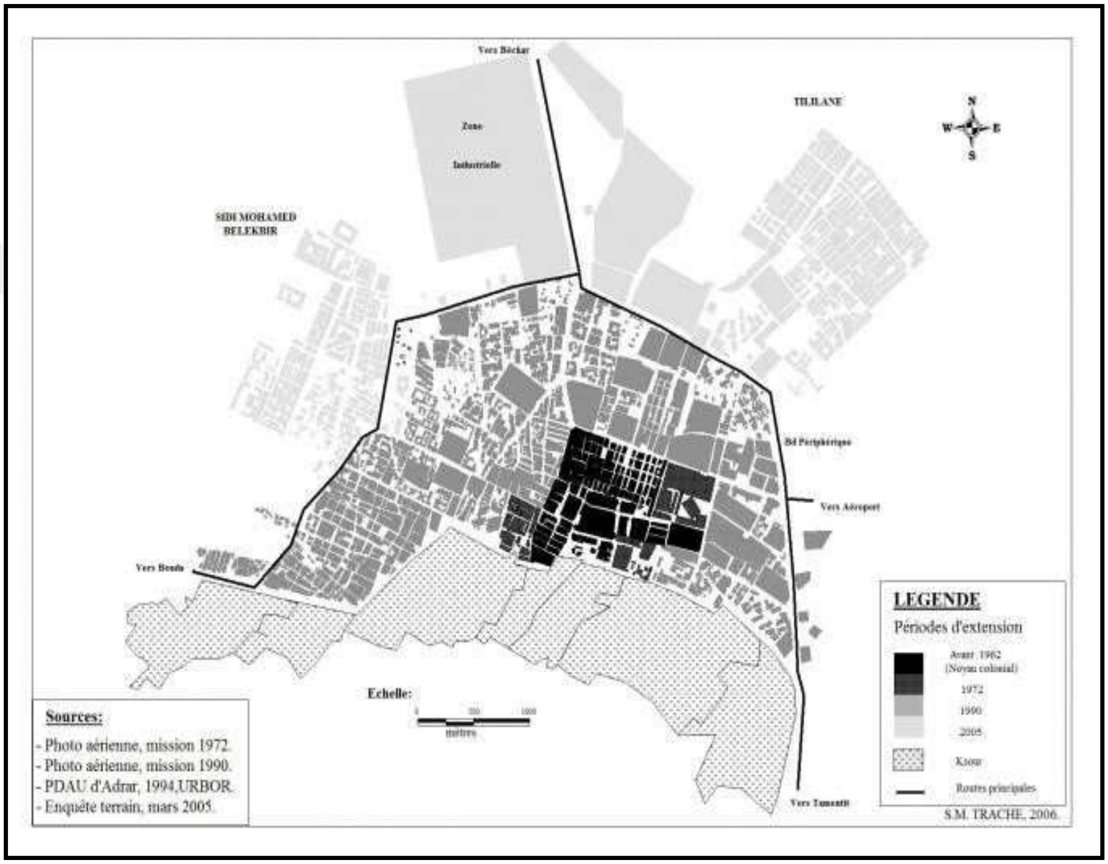
The doors described by nineteenth-century explorers as well as major buildings or public places are currently difficult to identify in the field. Let us wager that the doors in question are those of the KSAR or the agglomeration of neighborhoods in a general enclosure such as one can still have a precise idea to Tamentit. The existence of this enclosure is attested by Deporter. "Adrar has two mosques: the big is of little appearance, heavy and massive. Of the two kasbas which are situated at the eastern end of the locality, one is inhabited exclusively by the sheikh (Rohlfs, 1869) This city would comprise 16 districts [and] would have three doors: Bab Dahraoui, the door of the caravans, it is the most frequented; Bab R'arbi, which gives access to the gardens; Bab Chergui, which gives access to the other ksour of the district. A wall, flanked by towers. at the corners, would surround Adrar, About the trans-Saharan, extreme South of Algeria, the Gourara, the Touat, In-Salah, the Tidikelt, the country of the Ahaggar Touaregs, the Adrar, Timbuktu, Agadès, Algiers.

After independence settlement:

Adrar experienced its first real spatial development in the late 1970s with the massive installation of community facilities and new structures to support local populations. it is observing the explosion of space where the city expands exaggeratedly and multiplies its surface by more than ten in twenty years, Adrar leaves ksour towards a new city, created from scratch. Most of this extension is done from the 1980s. This accelerated urbanism, very spread out and specific to the city of Adrar is the result of many social housing and housing developments and the development of large tertiary facilities: headquarters the department and the commune, banks, and insurance companies to which public social facilities are added on an ad hoc basis (high school, colleges and schools, new hospital, health centres, etc.) (figure III-31).

Spatially, the urbanism of Adrar is done starting from the first colonial allotments (current city centre) at first and then develops in a classic way around this ancient fabric towards the north, the northwest, and the north- East. The colonial implantation since 1900 has allowed some public achievements which have given a checkerboard structure to the development of the city with school groups, high school, hotel in the main square, market, church, and hospital Adrar broke away from the traditional Ksourian system by moving towards a modern urban design model from his promotion to the rank of capital of the department of department in 1975. This allowed him to realize his supervisory structures, to set up his administrative and financial structures which will be followed by large local community facilities and large supportive housing programs. It is urbanism supported by the public authorities but also the result of a major urban dysfunction in the city of Adrar. In fact, the subdivisions planned during the period 1980-1990 by the local authorities were not all carried out, thus leaving huge empty spaces; they constituted a real obstacle to urban planning coherence with the development of the policy of "beni ouskout ", initiated by migrants.

Later, at first, the city stretches in the west direction (Sidi Mohamed Belkbir) to then change and take, by breaking with the previous urbanism, the direction of the agglomeration of Tililane to the northeast from the city of Adrar. These two spaces are at the limit of the peripheral boulevard which surrounds the city from west to east. They can be assimilated to peri-urban spaces insofar as they are offset from downtown Adrar. They developed, the first on a virgin site, the second on the secondary agglomeration of Tililane.



FigureIII-30 Adrar extensions (Trache, 2011)

This urban sprawl was essential as a choice of urbanism about the housing estates surrounding the city which posed significant urban planning problems insofar as they generated significant gaps between the new urbanism s and the old city. On the other hand, this new urbanism towards the east of the city seems to be a will of the local authorities for a better control of the management of the city and to give it a more harmonious urban landscape figure (III-32).

TOUAT Hotel 1979

Adrar place commerce center

Commercial center

Adrar place

Adrar university

Culturelle center Adrar

Figure III-31 Adrar architecture evolution

New extension social settlement:

The economic and social development of a territory is dependent on the performance of basic infrastructure, road, energy, communication, facilities. In Adrar city, the basic infrastructures that exist are numerous whether they are of local, regional, or national importance. The availability of infrastructure and many public services, in addition to housing programs with major support from the government, has helped the city's development rapidly.

Figure III-32 Actual stat of Adrar city

The development of housing in Adrar is almost exclusively social (figure III-33). In fact, Adrar's real estate policies were mainly aimed at attracting young and qualified residents facing the housing problem, and the public authorities bet on creating a large practical and living environment by investing in social housing to meet and stimulate the demand of residents and those coming from shortcomings to work in departments and immigrants from other regions of the north of the country

III.4.1 Characteristics of new urban structure

This KSAR, which has gradually become a city, has evolved overall in a moderate fashion while respecting the master plan proposed by the PDAU in 1997. Having not been subjected to the pressures of illegal housing, the new extensions present a certain coherence in land use. This city is becoming an important appendage to the city of Adrar. But given the constraints of its site, this implied an orientation of urbanism towards Hamada, and towards Ouled Ahmed Timmi. A clear improvement in living conditions. The problem of housing within the community is not different from that presented at the national level, because it is the state that remains the most important provider of this issue at the level of the national territory. The latter already has land, credits, and real estate production structures (AADL, OPGI, land agencies etc.).

The housing crisis seems more than a social fact rather than a material fact, because in Algeria, a lot has been built and there is no doubt that housing conditions are better than they were 40 years ago, especially in infrastructure where many populated areas have facilities such as water, sanitation, and electricity. Some studies show that even from the point of view of the average size and number of dwellings, the improvement is significant.

The real question is that there is a very uneven distribution of housing, associated with inconsistent allocation policies, which means that there are always families living in one room, more and more, and on the other hand, spacious places for very small families occupying the centre of buildings. In addition, there is the reality of speculation on housing, which explains the large proportion of vacant housing. These attitudes exaggerate demand and tensions between local elected officials and housing seekers as local decision makers are in fact the link between the state at the central level and the population. The housing crisis is one of the main constraints it faces, and it is plentiful. Facing an increasing number of urban residents and agglomerated residents, without adequate resources, is polarized from the city where demand appears to be constantly increasing, and land and aid prefer certain social justice. The numbers of housing increased significantly from 12,784 housing units in 1998 to 18,791 units in 2008, or 6,007 additional housing units, which represents a significant increase related to the achievements during the first five-year plan 2005-2009.

Construction of 32,000 homes was scheduled to run between 2002 and 2007, in all municipalities of the state. The operation aimed to eliminate the housing built in Top and improve the living conditions of the residents of the Ksours. This important implementation program has been distributed as follows:

- 26,400 units in the context of rural housing, considering the specificity of the Adrar region known as 297 Ksours distributed in the desert.
- 3565 socially shared housing.
- 3700 social housing units.

Adrar city has benefited greatly. It should be noted, however, that the number of unoccupied housings in 1998 was estimated at 3,863, or 30% of the entire park, and in 2008, it was 5,204, or 27.6%.

However, this construction effort based on state assistance, made it possible to improve housing conditions slightly, in fact the TOL fell to more than six in 1998 to less than 6 people / lot in 2008, a decrease of 0.5. Despite the importance of the program implemented, the deficit still considers the rate of population growth.

An analysis of housing characteristics in 2008 already provides information on improving living conditions. With all the data it stated, the problem remains more complicated in the housing pattern, the absence of architecture that is compatible with the cultural and environmental data of the population, and the absence of green infrastructure, which seems to be clear that Most of the residents of social housing are trying to change them and add some changes, whether in the facades and interior design, while others went to the establishment of home gardens over public corridors in order to shade or plant some of the needs This was not limited to social housing, as the western neighbourhood also there is a phenomenon of sheep that occurs Tour in the streets, because most of the residents of this neighbourhood came from the Bedouin areas of North African desert, all these data make us think about an architectural pattern that takes social, environmental and cultural data for housing.

III.4.2 Logics of evolution of city.

Regularly, it observed the emergence of new facilities or new developments in the city of Adrar. The regions are developing and transforming themselves, new locations appearing in the north, east and South, ensuring certain continuity in the existing structural plan, and thus not complicating urban phenomenon complexities. One of the goals of the PDAU (Urban Development Plan) is to give coherence to these changes in the coming years through decisions regarding land use, transformation or renovation of buildings, development, and preservation of cultural heritage, natural and landscape, and integration of new urban areas. Surrounding the structural graph, if well studied, also defines a course of action that clarifies the objectives to be achieved and the pursuit of criteria to be respected. He is the one who gives the city its shape, function, and readability, but the recommendations of the directive plan remain unapplied on the ground, shaking what made this part of the city suffer from many problems.

In Adrar's case, the fact that the urbanism sectors are to some extent the continuation of the old urban fabrics is somewhat different in many regions, but the basic fabric remains to have a well-organized regular network, and this provides the possibility of ensuring adaptation to this scheme eliminating rest periods.

Thus, the main boulevards are expanded so that the net roughly matches the downtown grid with respectable alignment. These boulevards perform mixed functions (traffic and urban animation).

The third road network is less hierarchical to project the role of major arteries.

The principle of mass and street is preserved as a basis for urban formation.

III.4.3 Perspectives and needs of city

III.4.3.1 Socio economics factors

Demographic perspectives

The average population growth rate remained high (3 per cent) until the mid-1980s, before dropping to less than 2 per cent in the mid-1990s. The mortality rate declined significantly, thanks to improved medical and sanitation facilities.

At the beginning of 2018, the Algerian population was 42.2 million, compared to 41.3 million in early 2017 and 40.4 million in early 2016, according to the Office for National Statistics (ONS). The purpose of demographic forecasts is to estimate the size of society that will be considered over a certain horizon and to derive its needs as well. Poverty in the future that awaits our cities to consider human needs. Therefore, perspectives are very useful in determining the impact in terms of needs for educational social facilities, housing, jobs and hence land. The comprehensive results from the various 2008 censuses and other projections of SRAT and PAW allowed us to create population projections based on reliable data.

To better control spatial trends and demographic behaviour in the long run, it was considered that aggregation would remain attractive at least in the medium term and that gravity should appear as a strategic objective for planning and thinking about the future of the studied space. As such, it observed the lower long-term growth rates without reducing the migration flows that can multiply. Population modernization in 2015 is based on the rates of growth observed between 1998 and 2008. This assumption is justified by the fact that there were no major demographic disturbances, but some migration flows from subSaharan countries should be taken, but which do not fundamentally modify development trends as One and volatile phenomenon.

Table III-9 Demographic trends in the municipalities of the Adrar city

Common Name	Population 2008	Rate (19982008)	Rate (20082020)	Rate (20202030)	Population 2015	Population 2020	Population 2025	Population 2030
Adrar	64 781	4.00%	3.00%	1.00%	69454	72997	76 720	80 634
Timmi	13 547	1.30%	1.20%	1.00%	14524	15265	16 044	16 862

Source: PATW

The following long-term growth rates are suggested:

Adrar: middle term 4%, long term: 3.5%

Timmi: 2% for the three terms that depend on the population moving to secondary communities through rural housing.

Table III-10 Demographic prospects

Commons	Est 2015	2020	2025	2035
Adrar	85247	101247	120249	169624
Timmi	17827	19682	21731	26490
Total	103074	122949	141980	196114

According to this assumption, the expected long-term population size would be 196,114, an additional 93,040, of whom 169,624 would be in the capital of Adrar, or 86% of the total population. The main objective of understanding the population growth is to understand the basic need of the city in terms of the spaces allocated for housing, public facilities and infrastructure that consider the living, cultural and environmental needs of the human being.

Needs for school facility:

Primary education:

According to the perspectives of the evolution of the structure of the population by age the school-age population would represent 11% of the total population, that is to say 21 572 pupils. According to a 95% enrolment rate, the enrolled population would be 20,493 long-term students, an additional 574 high.

According to a TOC of 30 students per classroom in Adrar, the net needs will be assessed at 293 classrooms to meet the future needs of the population. If the unoccupied rooms (64 rooms) are used, the needs would amount to only 229 rooms, which means that in the short term the needs would be zero. Regarding Timmi where the TOC is already low (24 students per class), it is preferable to keep a TOC of 25 to preserve the quality of education.

Middle teaching needs:

The overall need for classrooms, at the rate of 30 students per class, would almost double the capacity existing today, or 180 classrooms for Adrar and 41 for Timmi.

Secondary education:

According to the objectives set by the Ministry of Education, a transition rate of 40 to 60% from the middle cycle to the secondary cycle will have to be planned. For this purpose, the number of pupils to be enrolled in secondary education would be estimated at 10,000 pupils by 2035. With an average occupancy rate (TOC) of 30 students, needs will be assessed at 7 new high schools.

Employment needs
Employment needs would not be easy to estimate since the public authorities will no longer be job providers. Everything will depend on the conditions of attractiveness put in place to attract investors in the productive sectors. It knows that the volume of the population expected in the long term (65% of the population will be of working age) and according to a load rate of 1/5 people, the cumulative needs will be of the order 5000 jobs / year.

Housing needs

The current deficit for the municipality of Adrar, based on a TOL of 5.5 is estimated at 674 homes, that recorded in Timmi, based on a TOL of 6 stands at 513 homes.

Table III-11 Housing needs

Commons	Cumulative needs				Net needs		
	Parc 2015	S. T	M.T	L.T	S. T	M.T	L.T
Adrar	14 825	20249	24049	33924	5424	3800	9875
Timmi	2458	3578	3951	4816	1120	373	865
Total	17 283	23827	28000	38740	6544	4173	10740

III.4.3.2 Land requirements

Based on a gross density of 15 dwellings / ha, land requirements will be around 436 ha in the short term, 278 ha in the medium term and 716 ha in the long term, for a total need of 1,430 ha.

The needs resulting from the development of the population will face the available lands available, especially in the context of irrational consumption of resources.

Main conclusions of the Diagnostic and assessment of planning rapidly urbanizing city

III.4.4 The agricultural question: wasted wealth.

The agricultural question in this environment is crucial because this sector is strategic for food security and supplying cities with fresh products. But many constraints and agriculture do not play a real role in the development of Adrar, while they represent important potential and key wealth. It certainly lacks the conditions that give it the sustainability. Trends in consolidation of agricultural activity, despite the often-persistent constraints (climate drying, competition for water, terrestrial structures in continuous division, maintenance of large-scale farming systems, etc.), are real and the production potential can be diversified thanks to new irrigation techniques. It is not considered a sustainable solution and the neglect of the traditional agricultural system and its failure to develop it is considered a catastrophe in the right of sustainability. The oasis was a centre of stability and agriculture is considered an economic and cultural stability factor and a large part of the ecological memory. The KSAR it considered itself is an urban fabric part, then agriculture the oasis is considered as a privileged urban agriculture.

The observations that we stood on through my living in this city and through my inquiries of the indigenous people. It is absurd to say that the oasis system is in crisis: all factors play in the direction of deterioration.in a. The Earth System is a formidable inhibitor that sometimes leads to a total abandonment of agriculture in areas of excellent quality.

B. The traditional system of allocating and distributing water freezes unacceptable rental cases that prevent any possibility of cultural improvement.

The amount of water available decreases much less due to climate change than it is due to the spread of pumping in the vicinity of oases and the use of wells in the vicinity of the sources of the traditional irrigation system. This last factor is the most important and constitutes a true deviation.

Facing the stalemate in the oasis, the country encouraged new farmers to settle in the suburbs and buy pumps with support from the Ministry of Agriculture. The result was quick. Another degradation factor for the oasis is the use of water sacrifice, one of the most important factors of the oasis fracture. It is a shortage of water supplies for palm groves, weak palm trees and silt oases. The production of current dates is mostly of very poor quality and is often dedicated to animal feeding. Additionally, above all, pumping is uncontrolled and multiplies until water is consumed.

III.4.5 The ecological question:

The ecosystem of Adrar city has been more pronounced than it is today. There were accumulated Ksours in the palm groves, and the "villages" of Adrar and its suburbs include a little scattered habitat, and we can say that coexistence in the palm grove is well guaranteed according to its characteristics and identity. This form of structure is the spatial translation of social ties and sometimes delicate lifestyles. Today, Adrar city know many extensions which impact directly to the environmental situation, which leaded to aggravate this situation with the population increase, the traditional and sustainable system was also broken, waves of migration from the north and South of the city, and the entry of foreign cultures to this ecosystem, made it difficult to maintain.

It goes without saying that it is important to strengthen the leadership role of this city due to its role in the Southern agricultural corridor of the state, but it is also wiser to develop secondary clusters to maintain spatial balance, especially in the context where the city is intended to accommodate a large population.

III.4.6 From specific urbanism to standard urbanism

Urbanism still tends to concentrate in large clusters, but it is also characterized by a form of small urbanism that tends to separate from agricultural land. This new area developed by the residents of the Ksours coexists with those in cities and in certain aspects that are not yet part of the rupture logic with the oasis region.

Small conglomerates, by sticking to the palm grove, have spread, and spread in Hammadas and in generally attractive corridors along communication routes, unlike the closed and bound form of the Ksar. Even if this urbanism paradigm is not generalized, he ultimately risks cutting ties between the traditional oasis and its habitat, as in Adrar. Something noticeable is the connection of the person who lives in this city with his ecological memory, through his interest in green spaces, even if with limited spaces and in an irregular way, and that is through all stages of the city's development. I remember, while I was a small child, palm grove in the old houses in the city centre in the urban colonial fabric as well, a person kept that with social housing, despite the limitations of that also what is observed in the western Neighborhood of goats that walk in the streets, which is the culture of the Bedouins who inhabited the city in the seventies of the last century after the wave of famine in countries South of the SAHARA.

III.5 Conclusion

Through the data obtained, it can define the principles social; environmental; economics and urban planning problems.

Social problems:

The city of Adrar knows a large population growth, in addition to that, it witnesses the influx of immigrants from many areas from within the country and from neighboring countries. This is reflected in the need for housing, job opportunities, the need for hospitals, schools, and public facilities, in addition to the increased consumption of water, energy and food, as it be noticed the weak potential of the city now, which makes us see in the future that it will know a great shortage in all areas of life.

Environment problems: As it has previously explained through the study that the environmental problem in the desert is very complex and sensitive due to the weakness of the ecosystem and its rapid impact.

Economics problems:

The Algerian desert is considered one of the most beautiful deserts in the world, which is what nominates it to be a tourist destination par excellence, in addition to the fact that the desert connects many African countries throughout history, which makes it a transit area to African countries from the Mediterranean basin

Despite the abundance of oil and gas, in addition to many minerals such as gold and uranium, the presence of solar and wind energy may make alternative energies an important source of clean energy in the future

Urban planning problems:

- Northwest, West, Southwest, and South: Agricultural restrictions, but farms in the South have positive goals unlike the North. It noticed the presence of modern palm groves is a target factor for a sustainable agricultural system as well. Its presence near the source of the traditional irrigation system is negative and must be corrected.

Availability of lands in the northeast, east and Southeast. Good thing, but the presence of irrigation system sources makes the expansion of this trend negative.

- The emergence of a residential property, a "new city" in Tililan, and an important population centre, but trying to develop a sustainable reconstruction program could turn this area into an eco-urban centre.

- Maintaining the road network while trying to cultivate these roads, according to scientific standards
- Trying to develop the idea of renewing the traditional irrigation system and thinking about reuse of wastewater in the city

Considering the choice of land for the selected programs (sub-divisions and facilities) and thinking in the South of the city, unlike the previous expansion, but using ecological urbanism techniques

The present urban form has many unsustainable data that need to be rectified specialty in as future urban areas **in Adrar city.**

IV. PLANNING PROCESSES AND MORPHOLOGY OF ADRAR

IV.1 Introduction

Ecological urbanism theories have established in industrial societies, in the objective to find solutions to environmental problems, but they have not taken in consideration Southern part of world. This part of world suffering from many problems resulting from global climate changes. Africa is one of the most important continents affected by these changes. Over many years the African Saharan man developed and created a very special ecosystem. This system is a lesson from which it can learn many principles of urban ecology.

This chapter aims to determine the ecological factors in the traditional settlements of African desert. Through the case Adrar, in southern Algeria. the study aims to determine the ecological aspect in the KSAR urban pattern, (KSAR; casbah; traditional house; palm grove) by examining the factors of modern ecological theories. The research chapter is divided into two parts. The first part is a morphological analysis of the KSAR urban pattern; The second part is to extract the ecological principles related to the morphological dimension of KSAR, which could be the most effective, for ecological city, in the African Saharan region.

Architecture in the African Desert is the result of a range of social, environmental, and economic factors during a well-defined historical period. This ecosystem is the result of an enduring process involving of society capabilities on planning, and construction and, maintaining themselves, in this arid geographical space. This architecture is also a real lesson that can be considered as a reference for our future vision. In this part of the research, the study aims to identify ecological factors in the traditional urban fabric in Adrar city through the understanding of typology and factors related to inhabitants, culture, and the environment. The urban morphology in desert architecture is not a result of coincidence but rather the result of man experiences. The knowledge achieved from these experiences can be actual lessons to be used in our perception of the morphology of future cities in this difficult environment. “In an obvious way, human societies are spatial phenomena they occupy regions of the earth's surface, and within and between these regions’ material resources move, people encounter each other, and information is transmitted”.

Architecture in desert cities is distinguished by its simplicity and lack of aesthetics, many lessons can be taken about its strength in domesticating difficult nature and preserving resources. The human need in these areas for a normal life, he developed a knowledge of dealing with ecological characteristics, Where the man tried in a rational way to provide his cultural, ecological, and economic needs through urban planning and architectural techniques. This knowledge needs a scientific reading that enables us to re-develop and reuse it.

Why our study focusses in the Ksar[4] part of Adrar city?

KSOUR[5] desert cities arose along the trade routes between the north and South of the African continent, where economic and social life developed in these centres. Over many years KSOUR has evolved into Oasis Systems and FOGARA Irrigation Systems. In contrast to the urban growths that the city has known in the modern era, it was characterized by its neglect of the principles of sustainability, energy conservation and thermal comfort. The oasis system is considered a sustainable system that needs a deep understanding to extract ecological knowledge and its reuse.

The study aims to highlight the importance of the impact of ecological factors on urban morphology in the traditional settlements in the African Sahara.

The question can be asked if the urban form used certain techniques through its various architectural levels in the urban system, casbah and housing to achieve ecological benefits? If so, what are these technics and what is their specificities? How can they be explained? Our hypothesis states that if there is technics and specificity, it is not just a morphological concern. Can be identified this benefit of technics and specificities and what are their advantages?

[4] Ksar or qsar (Maghrebi Arabic: قصر qṣer, plural qṣur; Berber: ⵉⵖⵔⵎ aghrem or ighrem, plural: igherman), plural ksars, qsars, ksour or qsour, is the North African term for "fortified village," from Arabic qaṣar (قصَر)

[5] Plural of KSAR

Our study in this part of the thesis depends on the morphological analysis of the city based on historical developments, using GIS techniques. Also, morphological analysis by

adopting the method of dismantling the physical components of the city and analyzing them as systems according to the geometry, topological and dimensional framework. Our study includes the city, the neighborhood, and the residential unit.

This method aims to understand the relationships and influences of the various components of city systems in order to understand the logic of the relationships between different systems and the ecological factors of each system.

Objective of decomposition of The Urban fabric in Systems: "Urban fabric is a fundamental small-scale component of urban form with important relations to social, economic or environmental phenomena. It is the result of interplay between buildings, parcels, and street segments. Quantitative analysis of urban fabric on a large scale has often privileged selected morphological aspects, linked to micro-climatic or energy consumption issues" (Araldi & Fusco, 2017). Architectural forms are already complex forms that require sophisticated morphological analyses. The urban system, they are composed of many more elements that have very different relationships. The problem is then to analyse this greater complexity of the urban system to make it simple enough so that it is easily comprehensible. "The city-classes are generally characterized as mixed classes consisting of numerous subs features e.g., houses, trees, sealed areas or roads. A mix of them lead to future urban features like urban fabric, continuous urban fabric (dense, medium dense), discontinuous urban fabric (dense residential, sparse residential, residential blocks) as well as industrial areas. With increasing spatial resolution of remote sensing data difficulties arise to build these “super classes”, since again the diversity of regions with homogenous backscatter/spectral properties increases. Therefore, the detection of large features like the mixed urban patterns classes requires additionally effort in contextual classification or post processing of a classification based on high resolution data” (Boehm & Schenkel, 2006)

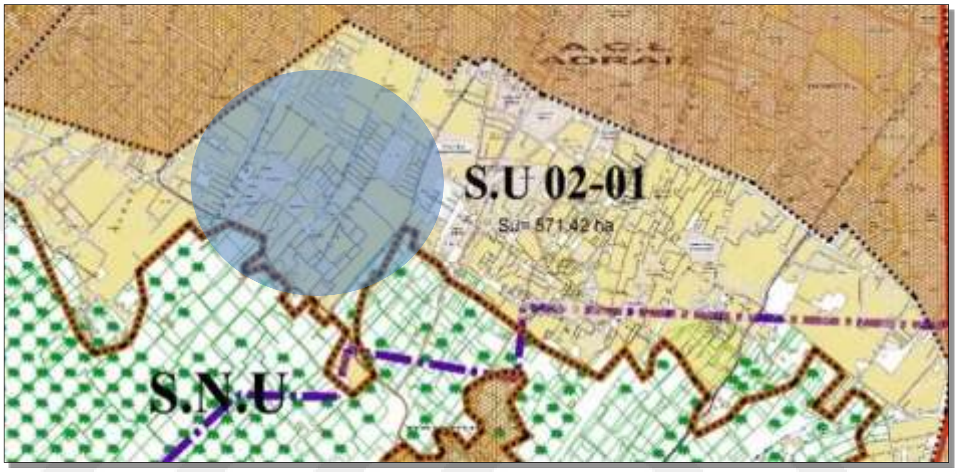


Figure IV-1 Location of casbah of Adghagh in traditional settlement of Adrar city source author by use of AutoCAD Application

Architectural forms are already complex forms that require sophisticated morphological analyses. The urban system, they are composed of many more elements that have very different relationships. The problem is then to analyse this greater complexity of the urban system to make it simple enough so that it is easily comprehensible by the spirit, while avoiding tackling reducing schemes that ignore the considered tissue specificity.

The method proposed is decomposing urban system to "sub-systems", a system being defined by the way are organized the relationships between the components of the same morphological type. For example, the fragmented system is!' all relations between the plots and the road system is the set of relationships between the streets. A system thus extends to the whole of the city. It can distinguish four systems: the plot system, the road, the system of buildings, the system of open spaces. These systems can come to overlap in all the points of the urban system (figure IV- 1). The morphological analysis will help us to identify the

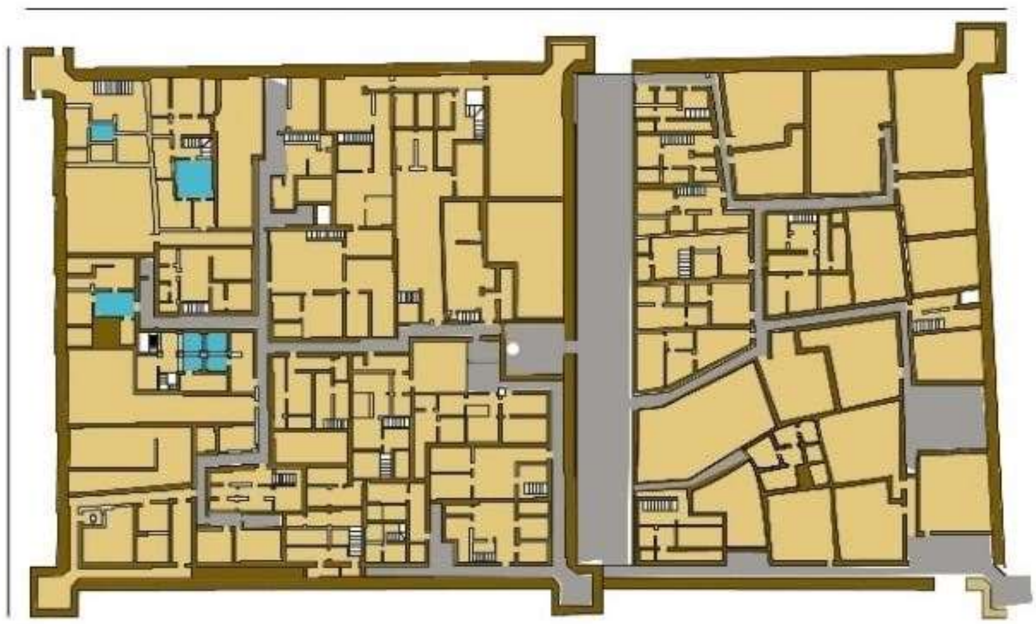


Figure IV-2 Casbah adghagh Adrar city

composition principles of the Kasbah. This reading also allows us to orient the intervention operation and serve as an instrument to delimit and define the intervention sectors. According to the casbah survey There are 14 dwellings in this casbah (figure IV 2) with a very homogeneous configuration. The building has high, almost blind walls on the outside, with "Borja" towers at the corners.

IV.2 Historical urban morphological evolution of Adrar city

The best tool for observing a city’s development remains a map of its historical growth pattern. The different historical ages displayed on the maps based on a recent comparison (figure IV -3). Morphological analysis is especially helpful when the urban design takes place in a historical urban pattern or in a well-established urban fabric. Such analysis can also help in the different urban plans like rehabilitation or restructuration or restauration.

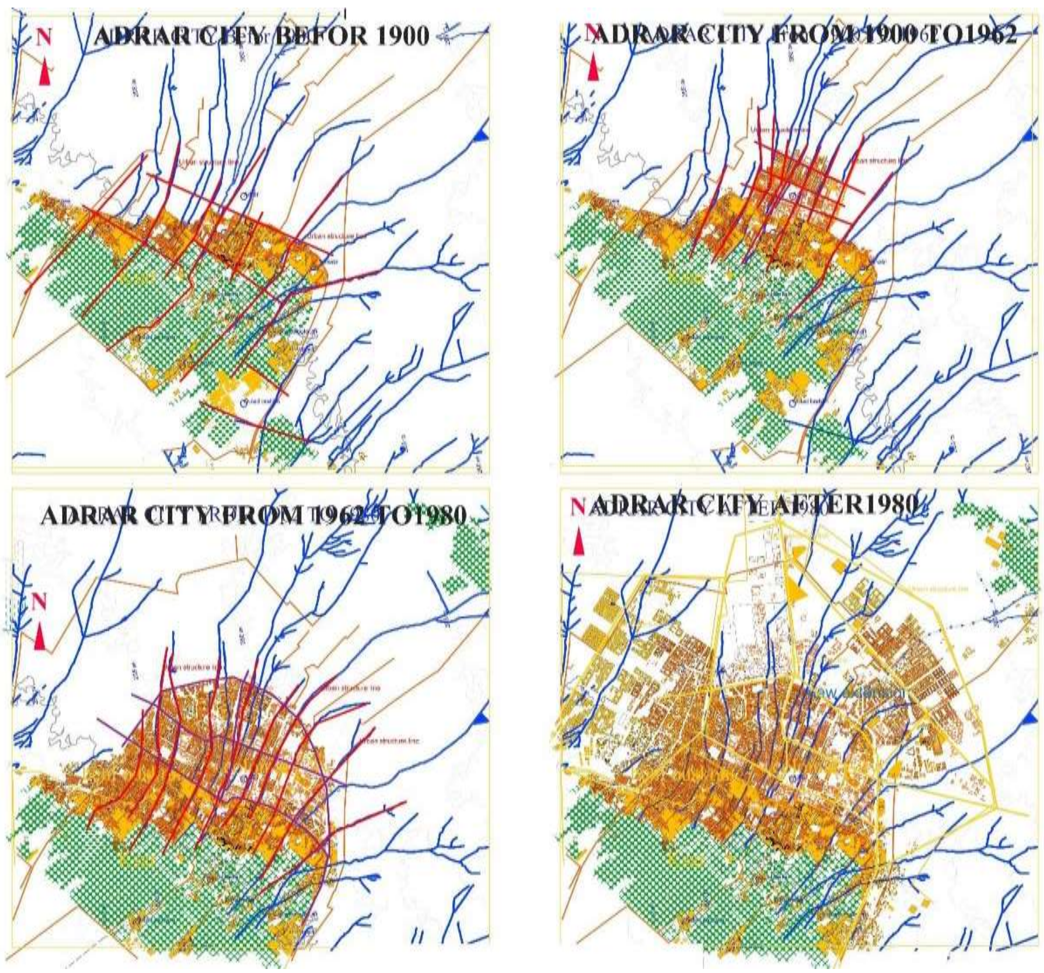


Figure IV-3 Historical urban morphological evolution of Adrar city (Large-scale map in the appendix) (A-6)

Urban morphology before colonial period (before 1900)

Adrar in his originally, is important refuge by its oasis, Adrar it was become a real commercial crossroad between the north and the South which will stimulate large migratory movements with the Arab penetration in the second half of the 10th century. From this period, the migratory waves follow one another at the rate of the events which shook the Maghreb, continuous alternation of isolation and outer conquest (Martin A., 1908)

The urban fabric at this stage is a group of Casbah protected in borders in oasis. The paths of the groundwater canals provide an urban structure whose lines follow pedestrian paths between the qasaba and the oasis. This stage was marked by the development of the oasis, dependence on agricultural production, the development of trade, and self-sufficiency.

Urban morphology in the colonial period (between 1900 To 1962)

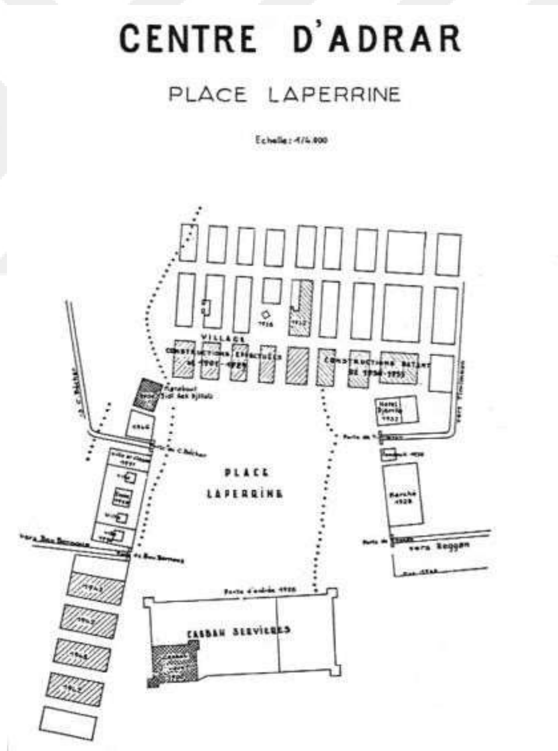


Figure IV-4 RONGIERAS Plan Adrar City (Frey, 2014)

RONGIERAS Departure Plan was drawn up in 1929, and it was the only one to have been drawn up throughout the Touat before World War II. This means that the first French installations from 1900 to 1928 were limited to the strict minimum, with no overall prospective plan (figure IV -4).

The principle of establishing the plan for the new colonial city was based on the presence of some monuments, some of which remain, and others have disappeared. The most important of which are the cemetery, Kasbah, the line of Foggaras and the paths to the neighboring KSOUR TIMMI, formed by the paths along the cemetery (indigenous people) to the east, the Great Mosque. The former fracture in the west and the small mosque along the small mosque and the formation of the western alignment of LAPIREN Square, seem to be the essential elements of the overall composition of the plan. The convergence point of these channels corresponds to the establishment of the residence of the head of the annex on the side of the oasis. The northern part commits to urbanize to the more formal and neighborhood part. It will also be the most important planned outbuilding of the colonial city. The segment corresponds to the main communication pathway with Tamentit and KSOUR South to Reggane. It will host a fort, the hospital, the memorial to the dead and the cemetery. The Southern part will be residential near Palm Grove and gardens.

Urban morphology in the independence period (1962 to today)

Adrar experienced the first real space development in the late 1970s. Its administrative promotion to the rank of capital and night activates this extension through the massive implantation of collective facilities and new framework structures to the local population. It witnesses, then, in a space boom as the city extends indefinitely and doubled its area by more than 10 times in twenty years, this phase marked by the migration of Ksour residents towards a new city, created from all parts. Most related to this extension is from the 1980s. This is related to the accelerated urbanization, its spread and very specific to the city of Adrar, and its new functions of leadership and management of the department space which is very broad. Numerous social habitat programs and subdivisions accompany the development of large facilities in higher education: department seats, country, banks, and insurance that they consider general social facilities (high school, colleges, schools, adequate. New hospital, health centres ...).

This was known as the establishment of a slum neighborhood for immigrants after the famine in the Sahel countries in the seventies and the establishment of a neighborhood for the afflicted after the floods that the city knew in the nineties.

The rapid expansion of the urban structure was associated with the avoidance of highway conversions, neglecting all the rules of urban expansion and the urban structures of the original city.

Evolution of architecture typologies in Adrar city

In Adrar, three directories contributed to draw up an architectural typology specific to the city by fitting into the chronology of the events that have made its history:

-Traditional architecture.

-Colonial architecture.

-Modern Saharan architecture.

These three types of architecture noted in Adrar (Figure), were the subject in this study of a description and a connection with the concepts of the original, durable architecture. Unlike the urban layout of the colonial and then post-independent part of the city of Adrar, the fabric of the Ksar is compact and dense. It leaves very little scope for an architectural expression that could be seen on the facade. Regulated urban fabric Traditional Ksourian fabric.

Figure IV-5 Evolution of architecture typologies in Adrar city

IV.3 Morphological analysis of traditional KSAR of Adrar

Certainly, it cannot be said that there is no relationship between the morphology of the urban system in the city and the environmental performance (figure IV -5). A morphological analysis of a part of the ancient city in Adrar is conducted, related to the physical aspect of the building in an area bordered by continuous settlements. Through this analysis, the study aims to summarised of the analyses to deduce the ecological factors for each morphological characteristic of the ancient city system by decomposing the city into four systems and analyzing them according to the topological, dimensions and geometrical aspects. Our analysis focuses on the ancient city urban physical form, spatial structure and character of the city through four main components of urban form that apparently signifies the form of the urban fabric (Levy, 1999) which are: (1) Plots or lots;(2) Streets (3) Buildings (or constructed space); and (4) Open space (Moudon, 1997) .

IV.3.1 The Plot System

“The importance of the plot (also referred to as ‘property’, as one of the fundamental elements of urban form is well recognized within the field of urban morphology. Despite the fact that it is often described as the basic element in the pattern of land divisions, which are essential as organizational frameworks for urban form, studies offering comprehensive descriptions and classifications of plot systems are quite scant."(Bobkova et al., 2019).The plot system is a system of partition of space of the territory in a few land units, the plots. The plot therefore fragments the territory (Figure IV-6).

Geometric: The regular shape (rectangle / square) confirms that the Kasbah is a creation.

Topological: the plots have divided into 06 large plot.

Dimensional: The dimensional aspect of the plots distinguishes the time of construction (build at the same time). The dimensions allow us to make a social reading on the inhabitants (the social value there is a social balance).

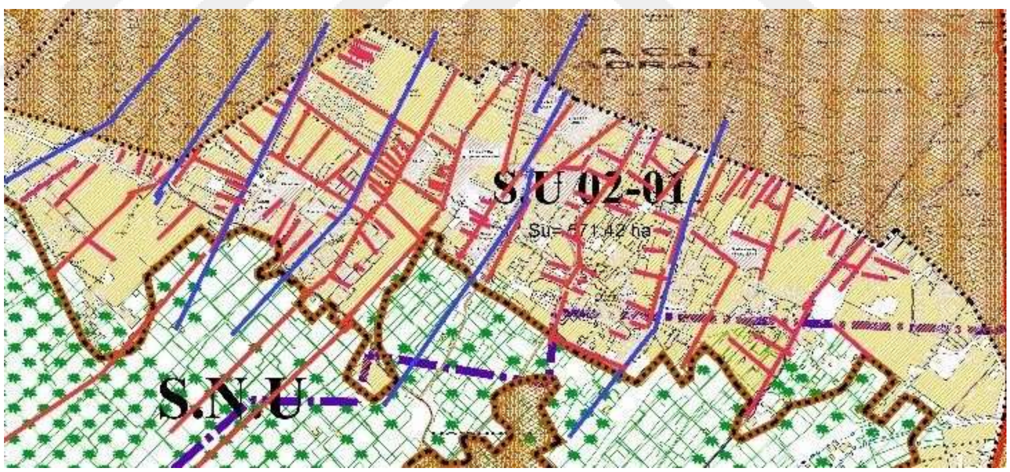


Figure IV-6 The plot system

IV.3.2 The roads network system

"This component is a derivative function of land use. As a connecting line, the road network greatly affects the efficiency and effectiveness of regional functions. The road network as a representation of public space is considered as the core generator of the vitality of the region as explained."(WARDHANI & BAHRI, n.d.) the road system is the binding of the space of the territory system. It is made by set of variable circulations of function and importance. This network is intended to present the plots, gives to interlink the different parts of the territory. In principle, but this rule suffers few exceptions, each parcel is served by a flow. The front door opens under this covered passage and has a raised threshold. After crossing “the chicane” corridor, it finds a long distribution passage, horizontal communications on the corners of the houses and at the ends of the Casbah. It is an Arborizing system in the end of the bag. Orthogonal encounter: In this context the hierarchy has not changed because the paths have the same character. (figure IV -7)

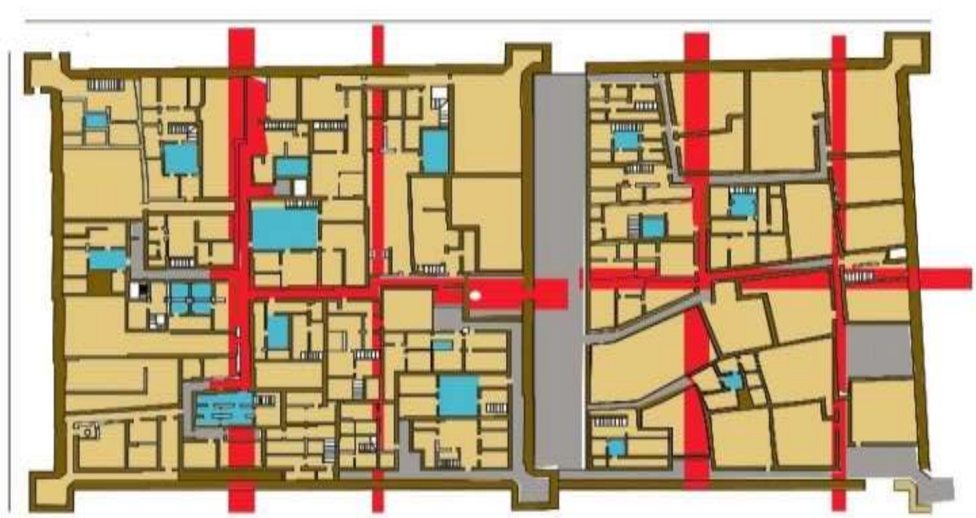


Figure IV-7 Road system in Adghagh casbah

IV.3.3 Built System.

“The urban fabric in the of older city in Middle East and Northern Africa has changed drastically over the centuries. The medieval Islamic cities in the region had an organic urban fabric which exhibited a high degree of cultural identity and unity. However, the modern overall urban fabric of these cities reveals no cultural identity, continuity, or unity. The urban fabric is composed of several fragments: the historic core with a vast Islamic architectural and planning heritage, the colonial quarters, the urban development’s construction systems in the post-colonial era, and the squatter settlements. Each fragment presents a different physical character and a separate social and economic environment (Atash, 1993). Built system includes all the masses constructed urban form, regardless of their function (housing, facilities) to their dimension. It is the system that brings together all the built masses. In general, the casbah houses of a planar topology (Figure IV-8), these types of buildings are attached to each other on all sides to form a continuous mass by

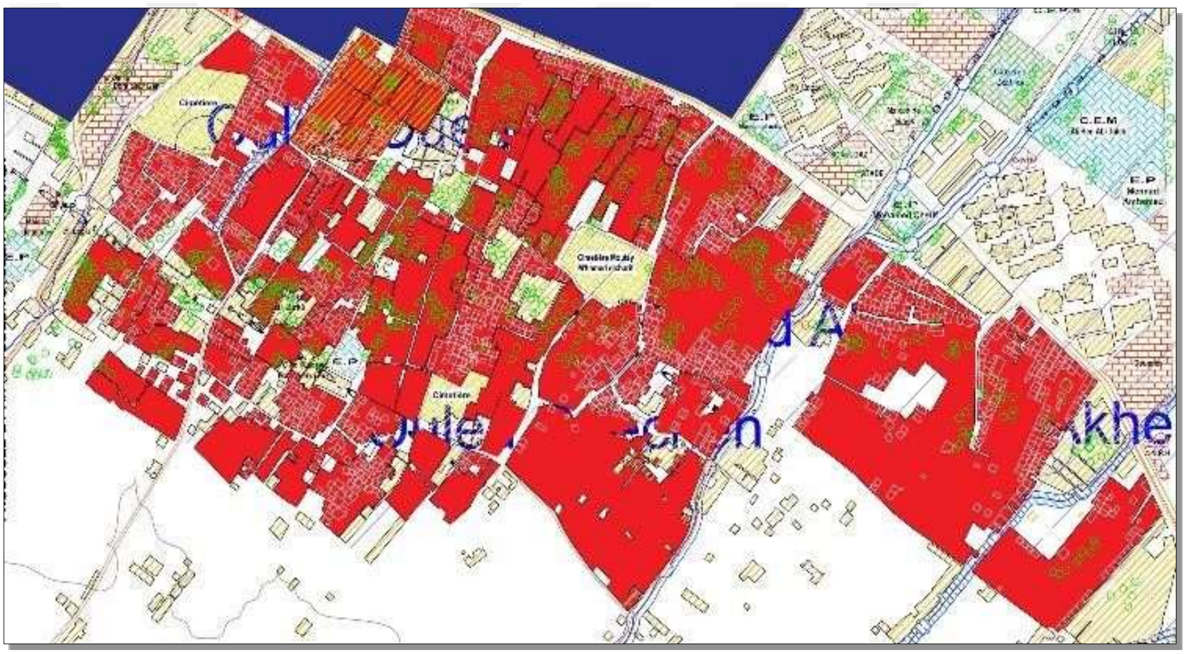


Figure IV-8Traditional building system Adrar city

adjoining only stopped only by the surrounding wall or the network of open spaces, the system generally perforated by patios.

The geometry: There is a great homogeneity between the frame and the plot in all the geometric shapes only the singular elements like - the towers - the surrounding walls the dimension: In the fabric of the casbah there is a great dimensional homogeneity of system except the mosque and the medersas.

IV.3.4 Open space system

"Urban open spaces are integral parts of city life to provide better quality of life. " (Sharmin & Perveen, 2019). Open space system is all the parts not built urban form, that these spaces are public (squares, plazas, streets, etc.) to the private (courses, gardens). The open spaces have regular geometry (square /rectangle) located in the centre of houses generally. 1/3 of each dimension of the boundaries of each parcel.

The combination of the different systems should not believe that each of these systems has a total autonomy of structure to others. What are considering the urban fabric, there are indeed some modes of coupling or privileged certain types of overlays. (Figure IV-9)

Figure IV-9 Open publics spaces Adrar ksar

Table IV-1 Analysis of eco morphological factors in Adrar city

	Aspect	Topology	ECO aspect	Dimensions	ECO aspect	Geometry	ECO aspect
Parcel system		Same line and logic with palm grove parcel systems	Integrity with palm grove	Homes: it is considered as the elementary cell. All the cells (houses and buildings) constitute the fabric. Small and rational dimension	Rationality	irregular form can gave more dynamic for urban fabric and can create climate regulation	Climate regulation Multifunctionality Multiscale
Road system		the hierarchy has not changed because if we assume a route made in the main street this variant is generally between the main and secondary axes	Network/connectivity	The width of the alleys: a factor in the hierarchy of the system. The length of the lanes: the longer a street is, the more its function is to promote it and it has a more structuring role in the city	Climate regulation Multifunctionality Multiscale	Irregular	Climate regulation
Open space	Home patio	generally, in the centre of houses	Climate regulation Multifunctionality Multiscale	1/3 of each dimension of the boundaries of each parcel.	Climate regulation	Regular rectangle or square	Network/connectivity
	Kasbah open space	generally, in the entrance of houses	Network/connectivity	Rational dimension	Multiscale	Regular rectangle or square	Climate regulation Multifunctionality Multiscale
	KSAR open space	The most important place is the market and the mosque	Network/connectivity Multifunctionality Multiscale	Rational dimension	Network/connectivity Multifunctionality Multiscale	Regular rectangle or square	Climate regulation Multifunctionality Multiscale

Building system	Habitation	In general, the houses of a casbah with a planar topology, these types of buildings are joined to each other on all sides to form a continuous mass by joining only stopped by the surrounding wall or the network of open spaces, the system generally perforated by patios	Material conserving design	In the fabric of the Kasbah there is a great dimensional homogeneity of the system except the mosque and the medersas.	Appropriate building material selection Consideration of physical environmental data	There is a great homogeneity between the frame and the plot in all the geometric shapes only the singular elements such as - the towers - the surrounding walls	Material conserving design. Sustainable design

IV.4 Analysis of ecological factor in KSAR Urban pattern

IV.4.1 The KSAR orientation

The main streets of the KSAR are directed from the northeast to the Southwest to take advantage of (humid) winds and exchange shade and sunlight in the streets. As for the façades, they are huge and are oriented towards north and South in general. The northern façades are not sunny, but the Southern façades can be shaded. The strategic location of the KSAR contributed to obtaining fresh air (it is located next to Palm grove), which is why energy conservation and sustainability are achieved.

IV.4.2 KSAR urban morphological structure

The KSAR consists of many Kasbahs, and each region has its own mosque, its own courtyard, and its own social fabric. Each tribe had its own population distribution based on social harmony. The extension is based on reviving the land - the land has no material value. Everyone wanted to build their own home, they could, but the process had guidelines like the necessity of building. "KSAR as Kasbah is a housing stronghold built in clay. But while Kasbah is conceived as an autonomous cell, KSAR is more "generous", and can accommodate one or more generational families. Of the various settlement patterns, Kasbah is still remains most advanced model, because it embodies both archetypal construction concept and even Mediterranean city"(Pietropaolo, 2017)

IV.4.2.1 Urban fabric

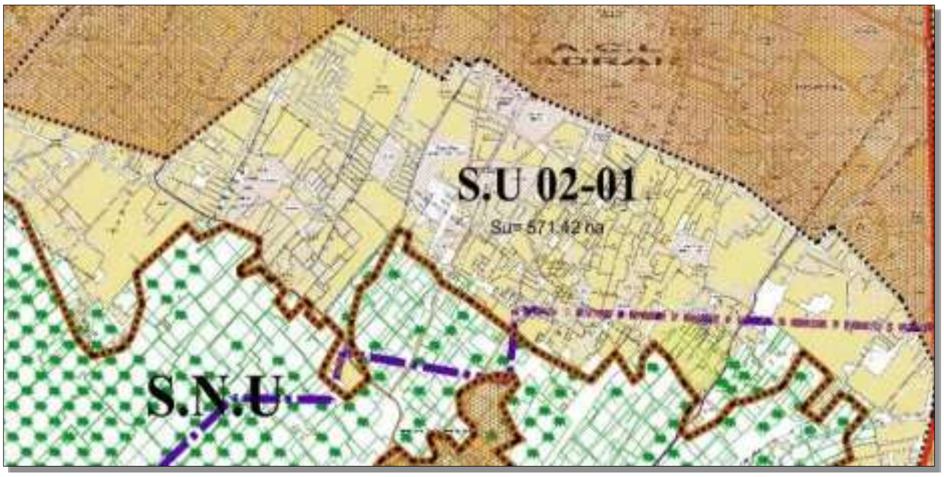


Figure IV-10Urban fabric in Adrar

In the KSAR urban fabric connected with several compact areas that achieve economy in the land, self-sufficiency, and social perseverance, according to environmental conditions. The combined fabric contributed to the shading of the entire The KSAR and realized that various amenities could be easily accessed. The KSAR realizes the most important principles of sustainability (social interaction, integrated use of the land, local independence, economics of the land, improvement of environmental conditions).

IV.4.2.2 Open spaces

We analyse the components that make up the link: subtleties (squares, crossroads, and intersections), linear (streets, alleys, lanes) and interfaces as boundary elements of the network; To extract the principles of urbanization that were the basis of the KSAR buildings:

Linear Elements: This network that leads to homes has crooked shapes, and is made up of organized and coordinated methods, based on climatic, social, and economic principles. The road: ensures the connection between squares and public facilities such as mosques, markets, etc. The roads have dimensions that are in harmony with the rise of the houses, the width of the roads is from 2 to 3 meters, it was suitable for human measurements.

Alley: is a separated from the roads and ensures the connection between homes and the main streets leading to the squares and various facilities. Alleys are short and narrow (1.5 meters wide). (Figure IV 12)

Figure IV-11 Cul-de-sac Street in ksar

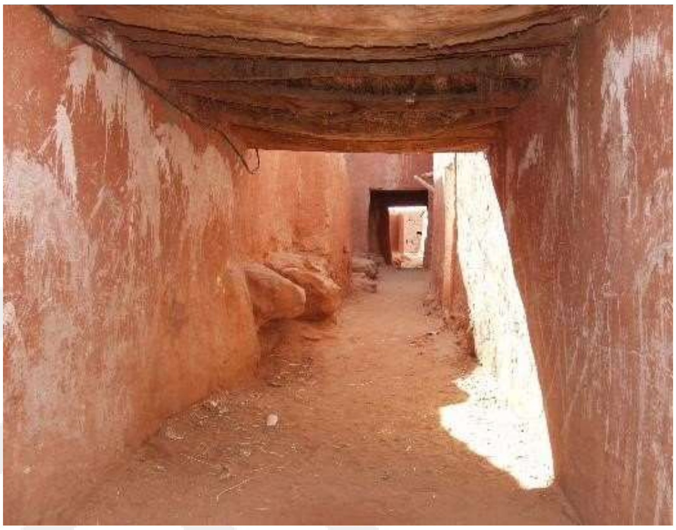


Figure IV-12 Alley source

Cul-de-sac (Figure IV 11): It is a feature of the KSAR and expresses value in the field of architecture, and it is the characteristic of the Islamic and Arab society that binds neighbours. Cule-de-sac imposes a private life on neighbours and gives them a private sphere "The dead end is an essential component of the traditions of Islam. Its appearance is associated with a type of building technique found exclusively in Islamic cities. Punctual elements: the collection of public courts (squares) and various unorganized intersections (streets, alleys, cul-de-sacs). It is based on specific principles: Intersections: An unorganized network of link network automatically leads to unorganized intersections. For example, street and street intersection an alley or cuede-sac, two-cue-de-sac ... etc. All intersections relied on different angles (sharp corners were broken and mentioned with bricks and stones to facilitate movement on one side and to expand the angle of view of pedestrians on the other side.

Al Rahba (squares or patio): “The square can be defined as a free space that is surrounded by the walls of buildings that constitute a full grouping”(HAMMA, 2017). The KSAR urban fabric includes the generally unorganized urban public squares, which are connected to streets, alleys, and fields. Although there are no outdoor facilities in these squares, they can play a big role in creating many jobs: social gathering, the role of entertainment for people, and a commercial / economic role as well because they include shops and mosques. The squares are based on the principle of complementarity between many uses and functions (social, economic, and religious functions) and between residential areas and public utilities (each complementing each other).

Through this, it is working on demonstrating one of the goals of sustainability and green infrastructure, which is integration: the necessity of integration, multifunctionality and land use, and decentralization through the distribution of squares / squares over the entire urban structure are characterized by simplicity: few openings, spiralling buildings converging to the main ground floor of the KSAR, it is rare to have those on the first floors. Sometimes it notices the presence of (the shed) that connects two façades only 12% of the vacant facades, which indicates the existence of the principle of shame as a social peculiarity that reflects the identity of the population. As for commercial and service fronts, such as traditional industry, they appear in the squares and the market.

IV.5 Ecological Principles in KSAR Urban pattern

IV.5.1 Multi functionality homes make up most of the entire area in the KSAR, but the remaining space is a few commercial and service locals. The upper floor is used as a living space in various seasons. The KSAR includes a lot of public facilities such as a mosque. This means that the KSAR has realized an important knowledge that sustainable development focuses on, which is (land use integration). This principle is one of the principles of green infrastructure and sustainable urban planning, as many economic, social, and environmental jobs and services are integrated in the same space. “A landscape is regarded as a geographic entity with obvious visual features composing a mix of local ecosystem or land use types, which is able to provide multiple functions”(Forman, 1995)

IV.5.2 Capacity of supporting.

Sustainable development focuses on small agglomerations, which are commensurate with the resources available in an area using land and water for agricultural areas. It finds this principle in the KSAR wherever it is established as a type of aggregation instead of isolated areas. “The Carrying Capacity Concept has significant practical implications for a balanced relationship between human development and the environment.”(Yu, 2003) . The Figure IV 13 shows the dynamics of exploiting the space in the same settlement according to the need, natural conditions, and internal and external changes, which is also a clear example of urban resilience.

Figure IV-13 Capacity of supporting; small ksar near to Adrar

IV.5.3 The social factor and connectivity

The space organization of the KSAR through the allocation of places for sitting, meeting and ceremonial squares is the result of the integration of social and cultural values, and the presence of many squares and intersections in front of the living and basic facilities that achieve brotherhood and harmony among the inhabitants of all this gave a strong sense of belonging and complete security. Connectivity of socialecological systems promotes resilience across urban landscapes. Community gardens are social-ecological systems that support food production, social interactions, and biodiversity conservation. (Gerer et al., 2020)

IV.5.4 Auto -sufficiency

One of the most important principles of sustainability is that cities must ensure the minimum level of sufficiency, as they must be independent through their natural resources, energy, and raw materials, which is what the ecosystem in the old city does. The Figure IV 14 shows a woman converting dried dates in the yard of the house into food that can be consumed throughout the year.

Figure IV-14 Women food production   work at Ksar homes

IV.5.5 Environmental and ecological compatibility

Sustainability is considered an original and important factor in the KSAR, as the culture of sustainability was imposed on the population in their urbanization and way of life through environmental compatibility and the better exploitation of natural environmental resources represented in:

IV.5.6 Link to green open spaces:

Access to oases and gardens is a simple reason for the possibilities created through the links between green open spaces and the KSAR. (Figure IV 15)

IV.5.7 Sustainability technics:

the common morphology of the KSAR, the nature of the buildings directed towards the interior and the walls surrounding the KSAR and the gardens.

Narrow**, covered streets**, and cultivated inner courtyards also reduce pollution. Natural uses in lighting, ventilation, and air conditioning: the organized layout of the

Figure IV-15 Palm grove road

mansion, the streets, the outdoor spaces (spaces), the indoor playgrounds, the use of local building materials, the planned trees, the small openings in the façades all this helps in improving the local climate using environmentally friendly technologies.

Twisted Street System: The twisted street scheme was used for the topographic and site conditions, but it gave other social and environmental benefits and shown that, as Cionco said, the twisted streets played an important role in reversing the wind and reducing its intensity. The findings show that air speeds do not exceed 3 m/s in many streets which is perfect for outdoor thermal comfort. (Figure IV 16)

Figure IV-16 Half covered streets in adrar Image 2003

System of Half Covered Streets:

Half covered street System is a magnificent creativity brought on by narrow streets (Figure IV 17), the upper level of which is situated between two adjoining buildings, the ground floor is called a street and an urban area furnished. The half-covered streets produce a kind of pressure differential from the air in a shaded space to an air pressurerelated area in a sunny area, which is scientifically referred to as the artificial breeze, which is a dynamic factor in ventilations and refrigeration in urban open spaces in summer days. The streets and alleys in the Ksours have characteristics that help them to regulate the ecology of the ksours. It is narrow avenues with parallel sides, and never straight streets. This contributes to the reduction of the light and therefore mostly shades the streets.

Their sinusoidal shape serves to break the wind movement across the city as normal winds of sand are unwanted. If these winds entered the KSAR, the cold air collected at night can quickly be dispersed. One important thing to note is that all homes have up to three exterior walls, thereby eliminating open facades to heat. Per Kasbah has a very thermally efficient lower surface-to-volume ratio. The only exposed surface that becomes the roof, as most walls are shared. The proximity to each other in some instances creates covered roads underneath which play a major role in the passive refrigeration of the property. The cold air contained in these shaded areas is certainly attracted to the courtyards by convection and then up to the outside. This helps to cool the house throughout the day.

Figure IV-17 The twisted street system

IV.6 Ecological factor in traditional Habitats grouping (casbah)

Figure IV-18 : Kasbah of MELOUKA Image 2003

These sites are always high on rectangular plan, and especially, are built of raw brick whose shape have changed over the centuries but whose implementation principle remained the same.

IV.6.1 The building construction system

This is the system that brings together all the built masses.

In general, the houses of a casbah with a planar topology, these types of buildings are joined to each other on all sides to form a continuous mass by joining only stopped by the surrounding wall or the network of open spaces, the system generally perforated by patios.

Geometry:

There is a great homogeneity between the frame and the plot in all the geometric shapes only the singular elements like - the towers - the surrounding walls.

The dimension:

In the fabric of the Kasbah there is a great dimensional homogeneity of the system except the mosque and the medersas.

Type of habitat

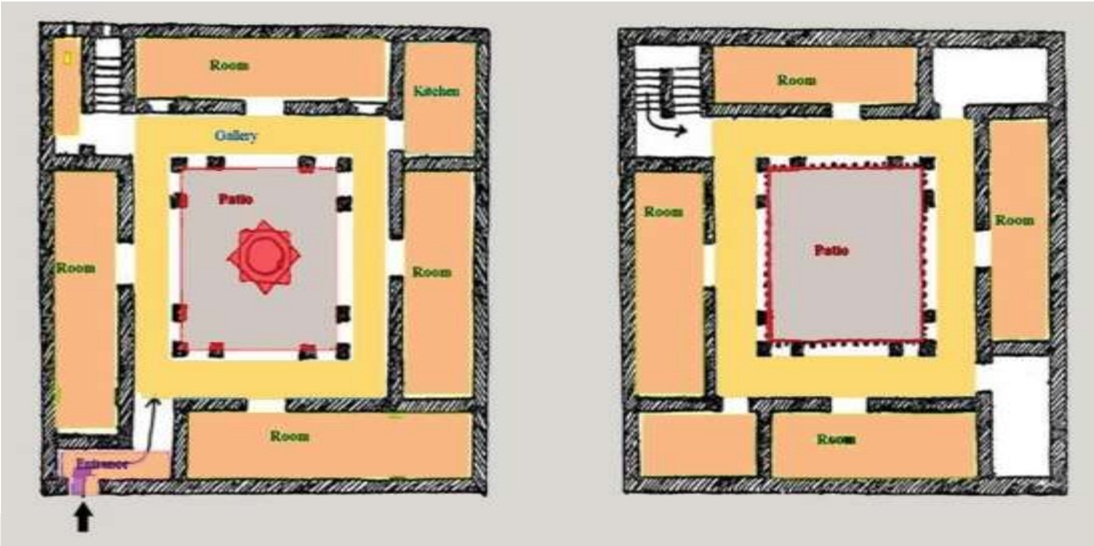


Figure IV-19 The houses in traditional urban pattern

Despite the lack of most of the houses in the aesthetic aspect, the traditional houses are very rich in ecological techniques using light and air movement and the use of very local and economic building materials that clearly meet the social and cultural needs of the residents, but the combination of these residences with each other constitutes the building system of the palace Which is considered positive from an ecological point of view (Figure IV 19)

IV.6.1.1 House analysis

The houses in traditional urban pattern are generally like all the houses of the Maghreb (figure IV-20) Its construction principle based on climate and light. The KSAR house is a house that keeps its privacy in a good way. By The separation of the masculine and feminine passages. The length of the pieces which is reduced to the span of the palm tree beam (around one meter). The stairs are almost one flight or two in that the height is not high and a structure of two load-bearing walls or one infill wall. The staircase link is usually separate the house built on two levels the Ground floor and the terrace.

IV.6.1.2 The decompositions of spaces

SABAT: woollen displacement space at the entrance of the house, Play the role of baffle to break the view inside the house (Rahbat) with Topology at the entrance to the house also an element of articulation between EL-RAHBA AND the exterior SABAT. Geometry: its shape is rectangular and Dimension 1.90x8.80

RAHBAT: A square space in the centre of the house of a regular shape shared by six arches, it is the vital centre of the house and the most airy and lighted element.

Topology: in the centre of the house surrounded by the rooms of a square shape Its role is the articulation between the deferent spaces of the house the geometry of Rahbat and square.

The dimension in general, the ceiling heights are low which requires less resistance to the wall. The dimension of Rahbat is 7.80 x 7.50.

The chicane: the chicane entry in the Ksourian houses is for the purpose of breaking the views from the outside treated in terms of an opaque screen.

Thresholds: for the purpose of preserving the privacy of a property it is also to set thresholds; this is the visual threshold,

Dar ediaf: a room after the chicane or upstairs reserved for receiving guests,

Makhzen: place used for storage of food products, as well as various kitchen utensils.

Masserai: same use as the makhzen

Stah: (terrace): sunbathe in winter eat and sleep in summer the interest of this space is to enjoy the benefits of the sun in winter and to have the evening meal and last under the stars in summer. knife: Place serving as W.C.

IV.6.1.3 The Patio houses

The patio house model is in fact one of the two great urban ecosystem models recognized throughout history. This style of house is a traditional Saharan house with its feature and typology that extended not only to the Sahara, but also to the Arab and

Mediterranean regions. The various sizes and shapes of the patio rely in part on local construction methods and the environment and in part on traditional local culture. The general arrangement of traditional houses is a century-long way of living that is reflected in the general architecture of the house and the significance of the central court. The rectangular hollow in the front wall usually is about 1.70 m high, 1.10 to 1.20 m deep. The first floor has an entrance, and an open-plan living area with an arcade surrounding a central courtyard. The kitchen and storage space are located on the second floor. After sunset, the roof terrace feature switches from parasol to bed with a severe drop in temperature.

IV.7 Spatial analysis of traditional architecture

	Spatial element	Spatial analyses
urbanscale	Site	In general, the oasis provides strong agricultural opportunities through the availability of water, the availability of a traditional fertilization system and the possibility of marketing due to the location near the city.
	Occupation	Permanent Occupation
	Building	A simple, unified form of the built system
	Doors	Every casbah have special door
	Streets, alleys, and cu de sac	Hierarchical streets
	Mosque	Integrated with housing system
	Market	On a week, occupied the public place
	Places	Several hierarchical places in the whole KSAR to enhance the social interaction and multifunction
	Wells	The wells are only symbolic elements of Kasbah
	Urban landscape	Urban landscape homogeneous in the height of the constructions, the colours of the facades and terraces.
	stores and commercial streets	No stores are allowed for loud activities or activities that may generate waste inside the Ksar
	Residential space (houses)	An organic form and are almost all similar.
	The houses	Develop in two levels maximum and all their spaces are functional.

Architecturalscale	Entry	The entry creates an intermediate space for separation between indoors and out and ensures the intimacy of home
	Distribution	The floor is the space that women often use during the day, rooms are arranged around a central area in the centre and are open to the ceiling (the patio). There is a space for women and families. There are rooms. The first floor is arranged to accommodate citizens and foreigners around a screened gallery, which provides access to the house terrace. This room could also be on the first floor, far from the lives of women every day.
	Building materials	Economical use of local materials (stone, palm wood and lime).
	Terrace	Any other type is forbidden on the terrace. It also has a hallway in winter, which is used for homework.
	Front and external openings	For all KSARs homes, identical and harmonious, according to the local typology.

IV.7.1 Identification of house ecological principals

IV.7.1.1 Natural ventilation

One of the strategies in Ksours, particularly in homes, is natural ventilation. This technique lowers the temperature and gives the interior thermal warmth. The windows are small but in a semi-arid and hot climate, the KSAR house is ideal for adoption. West Eddar has a more temperate microclimate than its outside and behaves in hot weather as a barrier between indoors and outdoors. Study shows that projection size directly influences the importance of erosion, particularly in small dimensions, because of wind motion (5-20 cm). That is why, in Ksours, homes are in a thick network that supports shared wall defence and the need for projections into walls is reduced. Wings of the wall walls for house walls exposed to wind events are made of a big hard material and / or all the hard stone material. Because of the unbearable summer heat in this part of the world, the early architects of the Middle East and North Africa spent hundreds of years seeking solutions that allow local people to live in conditions as bearable as possible during the hottest days of the year"(Fardeheb, 2008)

IV.7.1.2 Concept of Internalization:

The principle of internalization of urban planning (Fig. IV 21) means that natural fields are limited and converted into houses indoors, which is the raison of scarcity of very few, urban open space in Ksour, and this is called the urban compactness. In hot summer days, this last played a significant environmental function by reducing energy benefit, as Mahoney said, while compactness played the role of heating shared between the homes during cold winter days, as indicated in Givoni's chart.

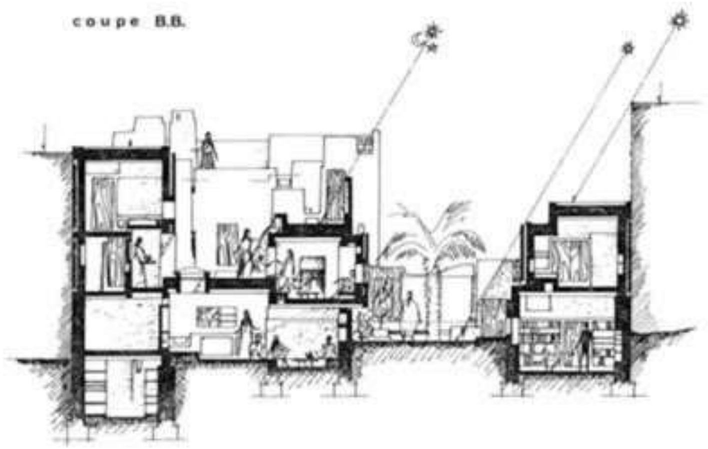


Figure IV-20 Section of house shows urban compactness and internalization concept.

IV.7.1.3 Control Tower wind trap is an engineering technique used in buildings for hundreds of years to produce natural ventilation. This tower's purpose is to grab and guide the cool brise that dominates the ground at a higher level. The typical KSAR architecture, where they are used for several purposes, offers examples of wind traps, the first of which is surveillance of the outside and maintaining safety, plus lunch storage and ventilation.

(Figure IV 21)

Figure IV-21 Control Tower

IV.7.1.4 Security and protection (Building Materials of Ksours):

The ingredients used in Ksours are local sustainability materials such as: clay, earth, stone, and palm. Thermal and physical characteristics of these materials are appropriate for areas in Ksours, and they are very sturdy, robust, provide residents acoustic and thermal comfort and need no excessive maintenance. The palm is Ksours' key asset, Palm timber is the most valuable material in the construction system, and its properties directly impose the dimensions of the building. It find urban models that are perfectly adapted to social needs, using construction techniques validated by practice and respectful of the environment .(Gil-Piqueras & Rodríguez-Navarro, 2021) The (figure IV 22) (Dethier, 1981)show the various traditional building systems used.

Figure IV-22 Traditionnel technique system (enduit) (Dethier, 1981)

I.1.1.1

IV.7.2 Ecological factor in Palm grove

"The history and the structure themselves of oases recall us this obvious fact: the nature of gardens and palm groves is artificial; to be more precise, anthropic. Surrounded by the desert, oases are usually the combination of agricultural spaces and dwellings. Their existence itself is not necessary, but the quite common shape and structure of these ecosystems in Sahara are answers, to the severe desert pedoclimatic conditions, selected and implemented by generations of gardeners".(Battesti, 2012)

IV.7.2.1 Protection from various winds

All hypotheses and experiments exploring the phenomena of wind from the desert to the oasis have shown that there is a strong degree of friction, reflecting the irresistible low level of the desert and that palm groves carry the wind from the surface of the earth to a certain height of 00 m. Sirocco has shown that between the desert and the palm groves vary in wind direction.

IV.7.2.2 Sand wind:

There are very powerful sand winds and the most successful way to avoid them is to divert them by palm-trees and by the windbreaks (Figure), to minimize their strength and their dust by the infrastructure of the palm-tree (trees and other crops). Palms Some palm rows are narrower and wider, so that there are powerful winds from the sand without blowing air that can damage the palm of the hand. (Figure IV 23 the repelling process of the sandy wind by the palm grove infrastructure)

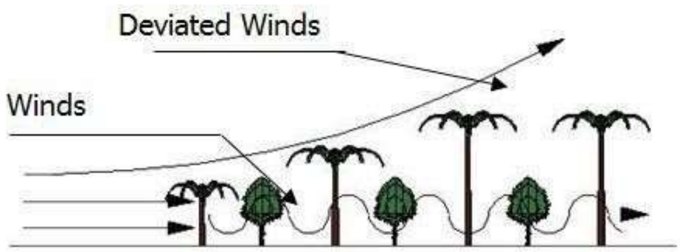


Figure IV-23The repelling process of the sandy wind by the palm

IV.7.2.3 Dry wind

In this case the palm rest does not directly influence the dry winds, but its function is to protect the infrastructure of trees and farms which treat the wind dampening and the lower temperature. The oasis acts as a moisture-producing agent, which helps reduce the heat island and cool the weather in the event of contact with dry winds (Figure IV 24).

IV.7.2.4 Dealing with heat and humidity

Many trees will generate vast quantities of water, which raises humidity and reduces the temperature induced by evaporation. The Sahara plants and the trees in general, especially the Palm trees, are losing small amounts of water for them to be preserved, so that the high humidity measured in KSARs, and oases is not caused by the palm itself; it must be said that the covered greenery is the source of trees, plants, and humid soil. Since one palm will suffice to moisturize a homeward while its impact cannot be noticed in an open urban environment (Figure IV 26), the findings of the

Oasis Effect Calculator software that is built and optimized especially for such limitations illustrate the hypothesis.

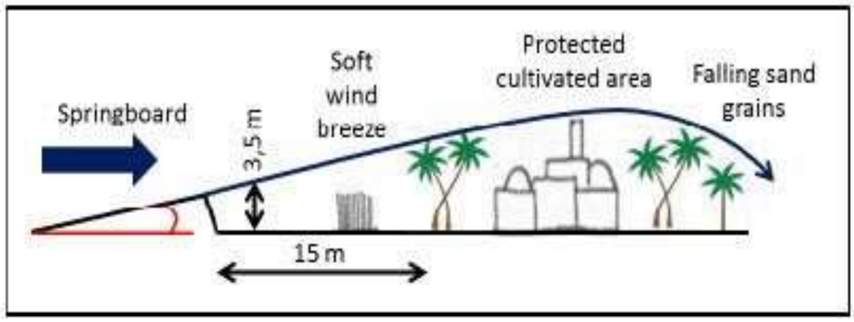


Figure IV-24Type of a windbreak where sand is hopped by a wind jumper aided by the palm’s protection.

The inside of the KSAR is lower than 2°C to 6°C depending on the season and month, although relative moisture will exceed +18% of the desert's equivalents. Even, on summer days where air does not travel, the built-up area is heated more quickly than the nearby palm grove, which creates a low pressurized area that draws cool air from the palm grove. It is a mountain breeze phenomenon.

IV.7.3 Conclusion

The KSAR Ancient urban systems in Africa Saharan are the result of their adaptation of urban form to the parameters of the ecosystem; But these urban systems are very complex in nature; To understand the relationships between the components of the urban system it is necessary to simplify them through morphological analysis. it can summarize the ecological factor in traditional urban pattern in flowing graph. The KSAR are considered lessons from which it can draw many principles that can be our reference in creating the most sustainable cities of the future, among the most important of these principles:

Climatic conditions (Heat Island**)**: through ecological urban design it can be improve the urban climate. Joining an environment that is in harmony with the climatic conditions of a desert environment can result in joined buildings reduce heat during the day and reduce a network of dense shade.

Social Sustainability: Affiliation contributes to creating an interconnected society and the preservation and consolidation of social relations. He can preserve values and identity and ultimately achieve social justice. It also provides security to reach a sustainable society.

Economic sustainability: Ecological urban planning contributes to the economy and preserves land used in construction through a true appreciation of the spaces required for different jobs. In addition, it combines functions and activities and there is access to the entire population. Joining can also shorten roads.

The principle of environmental and environmental compatibility: It could be through achieving an equivalent urban agglomeration: - Using natural energy to obtain ventilation, this technology is brought from the accumulation of experiences to identify the mechanisms that address the local climate by applying the principles of green infrastructure and applying the foundations and standards of sustainability in addition to Energy efficiency and resource utilization. Flexibility and compatibility with variables

The principle of continuity is considered in the KSAR, that is, the land and resources should be kept for future generations to enhance and develop them.

Principles of planning streets and squares: Among the characteristics of these principles are the zonal graduation, the provision of shaded streets, and the importance of determining the stadiums for activities in free areas to control the climate of desert areas. To reduce negative and large vacancies not cultivated land.

Public utilities are based on three principles: mixing, aggregation, and decentralization. The mixing functions are then combined, and here it observed the

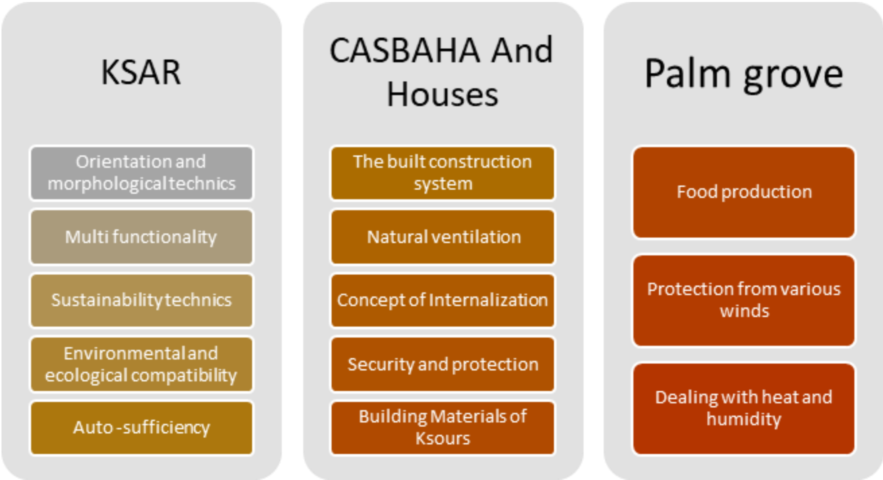


Figure IV-25Ecological factor in traditional urban pattern (KSAR)

economy in the ground as this can reduce the need for transportation. It can also observe the distribution of facilities in a thoughtful way called (decentralization).

Home design principles: A house designed according to sustainability standards must be built from its environment and make use of the capabilities of its environment. The residence is based on the principles of energy conservation and knowing how to design the choice of building materials, building systems until reaching architectural details and environmental solutions that are in harmony with the nature of the hot climate. And according to social needs and not individual needs,

Squares: are all the vacant space in the urban centre.

Organizing the open spaces: The open spaces are used for various functions (economic, environmental, and social

Environmental treatment: homes can achieve natural ventilation, breeze and air conditioning solutions that completely neglect energy resources. Energy conservation: Sustainability concepts focus on auto energy (self-energy) for economic, health and environmental reasons, and the search for new energies.

Defining of indicators of ecological factors in traditional settlements

Through our study and analysis of the Traditional settlement's it can determined the indicators of the indicators of urban social ecological memory (the ecological factors in the original settlement) in the following graph. With the design of software application, the study tries to integrate the principles concluded from this chapter of the research and consider them as indicators of the urban social ecological memory, through which can measure the degree of preservation of the original urban ecological principles in all parts of the city. This step it will combine in next chapter with the Study of Ecological Memory section.

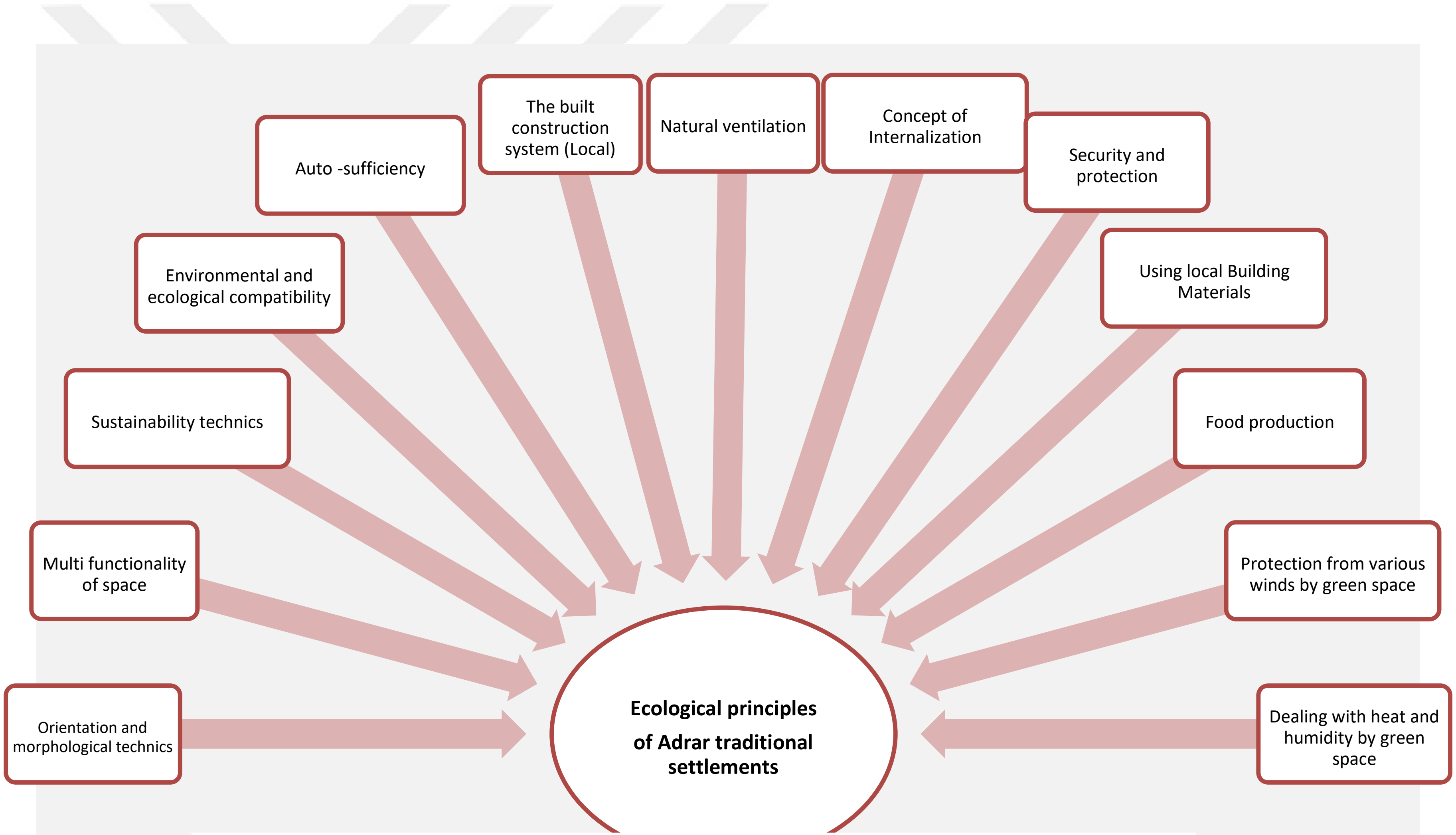


Figure IV-26 Adrar Traditional settlements ecological principles

V. DEFINING SOCIAL ECOLOGICAL MEMORY FOR ADRAR CITY

V.1 Introduction

To achieve greater sustainability and resilience in urban areas, social and environmental knowledge must be better integrated into urban planning and design projects and attempt to address environmental conditions. As of the gaps in environmental science and urban design, although the integrity of science is still the only path through which sustainability goals can be achieved, reality has proven challenging. In mainstream practice, ecologists are often used only figuratively; they rarely engage in the creative and conceptual stages of the process. On the contrary, it is assumed that the gap between design and the environment, which tends to be dominated by a fixed and relatively written view of what the design process and what it can be, must be bridged. Moreover, Although there are many examples around the world using environmental design methods, the study attempt in this chapter to apply the concept of using the social ecological memory of the desert community in the Sahara of Africa; over to understanding the cultural, social and environmental components indigenous to this society, and analysing the relationships and interactions between these The components in order to comprehend the logic of the ecosystem in this region and study the possibility of rebuilding the social ecological memory in its various dimensions and the possibility of re-integrating it into modern environmental design, which is the most serious and logical scientific and cognitive framework through which urban resilience can be reached “Memory carriers are the motors in long-term social-ecological dynamics and renewal”(Barthel & Isendahl, 2013)

Through a design-oriented and action -oriented approach, the study discusses how this collaborative design process can integrate environmental knowledge into urban design through concrete practices:

Through this part of the research, the study attempts to focus on identifying the components of the socio- ecological memory and the possibilities of reintegrating it into ecological urban planning, by analysing it in the traditional urban fabric and understanding the ecosystem in the oasis as well. The study depends on literature study of social ecological urbanism in within its global context, depending on the bibliometric analyses of their leaders, Stefan Barthel, Nazarea and Piolino. But it observed the great shortage in this field of research, research in the social ecological memory in desert areas is considered a new matter. The study tries to understand it in the special context in the desert Oasis in Africa. it noted that the modern urban fabric in the colonial period carried a set of positive data that was not present in the recent expansion of the city of Adrar.

Also, considering the unprecedented global urbanism, environmental data, active crises, and new diseases, it has become necessary to shed more light on operating ecosystems as necessary for human survival. Instead, it has endured human existence from eternity. And here I mean our condition. Life has been for centuries, unlike what urban societies live today by relying on bringing all their needs from abroad. Given these data, creating better links between the disciplines of urban design and ecology, as well as thinking about "city ecology" in an integrated and systematic way, is essential for moving towards a more sustainable future. In environmental science, this vision has led to a growing interest in cities. This data made urban ecologists think of a serious way to find realistic solutions for urban planning issues. the ecosystem began to move towards a more dynamic, non-linear, and complex understanding of the interlinkages between ecosystems and social memory. Key concepts in this new school of thinking include ecosystem services (which understand humans as a joint facility, as well as the benefit from nature) and flexibility (which indicates the ability of the system to absorb and benefit from shocks and reorganize them and then continue to develop without losing basic functions). This shift in thinking sees humans resettled from being outside of the original ecosystems - as pollutants or as managers of charitable resources - to integrating within them, where "mobility" agents in the system are internally.

In urban planning and design processes, has always been a need to improve the integration of ecological knowledge with planning processes for a long time, for example, the development of environmental ideas and environmental thinking can be observed, and in order to get an overview of these recent developments, it can observe this in many from emerging eco-cities, by investing in landscapes, ecological planning and environmental knowledge are integral and indivisible parts of the urban fabric and as a key to sustainable development. Also, sociology must be integrated into the same urban context because of its important effects that must be understood in a good way, in addition to social psychology. To create a social environment that aims to integrate human social interaction with the physical environment in a broad, interdisciplinary approach, so social intelligence is a strong indicator of preserving individual and group behaviors to preserve the environment and achieve the goals of sustainability.

V.2 Methodology Of Analysis of Social Ecological Memory:

The methodology was formed through field analysis of the reality of the Ksar ecosystem and trying to identify the components of social ecological memory around the phenomenon of custom gardening and selecting areas for deeper studies, using interviews with residents of:

- KSAR inhabitant
- Palm grove
- Adrar city centre residents

To try to understand the components of the gardening system in the oasis.” Understanding local community perceptions is an important first step in seeking ways to revitalize degraded urban streams.”(Lima da Costa Preuss et al., 2020)

Understanding the reality of the irrigation system and its effect on the urban fabric at all stages Comparing the components with an oasis of generating components in the Adrar Oasis to confirm the data.

After collecting and analyzing data and determining the basic principles of the social ecological memory of desert cities, it will integrate into the software application, which will help us in analyzing the obtained indicators and proposing clear goals for a future model of the ecological city in addition to integrating the indicators of the principles of urban ecological factors extracted from the previous chapter.

V.3 Ksar Ecosystem

The desert Oasis is isolated islands in a sea of sand, but when you look at the reality of the oasis, you find that as a result of the interaction of human action that invested in the environmental factor within a distinct social pattern, this factor played an important role in adapted and adapting to the environment at the same time, with the transmuting of knowledge from generation to generation in form of social ecological memory, which is played an important role in sustaining life in this space.

By creating a living environment that adapts to difficult natural characteristics, the Saharan man has found a balance between activity and the workplace by grouping them within the oasis. This gave rise to a system consisting of inseparable and interconnected elements. Thus, the water factor was the most specific in this system not only to choose the site of construction of the oasis, but also to organize the community.

The oasis system of South of Algeria region is more complex. It in three interconnected subsystems: the first relates to water and foggara as a means of filling and the second subsystem, the palm grove, directly depends on it; the volume of the water abstracted determines its spatial extent and its allocation and rank and role in the third subsystem, the Ksar, the place of social life. The overlap of the systems has led to the change that affects one of the three-panel components formed by Foggara, the palm grove and the residential space, and affects the other components retroactively. Touat[6], Gourara[7] and Tidikelt[8] territory is distinguished in the Algerian desert by maintaining the foggaras oasis system. In other hand, KSAR has a palm grove, an arrangement that makes it possible to alleviate the harshness of the desert climate. The presence of water was crucial to this institution. In a desert where water is scarce, the Ksours were made to exit through foggaras, through the traditional irrigation system. Each of these three components symbolizes human ingenuity and the challenge facing a harsh

[6] Touat, or Touat, is a natural region of desert in central Algeria that contains a string of small oases. In the past, the oases were important for caravans crossing the Sahara. Wikipedia

[7] Gurara (Gourara) is a Zenati Berber language spoken in the Gourara (Tigurarin) region, an archipelago of oases surrounding the town of Timimoun in southwestern Algeria.

[8] Tidikelt is a group of oases in the Algerian Sahara situated mainly in the wilaya of Adrar

environment, the relationship with agriculture is related to water, and living space was also the effect of this on the space cleaning of the urban environment, whether in the

past or present, and it will address in the morphological analysis of the city of Adrar. This spatial composition of the oasis reflects a form of community and work organization (graphic form). "The oasis generally collects one or more Ksours supported by one or more palm groves, and thus forms a unique, geographically coherent whole of the same stratum name, as previously shown with respect to the Adrar Oasis. In this group it observed the homogeneity of agricultural practices and the mobilization of water, after expanded a strong dependence on local topographic conditions, but, this is not the norm, you can have a small oasis consisting of one KSAR supported by some gardens such as some spaces near the city of Adrar such as the MELOUKA kasbah which is in its idea of the independence of the neighbourhood in modern design theories that it mentioned it in the previous chapter.

The Saharan Oasis form archipelagos of very low density. The technical differentiation between agricultural production and trade flows results in socio-ethnic differentiation. Historically, nomads control the entire interstitial space, the exchange between Oasis such as the larger one, between the north and South shores of the desert where non-Saharan agriculture is developing. The sedentary people, often former vassals of the nomads, lead the farming of the Oasis.

Faced with climatic conditions characterized by significant evapotranspiration and the scarcity of surface flows, only entirely artificial structures allow agrarian production (fig. 5-4). The agricultural organization, capable of withstanding climatic conditions, tends to limit evapo-transpiration as best as possible by creating an artificial microclimate, relatively humid, in a space of very small extent.

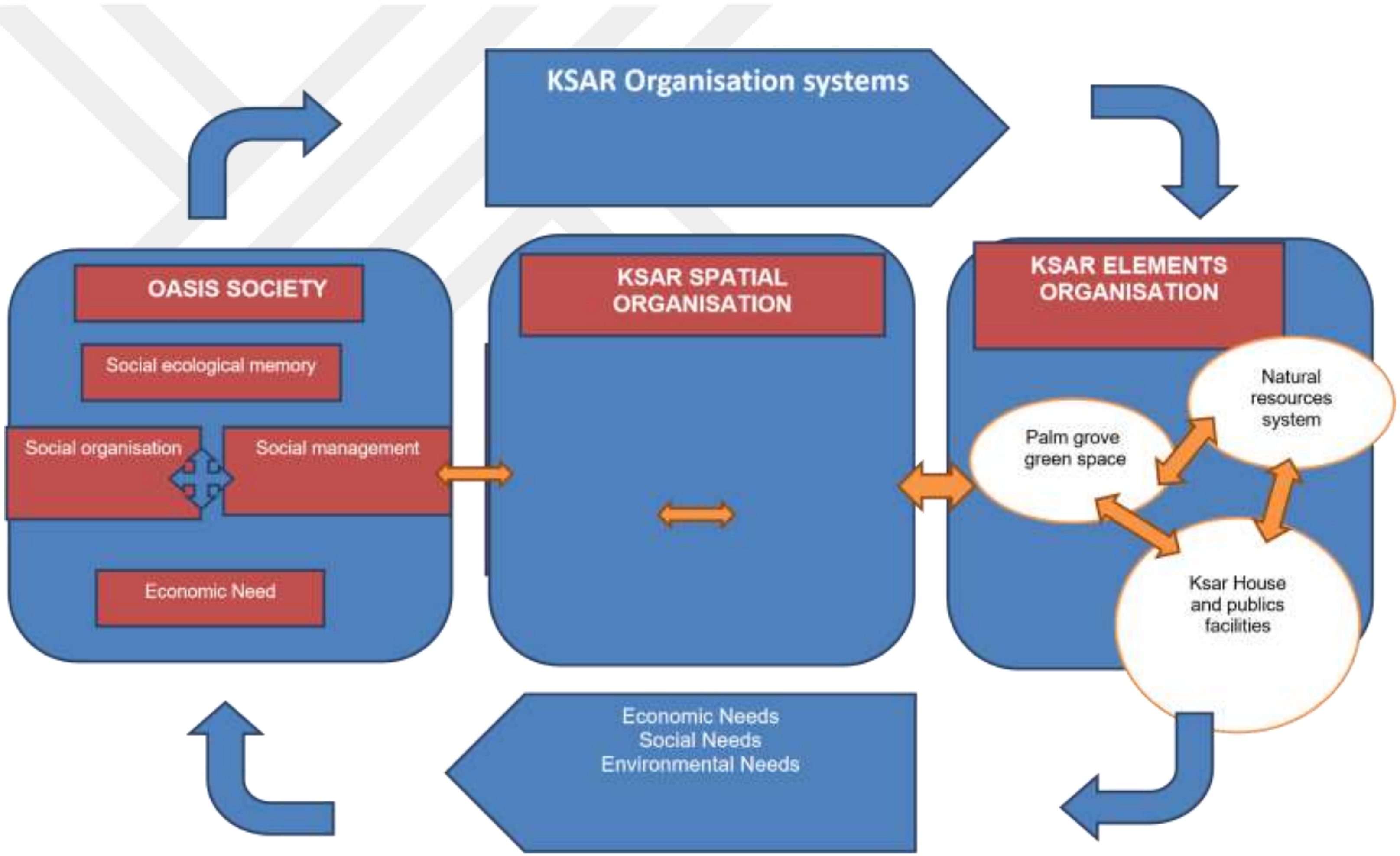


Figure V-1 Organization schema of oasis (source author)

V.3.1 Social Ecological Memory in Ksar

Table 1 Categories of social–ecological memory in the allotment gardening and the criteria for choosing them. (Andersson & Barthel, 2016)

Category	Criteria
Habits/rituals	Imitation of practices, learning-by-doing, repeated collective gatherings, parties
Oral communications **Rules-in-use (institutions)**	Dialogues, discussions, sharing of experience, learning, teaching Norms, regulations, and property rights
Physical forms/artefacts	Features of participation and reification
External sources of support	external to individual allotment gardens

The patterns that emerged during analyses and model observations were analysed with the theory developed internally domains of collective memory and social memory (e.g., Halbwachs, 1926 [1950]; Gunn, 1994; Olick and Robbins, 1998; Wenger, 1998; McIntsoch et al., 2000; Misztal, 2003. Rothstein, 2005). According to Halpax (1926) [1950] collective memory can be divided into two main frameworks.

(1) A biographical memory, which revolves around the narration of identity based on individual experiences and is also about knowledge in the family and transmitted between generations.

(2) Historical memory that includes information stored in institutions, physical forms, location, and written agreement. it mentioned here, for example, in oasis, group and group management, especially in the management of water resources and urban ecological memory.

Memory acquisition and transfer can be facilitated through personal sharing experiences. Oral communication is emphasized as pivotal to the reproduction of collective memory and meaning according to almost all the literature analysed which is confirmed by Barthel. The fact that memories are often organized around landscapes, indicates that remembering takes place in the physical earth and is something that involves our senses, which is why sharing may alter social memory in relation to a constantly changing environment. Some social practices are habits, such as established group practices that are repeated regularly. Through customs, social memory can be transmitted, often implicitly, in embodied, non-textual, and non-cognitive ways. This phenomenon is sometimes referred to as habit memory, and is reflected in physical situations, activities, techniques, and gestures, and through practice brings the past to the present. This is in line with the results of Cromley (2002) and the results of Nazari (2006), which indicate that non-verbal forms, such as gardening practices, temporarily transmit environmental information. and urban ecological factors in original settlement.

Social memory can be preserved and transmitted through unification processes, which restrict and enable participation at the same time, as sharing provides social references to interpersonal relationships. The study used the concepts of participation and standardization as a classification scheme when developing four classes of internal social ecological memory for the allocation garden, where the first two categories represent participation and the next two represent standardization. The literature also emphasizes the importance of external memory reserves for internal social memory.

V.4 Survey of Palm Grove for SEM:

The study site was chosen based on group of palm groves (Figure V 2) in Adrar, some gardens in the urban fabric as well as colonial and some home gardens in the areas of urban expansion in the outskirts of modern urban expansion.

Figure V-2 Participated Works

Informal conversations and interviews conducted with oasis owners. The aim of the discussion is to determine the ecological knowledge, how the oasis is preserved, and the various knowledge transferred. 30 interviews were conducted with peasants who own the oasis. The selection of respondents by taking informal samples according to their presence in the fields, and notes were taken during most of the interviews.

The research was conducted in location by ADGHA AND AKHNATIR O / OUCHEN AND ADRAR to determine the social ecological memory in the city of Adrar in August 2020. The study tried to focus on an age group of both sexes between 50-60 years, which represents 70% and the age group below that represents 30%. Where the physical structure is palm groves and Foggara irrigation system also, the oasis sites connected to the city, in the vicinity of 5 km. The interviews took place in two stages.

The first stage is to determine the ecological knowledge of the oasis and the irrigation system. The farmers 'answers were consistent to 90% in the interviews.

The knowledge was previously divided into five categories.

Customs / rituals, oral communication, rules in use (institutions), physical forms / artefacts, and external sources of support

The body of knowledge is defined in Table 1-5 The second stage was done in two parts:

1. Determine the ecological impact of the components of the social ecological memory
2. Determine the ecological impact of the social ecological memory carriers

Summarize the results of the two parts in Tables V-1 V-2.

It remarked that after the conversations, that the social ecological knowledge is divided into two parts; a part is transmitted by oral conversations. As for the management and water rights part, it is written and according to an arbitrated local tradition in which one person is assigned the name of the witness. All laws and customs are regulated by the group and the government administration is not involved in managing the water or the oasis.

The results of the questions were:

Through the questions asked, it noticed93% of all farmers learned farming techniques through their parents and through the exchange of experiences between them. There is also an important category that tries to obtain external knowledge and represents46 % follow some suggested configurations by management and social media to develop their technical knowledge. This constitutes a problem and a factor of dispensing to local knowledge. Another factor that threatens the preservation of ecological knowledge of palm orchards is that66% of farmers refuse to receive agricultural knowledge after reaching the working age due to the need to work in other sectors.

Despite the importance of the traditional irrigation system, which is the source of life in the oasis and the basis of the ecological balance and the ideal quality of the water it provides, it noticed also 46% neglected the traditional irrigation system and digging wells due to the shortage of water levels and damage to irrigation canals.

The economic drive towards improving agricultural production is an important matter for the inhabitants of the oasis, which is what made them rely more on chemical fertilizers and abandon organic fertilizers. Where it noticed that 46% rely on chemical fertilizers and hybrid seeds to obtain better marketable production. and 53% rely on organic fertilizers only. And 70% rely on organic fertilizers but use less than 30% of chemical fertilizers.

The social factor and the preservation of the cultural heritage is an important part of the life of the inhabitants of the oasis, where93 % celebrate the beginning of the agricultural year and celebrate traditional occasions. Oasis residents try to find solutions to their daily problems and their problems with the public administration through consultative work between them organise periodic meetings in the oasis, the square, or a specific place 66% participate in group dialogues and local council meetings.

40% exchange seeds. Also 53% participate in a collective maintenance of the irrigation system. Working in the oasis is a participatory family work in which all family members participate, each according to his ability and qualifications where 46% teach their children at the end of the week and work with them in the fields. also 33% memorized songs about agriculture and 40% work with their women's and children's 70% of women working in the fields depend on two economies for what they produce. 66% share a business with their neighbours during the difficult work seasons. In the oasis environment, the grazing areas are very limited, as the population depends on raising their animals inside the orchards, it noticed that 50% Ranching sheep in the gardens. Also 40% of population depend on more than 50% of their lunch on gardens.

The second survey and final interviews

Based on the patterns that have emerged around what constitutes social and ecological memory, it is re-examined and analysed, according to its relationship to environmental design and the possibility of preserving and developing it. Social–ecological memory in relation to allotment gardening allocation ecological social memory in the Ksar palm grove, which is a very important place for me in terms of biological singing because it contains large numbers of plant species in addition to the space organizations for palm grove Add to the irrigation system All these data the study attempts to be fixed it (Table 5-1). Participation includes acquiring, transferring, and modifying ecological practices and knowledge (Figure V 3). It refers to the process of participation and participation as well as to relationships with others that reflect this practice. Hence, work, communication and mutual recognition are suggested. It goes beyond cooperation and includes all kinds of relationships, including conflicts. Participation is a powerful thing in organizing the agricultural community in the KSAR through regular teamwork seasons throughout the year, such as collective cultivation or collective harvesting. The process of cleaning the collective irrigation channels all these things include Knowledge transfer through oral communication. In line with the literature on social

Figure V-3 Collective familial works in palm grove

memory, questionnaires revealed that oral contact is the most important means of transmitting ecological practices and knowledge in palm grove. So, most of the initial knowledge takes place within the family and the garden, but regarding the irrigation system, external training is needed. Newcomers enter the community of primitive practice through conversations with experienced neighbours, and through teaching by specific mentors. Among the dedicated gardeners, learning from older and more experienced gardeners is the most important means of imparting garden knowledge and practices.

As already said that men are cooperating with each other in some large businesses that need more power, and exhausted longer time for and entrusted to one man, and cooperating women among themselves in some hard work, such as harvesting dates, after being cut off man dates and leaves them under the palms, come Women in the morning holding the jugglers stand up in their hands, collecting dates and putting them inside sacks, and during that work, which did not have the opportunity, they simulated some things, and this work was an outlet for women to meet and exchange news and concerns, and gather as well as in wheat and barley harvest, women participate in order to facilitate the work (Figure V 4), and after the end of the work will be paid aid women is the share of dates and wheat customary among women. When asking questionnaires to most gardeners, the answers were that they pass on the seeds and experiences through oral communication.

Figure V-4 Collective man and women works.

There are also local seeds that they depend on. They store most of their previous products or buy them from seed shops and they are approved in traditional meals that are used daily in food or on occasions where they are considered It is a symbol of the nobility of the species, which is produced on modern farms and whose seeds are from European sources or from other regions. In the urban environment, it depends on private gardens, which are not considered in terms of area or number. It is important to rely on the same experiences of the oasis, but the difference lies in the method of irrigation, as it depends on drinking water from the water network for irrigation. In the past, there were many parks in the colonial urban pattern, but they started to disappear due to the importance of the real estate area and its transformation into another activity. As for public parks, a Neighborhood Park brought four hundred houses to our attention, as it relied on another type of solidarity according to other data under the organization of the Population Association.

V.4.1 The spatial organization of the irrigation system (foggara)

The foggara oasis is practically invariable. It rests on a plateau containing the aquifer stones whose drained water (draining part of the foggara) is conveyed, by galleries, towards the relief. For each km2 cultivated, the land is here "disembowelled" (etymology of foggara) by a network of many kilometres, the galleries, whose depth varies between 5 and 20 meters, are fitted with regularly spaced wells.

They were used to evacuate materials and now provide ventilation and access for maintenance, in sections of 10 to 20 meters. The minimum distance between the foggaras is 80 meters. The oasis, located on the slope to facilitate access to the gardens, is compact. The network, towards the gardens, is made up of small irrigation channels remaining on the surface. The distribution of water is achieved by the permanent sharing of flows using stone structures, the "combs". Housing is originally grouped into Casbah (defensive villages). The village is most often located on the edge of the plateau, close to the channel of the routing galleries and water "combs". The Figure (V 5) show the foggara traditional irrigation system component.

Figure V-5 Foggara traditional irrigation system composition source author

The galleries, and depth

Channels remaining on the surface.

Pool

Combs

Combs

V.4.2 Characteristics of social ecological memory in palm grove

The Oasis in the desert give a clear example of the existence of a clear social ecological memory through the presence of palm grove whose role is clear in environmental, economic, and social terms. Those agricultural activities have a great role in desert through participatory work and the presence of all classes of society in addition to the presence of children, women, and men. This activity of different classes of society and gender generates many place experiences. Participation in urban gardens includes oral communication, which conserve the rural community practice and ecological experience. also, that participation also includes garden design, which leads to repairs, and space management. this gardening practices and knowledge established the important part of the ecological social memory.

So, we can ask how these things include ecological knowledges and practices?

In gardens, material things are the product of previous participation. This includes engineering knowledge such as the size, shape and location of Oasis, and ongoing practices and relationships. For example, the open nature of palm gardens, with few hedges or fences enables gardeners to engage in everyday spontaneous conversations and emulate management practices in this way, the park conveys many practices. Gardeners tend to conserve and stick to the spatial characteristics of their gardens because it gives them opportunities to engage in conversations and bonding. In addition, this spatial shape also directly affects ecological and biological processes, such as the transport of pollen through the wind and facilitating grafting, as there is no abnormal form of plant design. Gardeners often make a special type of hedge against date palms and species that increase habitat quality for pollination. The rules in use are also seen as laws in effect in the form of habits and thrive on sharing. In assignments, there are rules of use related to social behavior, as well as those related to practices towards the ecosystem. While it seems that the rules related to dealing with the garden ecosystems in general come from the fusion of cultures and cultures transmitted by the caravans of merchants.

Palm groves are a strong source of ecological education as farmers guard the local seeds, pollinate the palms on certain dates, and teach them to their children. The cycle becomes a positive reaction as the continuous participation in these gardens reproduces these rules, through oral means, and then the ecological practices are transferred over time by the rules of use. New types of information are dynamically intertwined with social and ecological memory, and there are possibilities for merging and reintegrating them, adding effects, as well as transmitting them in time and space. Although social ecological memory somewhat dormant as described above, it is constantly shifting at the same time, not only because we forget and partially remember, but also because our forms of sharing change, our perspectives change, and we experience life in new ways. Participation with local ecosystems is constantly modified. Practitioners adapt to many different situations every day skilfully and incorporate, by observing ecological feedback, many of the small, imperceptible differences that an ever-changing context creates, and which is evident in road trees and public parks through changing ecological behaviours and tree types where thinking becomes in the landscape side. As a result, any practice must be revived and reinvented, even if it is "the same practice». Documentation and sharing act as distinct but coherent patterns, as a dual process, which over time generates a "living library" that maintains ecological practices and knowledge.

The social and ecological memory permits gardeners to move forward without needing to know everything, and helps newcomers join the community by connecting, reviving, and reinventing imperceptible practices. Based on the results, it suggested that the social and ecological memory is a flexible and evolving feature of the traditional horticultural societies in palm groves. Part of the knowledge and ecological practices included in this garden's memory seems to be the tacit knowledge that is expressed in the customs and behaviour of certain ecological states). According to Leonard and Sensiper (1998), tacit knowledge is not passive knowledge but an essential feature of group creativity. Collective tacit knowledge is developed collectively, over time, in interactions between individuals in a group, promoting informal joint use of behavioural standards and the implicit ways of working and learning together. Moreover, Leonard and Sinsper (1998) emphasize that the company's success depends not only on skills and knowledge at any given time, but also on "memories", intangible things to experience teamwork, triumphs and failures, culture, and vision. It also suggested that in urban allocations, the success of gardening lies partly in the features that carry, impart, and revitalize implicit knowledge.

Social organizations

The study examines three stages of social organization observed in a Adrar City (Figure V-6): a historical stage, for the pre-colonial phase, it relied on the work of A.G.P. Martin: Attempting to reform land based on opening to international markets; a more recent final stage toward satisfying the new domestic market caused by immigration from the north and the development of the local market economy. This information was confirmed in my dialogue with people and peasants over the age of eighty years and the personal observations of the last two phases. The first stage: the feudal period, characterized by the absence of the local market. Self-consumption and fees paid in the products constitute the distribution mechanism. The social classes are divided into 3 layers.

The dominant social class includes, in Adrar and Timmi Arab, and Chorfas, like in another Oasis with Foggara in Southwestern Algeria. They own almost all water rights and palm trees and have almost no production activity. The products that Bedouins buy and transportable are mainly dates and wheat. The public practices trade in addition to palm grove to provide daily needs. They own a small portion of water rights and palm trees. As for workers of African descent, they provide almost all employment. Two systems coexist. First, the workers who earn their rights to take 20 percent of the production, the farmer who was at that time the dominant position. Theoretically, they receive one-fifth of the products from the gardens and own neither the land nor the water.

The second stage: the reformist illusion. The agrarian reform in the Oasis is applied in two forms: Counting the lands of large owners and redistributing them to former farmers. Create new Oasis in the deep wells. It targets the international market, especially through the production of winter tomatoes. At the same time, the products of the beneficiaries of the reform, which the local company boycotted, cannot flow in the local market, considering this policy, starting with the abandonment of the traditional irrigation system work that was previously carried out by the workers. Of course, the state’s general policy towards directing the workers More to the administrative services sector, and the oasis was transformed into small cities, and with the waves of migration from the north of the country, it became populated by new arrivals: administrative and service personnel.

Stage 3: Local Market The village turns into a small town, and residents from the north of the country, civil servants, and state agents around the KSAR .form a local urban community that stimulates the market for fresh produce. Actual workers, such as the former, who came to direct production, took control of the soil and water that, in the previous phase, lost their financial and symbolic value. And the emergence of agricultural markets and neglect of the local market. Working outside the oasis leads to a gradual reorganization of the laws. The income again allows investment in maintenance of the hydraulic system. This is the era of "gardens", the production of valuable vegetables, especially locally. Palm trees, which are necessary to make a small climate, lose a large part of their economic function, as they give low-quality dates, difficult to market, to several factors first to the quality that cannot compete with the northern Oasis, especially in the national market, and therefore go to the African market, too. Oases live a great problem due to water shortages and diseases. Therefore, it is observing a profound change in the social organization of the oasis, which tends to reduce the old variations, without modifying the spatial organization of the cultivated part. The urban development of the oasis allows for social change. The new social performance, which favours gardening in the marketplace, remains an environmental fragility: the system that maintains the microclimate is at risk again because palm trees lose their economic function, are threatened. The resumption of trade across the desert.

So, oasis cultivation has changed dramatically over the past century. The acquisition and control of space and water resources, and agriculture and development strategies, have succeeded without changing the area of the oasis. When environmental constraints are very strong, the same spatial organization can therefore be invested respectively by different social systems.

Figure V-6 Social organisation in Adrar palm grove

V.5 Social ecological memory in city

It cannot state that agriculture and the agricultural community in the city are far from external influences. Most owners of the Foggara organize in associations that benefit from state support on many occasions. They are also a very important actor in municipal or even national elections, given that associations are a strong advocate for the local population and for Their farms are in exceptional conditions. Also, many young people now rely on social media to raise their concerns and communicate with each other and create Facebook pages for gardening. In addition to their reliance on online access to modern technologies and the use of modern irrigation methods, which prompted many farmers to drill wells in palm grove to develop production shares with agricultural support programs in recent years by the stat.

V.5.1.1 General aspects of social ecological memory in Adrar city

Most sociologists assert that social memory has an important role in relation to the value and identity of individuals and groups, as well as its role in promoting social cohesion between individuals in a single society. Therefore, social memory becomes a concept to explain group action within a given society. This makes us admit that the newly adopted methods of preserving the environment are considered very limited and useless to move away from the ecological habits of societies that are supposed to play a positive role in preserving the environment and seek to sustain the urban environment and are used in environmental regulation and development.Sustained flows of desirable ecosystem services depend on the resilience of social and environmental systems, indicating the ability to respond to surprise, benefit, reorganize and continue to evolve without crossing the critical threshold of alternative pathways, as the required ecosystem services are no longer produced (Carpenter and Folke , 2006)(Walker et al., 2006). According to Carpenter et al. (2001) (Clark et al., 2001) Management needs to address changing ecosystem processes and nutritious, nutrient content in soil or water, as these are of great importance in relation to thresholds. In this context, socio- social ecological memory as a carrier of practices and knowledge becomes important, as memory is also a slow-moving feature in socio-environmental systems and has the potential to carry experiences from the distant past. Perhaps the scandals that afflict agricultural drug companies are the biggest evidence of the danger that threatens the normal life of people in cities. The lack of understanding by designers and scientists of the social ecological memory that deals with a specific place and slow changing environmental processes. The lack of a good understanding of the interactions of social ecological memory and its social impact does not allow us to make good use of these data in managing the environmental situation in cities and trying to resist environmental shocks, but at the same time, it cannot consider that social ecological memory is the "panacea" for managing the ecosystem, as it has been observed in past ,the social memory can also be inappropriate to adapt to the dynamics of a local and regional ecosystem. Uncoordinated social memory can lead to intense stress, as individuals tend to engage in one of many interpretations of reality, and to the same behaviour that their peers follow in the same group. This has historically resulted in increased rigidity and clinging to non-adaptive structures and habits in response to crises, reducing the opportunity for innovative change. But horticulture has slowly evolved with the harsh natural conditions of one of the world's hardest regions of drought and heat relying on the idea that the acquisition of practices usually follows resource crises in conjunction with dynamic learning of practice societies. The social and ecological memory of gardeners, including the allocation of gardeners. Our results, however, indicate that gardeners are often unaware of the environmental significance of some of their

practices.

V.5.1.2 Relationship between memory carriers and social-ecological resilience

The basis of social ecological memory is biological diversity, at all levels, plant, and animal species in addition to insects and soil to ecosystems, their internal dynamics, and their interconnectedness with the physical geographic landscape and the ecological environment. After its common use in the ecological literature, the social ecological memory considered the most important factor in ensuring the existence of ecological diversity. At the local level, social ecological memory vectors are included in genes, plants, animal and plant breeds, and adaptation to different site conditions, as well as in societal structures, species interactions, people's habits and their familiarity with climate, disasters, and emerging conditions. Such local banks exist within the memory correction banks in the form of a heritage that the inhabitants of the Oasis are keen to ensure despite the threats to which they are exposed, i.e., the remaining structures and organizations. There are such local banks within the memory correction banks in the form of a legacy where the oasis residents are keen to ensure that despite the threats to that, i.e., the remaining structures and organizations. For example, structural legacies such as dead wood or large dead trees be part of social ecological memory. Soil banks and soil microorganisms can act as major ecological drains of memory, setting the stage and setting limits for future development.

Through our analysis of the dynamics of the temporal and spatial factor

In general, the landscape as an ecosystem and physical as a bank of reliable memory in times of turmoil, crises, and disasters, which constitutes a catalyst that supports environmental resilience. Ecological barriers and high levels of spatial variance often characterize urban landscapes .Each landscape patch is embedded with the banks of the environment and memory in the larger landscape mosaic, forming a different mixture of spots in each scene, the present and future nature and potential of the scene in question. At the spatial scale levels, memory banks can be considered as variable according to environmental parameters, their variables, and ecosystem shifts. Among them, colonization can occur after disturbance as well as the interactions of some alien species. Organisms, known as mobile link organisms, that perform their role in the ecosystem as spatial conductors of memory, either by transferring genetic material such as seeds and pollen, or by re-processes such as grazing or pollination, or by seasonal migration such as the migration of birds or animals. Aside from the active difference between regions, memory can also be spread by vectors such as wind or water. People navigate the landscape, and thus can serve as types of mobile links that help other organisms move (Barthel et al, 2013). This is intentional, for example trade with plants and animals, or unintended as in passive transport of seeds along roads.

Social ecological memory in urban areas and other agricultural lands is strongly influenced by land use practices, and a socio-environmental perspective is crucial to thinking about the continuation of this memory in the future, with associated biological diversity. Where its non-viability threatens the biological diversity of the oasis, the only guarantor of this continuation and the presence of Oasis, Himdal (2005) (Birmingham et al., 2005) shows how the formation of urban seed banks and microorganisms in the soil is often partially shaped by human practices. More broadly in urban land coordination, humans have designed land-use institutions such as housing, transportation, food production, and entertainment. This decision-making has sometimes inadvertently resulted in ecological corridors and migration routes, such as dams, canals, boulevards, green roofs and landscapes, and land use mosaic landscapes are often rebuilt (such as Foreman, 1995) (Foreman, 1995) and thus this mosaic remains the primary factor the biological diversity inherited from generations. On a larger scale, humans have used and influenced local genetic material in various ways and systems (Figure V 8-9). In gardening, for example, farmers keep the best seeds from harvest to plant for the next crop and sometimes they buy seeds from their neighbours who have had a good harvest and thus work to improve the most compatible seeds and environmental data. This practice is evolving

It is widely used in ecosystems, where species function as crop varieties that are adapted to the local environment, and which act as memory carriers that transfer knowledge to future generations of farmers. With palm groves or even gardens, the practices of many gardeners are part of the selective matter of semi-wild species. In short, social ecological memory can be supported, supplemented, or even replaced to some extent by human practices.

Figure V-8 Local cereal

Figure V-7 Local date

V.5.1.3 Social ecological memory carriers' effects:

Social memory (see Table V 1) guide human practices, and are defined as repositories and messengers of experience, knowledge, and meaning(Barthel et al., 2015). Within the social sciences, discourse of social (or collective) memory recently became a framed lens for research. This line of thinking is associated with group reminders and forgetfulness with various characteristics that help preserve and transfer experiences and meaning within specific historical and ecological contexts (Barthel et al., 2010(Parfitt et al., 2010); Crumley, 2000(Barthel & Isendahl, 2013); Folke et al., 2003; Macintosh et al., 2000(McIntosh, 2013); Nasiriyah, 2006) .). It is something clear in the desert Oasis, where the agricultural side of the oasis represents a large part of social customs and traditions, daily life, and sometimes even spiritual beliefs.

Societies ensure the transfer of ecological knowledge in several ways throughout history and in completely different cultures. Songs, sayings, and poems are passed on from generation to generation. Visible signs and other memories are included in landscapes, monuments, and objects. The embodiment of daily practice is taught through many cultural phenomena such as celebrations, dance events or rhythm of work. Administrative practices and related customs implicitly passed, embodied and non-textual. The concept of social memories highlights that the rules used to guide ecosystem management carry different forms of captured experiences that bring the past to the present. Physical memory carriers include scripts, tools, and effects. These bring social meanings and shared stories from the past to the present. Tools often require embodied knowledge of how to use them and are often conveyed by simulating the model of others. The (Figure V 11)   show how to transfer ecological knowledge to children and connect them to life in the palm oasis

Figure V-9 Children work in Palme grove.

The meaning moves seamlessly between individuals, and the time error between personal learning and environmental timelines is at least less. Memory carriers can be counted on for example to allow newcomers or children, even those with no prior ecological knowledge, to engage in environmentally beneficial practices immediately by following the leadership of others. However, social memory vectors may also become unable to adapt to local environmental dynamics. Economic and political signals also form social transport companies, and over time they become completely dominant of signs from the changing local environment. Nowadays for rapid change and easy access to "knowledge", some social information networks and some types of ideologies often become dominant in highly politicized situations. This often separates supervision practices from social and ecological dynamics on site and the emergence of nutrition. Social memory carriers

In the ancient cities, it can find dynamic cultural scenes with long continuity. as in other cultural landscapes, social and environmental spatial and temporal memory vectors have evolved together and are still interconnected. For example, the palm groves in the African desert provided important resilience before climate changes and preserved the ecosystem. The types of palm trees and plants suitable for the desert environment are part of the continuity in this social ecological system.

Through our study and for a systematic inventory, the social ecological memory is divided into three parts (Figure V 11).

1. Participation: composite by two-part ritual/habits and oral communication
2. Reification: composite by of rules in use/metaphors and forms of physics/artifacts
3. External resources: such as artifacts, laws, and social networks

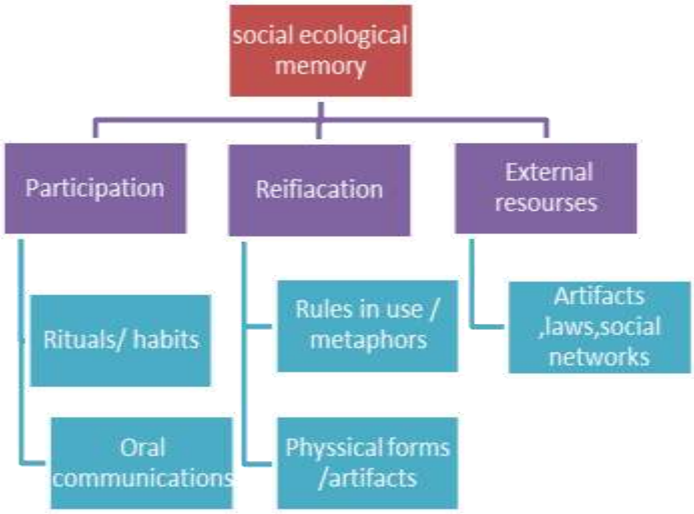


Figure V-10 social ecological memory component

The table V 1 shows these components in the Ksar and palm grove.

Table V-1 Defining component of socio-ecological memory In the Ksar and palm grove

Participation		**Reification**		**External sources**
Rituals/habits	**Oral communications**	**Rules-in-use/metaphors**	**Physical forms/artifacts**	**Artifacts, laws, social networks**
Management of the ksar, Djamaa A local council to run the KSAR assembly is when it is necessary to meet Childhood experience of imitating adults Parties   Gardening  Mimicking practices of neighbours Exchange of seeds and plants   TEBOUAGH Drying wheat ears	Conversations with relatives and Active teaching of less experienced neighbours  Daily small talk in the garden  Thea breaks Negotiations Dialogues Listening to people with experience  Board meetings (internal)	**Choice of traditional plants**  **Proportion of vegetables and dates**  **Exclusion of pesticides** **Use of Organic soil fertilization**  Phrases/sayings dance of agricultures 	**Architecture**  **Distribution of water** **Pool**  **Form and dimension of**  **garden** **Animal space**	**Social networks of individuals**  **Folklore**  

TOUBER The tillage season

Sense of place

Instruments/measuring

Register Document of water distrebution

Documented meetings

Social meeting

V.5.2 Relationship between the agriculture and land use in Adrar city

Example of Adrar square (la place and the party (Tomato)

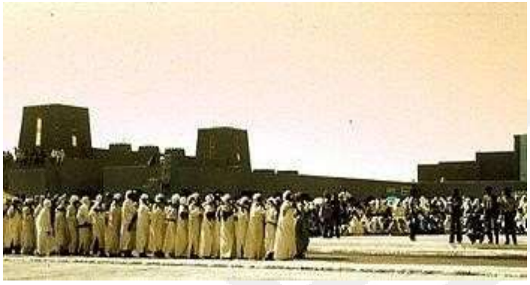
Among the squares that represent the memory of a city and society during the 20th and 21st centuries, the square (La Perinne) is currently the Martyrs Square, overlooking the four doors, the door of Regan - the door of Bechar - the door of Boubernouss - the door of Timimoun was mistaken by French colonialism since 1900 AD surrounded by service and military landmarks including:

(server) Tower 1900 then 1928, what is known today as the Banking Complex and the Directorate of Education.

- DJAMILA (1932) hotel today known as the Touat Hotel. The local market 1928 are known today as the Martyr Market (dinars) and The Girls 'School 1929 then 1930 then 1931 the House of Culture now. In 1962, this square witnessed the joy of independence, the cheering of the masses, long live Algeria, the mujahideen parade, the joy of women and children, and the dance of the people of gunpowder in the form of (Our Flags Star and Crescent). In 1971, the first celebration of (Tomato Festival) (Figure V 15) witnessed a tomato party, according to a decision issued by the head of the department of the turn of the deceased (Muhammad al-Nasir Makrani), which was affiliated with the mandate of Al-Saoura Bechar. In the form of (red tomato, you left me without mind the truck is calling, and I do not know)

Adrar place Map situation

Festival in ADRAR square colonial period 1932



Festival ADRAR square independence period 1982

Festival in ADRAR square Recent period

Figure V-11Tomato festival events in Adrar square on different years

Among the results of this festivity:

1 - Leaving the city from its isolation 2 - Keep up with the farmers of the region, who have been in the field of production, marketing, and export abroad. 3 - The abundance of goods and goods thanks to (la foire) which enabled people to own their goods 4 - Trade in barter with Mali and Niger revived 5 - Folklore, especially gunpowder, has revived and became (the parade) is an important annual event that reflected positively on the teams financially and morally 6 - dusted the heritage of the region, especially the manuscripts, the Foggara and local production 7 - School activities were revived through competitions and the creativity of students and exhibitions 8 - in which national and foreign teams played in a special football event.

The social and ecological memory in the study was determined from retaining practices, knowledge and experiences and transferring them to the management of ecosystem services in the palm groves in the Adrar oasis. At this point the study adopted the Bartˡal method (Barthel et al., 2010).

Lost of green spaces impacts

The urban fabric in the colonial period is analyzed by comparing an aerial photograph 2003 to 2019(Figure V-12). Where it noted with the red colors gardens that have disappeared and that for several reasons, whether the need for the property or counterparts to convert the green space to another service system such as trade or services due to the demand for real estate in this fabric as a center of the city also the absence of public services in new urban expansions makes the need for these spaces The green in the city center is large, which is a danger to its existence.

Aerial photograph Adrar colonial urban pattern 2003

Aerial photograph Adrar colonial urban pattern 2019

Figure V-12 Disparities of urban garden in center of Adrar city

Agriculture social value

The following map figure V-14 elaborate by (Dechaicha et al., 2021) also shows the apparent decrease of green space in the city. For conservative society, the agricultural space is considered one of the most important factors that affect the social aspect, also in the Touat region have the agricultural year, the terminology related to agriculture in relation to the days, means, and works used. Through my talk with a group of owners of palm grove and observation, the palm grove, and the water of the Foggara is the sacred legacy. Owning water and palms considered as a symbol of social superiority. As for the buildings inside the palm grove, they are considered not important in raison to humidity and building system but in general are part of the traditional architecture. Also, the interest in animal husbandry has prompted many young people, especially

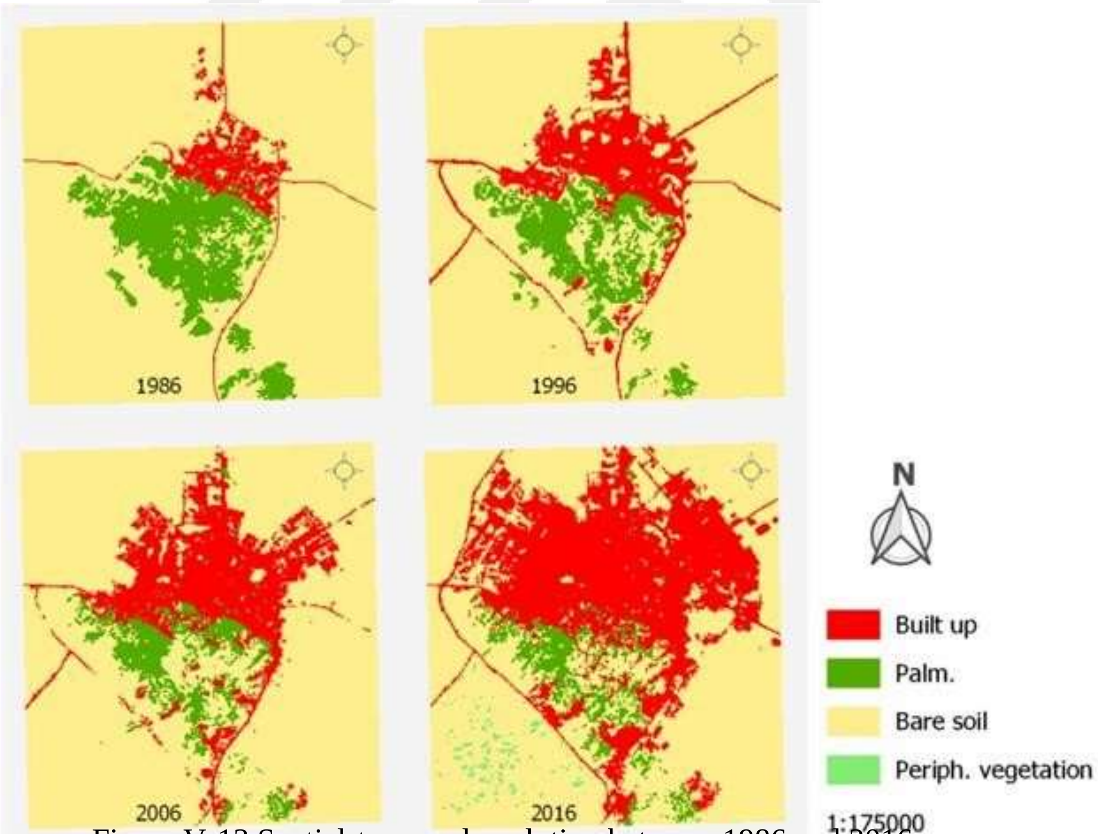


Figure V-13 Spatial-temporal evolution between 1986 and 2016

(Dechaicha et al., 2021)

those who raise horses, to rely on working in palm grove in their spare time to provide food for the horses (Figure V 15).

Figure V-14 Young people in palm grove in the left, Horses in tomato festival in right

V.5.2.1 Memory loss problems in urban patterns

The loss of the ecological memory of ecosystem is considered a major threat that menace the continuation of the ecosystem and separates it directly from the society that is supposed to work on its continuation and thus deprives the community of ecosystem services. The restoration of ecosystems and the design of urban green infrastructure is often rooted in the values it possesses the public. In cases where all social memory carriers related to the local environment disappear, or when they are intentionally suppressed, these projects run the risk of relying on a “separate social memory” not associated with local ecological social memory. In such a case, the carriers of social, spatial and temporal memory, but separation from social ecological memory make it a problem rather than a benefit (see the table V-2 for example, in desert cities such as the state of the study, which is the city in Adrar, the continuous scarcity of water formed as a result of the abandonment of the indigenous population on the work of Oasis and palm grove, which directly affected the irrigation system (Figure V 16) and maintenance work.

Which consequently, stopped the flow of water in the oasis, and affecting to the ecosystem services . The presence of green spaces in urban fabric have big consumption of resources and also impact to Foggara system performance.

Figure V-15 Foggara abandoned.

Today the challenge is to preserve and renew ecological social memory facing to new lifestyle, In the case of Adrar city, the oasis and the irrigation system that was established through the practices of human habitation over the centuries. fertilizer and waste have been used to fertilize fields, raise animals of local breeds, and ensure regional interaction by selling poultry products and meeting daily needs. However, because of the development of the lifestyle, this memory has not been able to maintain its continuity. The irrigation system needs a lot of effort in maintenance in addition to the small area of the oasis, which does not meet the needs of the population from production and the transformation of the indigenous population to live in the urban environment, directly affecting the continuation of the ecological memory.

The table (Table V 3) shows us the carriers of social ecological memory in the Ksar. Which it divided according to the components of social ecological memory vertically, and it explained through the table the role of memory carriers and their type, whether temporal or spatial, and the ecological impact and result of it.

V.5.2.1.1 Memory vaccination

The agricultural areas near the city of Adrar considered as urban environmental area, offer some ideas on how to vaccinate social memory vectors in new contexts. In addition to some green areas, different types of collectively managed urban gardens have similar ecological characteristics despite the socio-economic differences of the population. While, for example, local palm groves tend to maintain high levels of agricultural biodiversity and social memory, they begin to build a new social ecological memory. This is something that transcends knowledge, as farmers in modern farms bring different types of plants. It has noticed in the city a collection of trees, most of them are from Asia.

Table V-2Social memory carriers' analysis

Social memory carriers	**Role**	**Type of Carrier**	**Ecological outcome**
Repositories of experiences and ecological knowledge	What is the importance for transmitting experiential knowledge and meaning	Mainly temporal or mainly spatial in character	Social memory in support of diversity, continuity, and connectivity
Habits/routines imitation of practices exchange of seeds, tools, and other artefacts repeated collective gatherings ceremonies 	The transfer of embedded skills and customs embodied is often expressed as empirical knowledge (on-site) and through individual experiences such as exposure to diseases or other problems. 	Temporal: Social practices that brings past experiences into the 'present' 	It can enhance local gene pools through reproductive / exchange programs, crop rotation, improvement of semi-wild and other habitats and conservation of good local species. 
Oral tradition dialogues mentor programs daily talk / songs / dances 	Meaning transfer: Through communication, farmers express a set of experiences, problems they experience, and how to summarize or present concern 	Temporal: Social practices that carry meanings between people and across timescales 	Creating and sustaining the cultural value of main stone species, universal species, longlived organisms and slowly changing variables 

Rules-in-use written down regulation's norms of social conduct norms towards the environment property rights religion practices 	organizational behaviour: In the traditional urban environment, and during many years, the group of individual or group practices became subject to custom in addition to the religious side and then the statutory laws come. As for contracts and water distribution, there is one person who enjoys the confidence of the entire population and is the one who solves all disputes 	Temporal: Social structures that enable and constrain human behaviour. Such tend to outlive the social practises that created them and brings past experiences into the present by shaping current behaviour.	Protect and regulate fragile ecosystem features, and long-term commitments to maintain original environmental practices
Physical forms/artefacts monuments landscape features tools / art /  literature	Artefacts: Oasis is the place of production of many things and tools for use in agricultural work or daily life, and these things constitute a large part of social identity 	Temporal and spatial: Bio-physical objects and other 'things' that structure human movement in space, and brings past meanings and experiences into the present 	Creating and perpetuating cultural value for key-stone species, umbrella species, long-lived organisms, and slowly changing variables, adding time markers and reference frames
External memory sources science media internet external social networks in broader governance 	Transfer of knowledge and cooperation between specialists: Despite the commitment of most farmers in traditional palm grove to traditional farming systems, they always try to obtain modern knowledge due to the new diseases and problems that agriculture may experience. 	Temporal and spatial Enabling access to information and generalizable data on previous social and environmental dynamics as part of the collective memory necessary for the continuation of ecological knowledge 	Allows for dissemination of knowledge and sharing of experiences that may help in the initial phase of building up new 'hybrid social memory' 

V.6 Software Application evaluation

Why study social ecological memory?

The human being is an important part of the ecosystem, and preserving the ecological memory is one of the important sustainability factors that enable us to achieve the goals of sustainability. The main objective of the analysis of the ecological memory is not to restore the same old customs and practices to the future city, but rather to preserve the principles of sustainability in the new ecological urban model that the study wants to achieve in the cities of the African Sahara. Also, societies that suffer from ecological illiteracy find great difficulty in achieving the goals of sustainable development and the ecological city.

Why we use software Application analyse in analyse of EM?

One of the objectives of the software application is to define clear indicators through which we can know the status of preserving the ecological memory. The software application enables us to assist decision-makers in taking the correct measures to preserve the ecological memory and to know the discrepancies between the level of memory preservation at the level of all parts of the city.

Definition of indicators of ecological memory in city

Through our study and analysis of the ecological memory, it can determine 22 indicators of social ecological memory in addition to the indicators of the ecological factors in the original settlement in the following graph.

These indicators are the result of the components of social ecological memory and the result of urban ecological factors in the urban pattern in the desert.

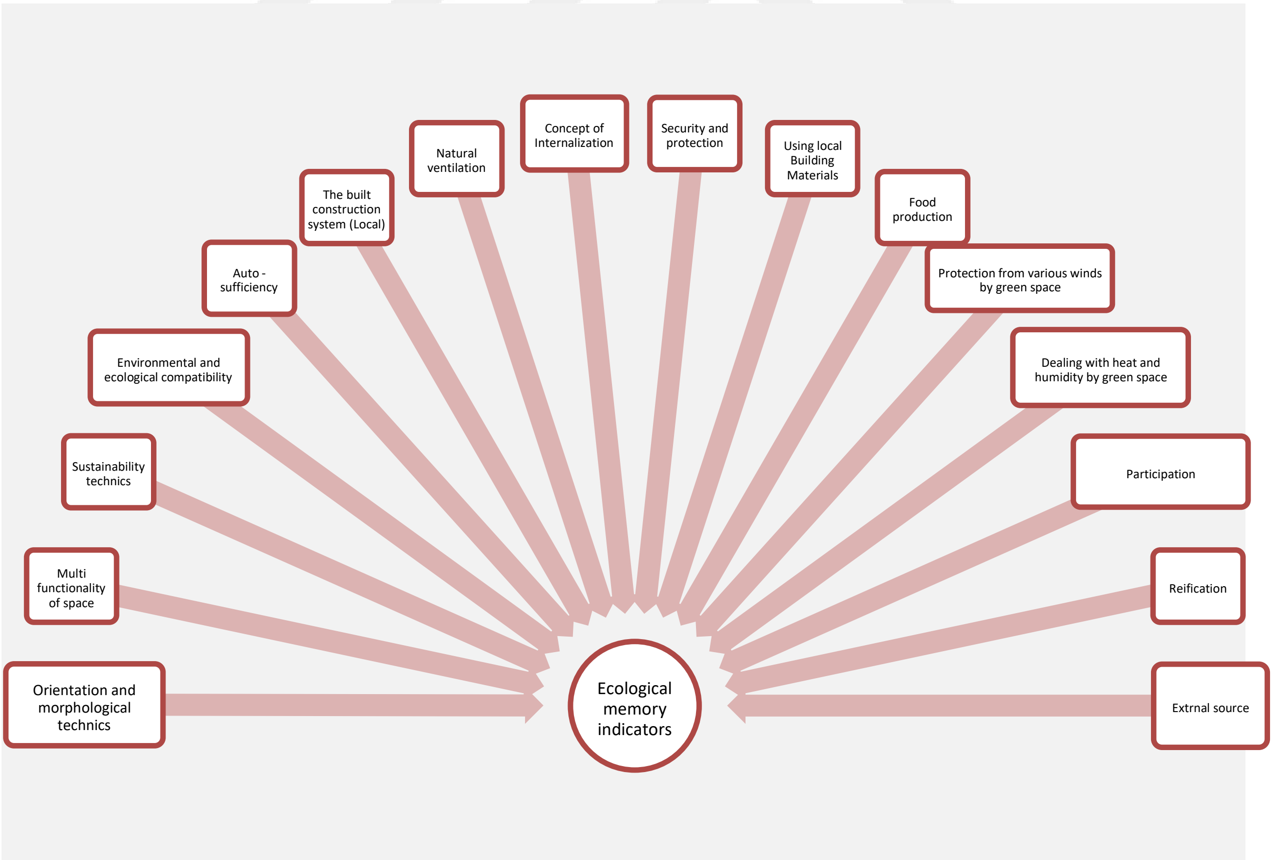


Figure V-16 Socio-ecological memory indicators

Analysis of social ecological memory in Adrar city with software application.

Social ecological memory is a relatively new concept and is characterized by a great interest in studying the structure and function of the ecosystem in addition to maintaining the generation of ecosystem services in times of crisis and change, and it concluded that decision-makers and urban supervisors can face further degradation of ecosystem services.

But the biggest obstacle for decision makers or urban designers is how we can evaluate and preserve the social ecological memory, which is a key factor in achieving sustainability goals.

The software application, aim to define clear indicators through the study to assess the level of performance of the social ecological memory in addition to knowing the abuses between the indicators.

The homogeneity of the indicators gives a clear indication of preserving memory. It noticed through the results of the application the excess in the level of indicators in every part of the city, which results in real forms that impede the achievement of sustainable goals.

It also noted how the level of preservation of the social ecological memory in the original settlement was at an acceptable level. But it observes the opposite in the colonial urban fabric and the social urban fabric.

These data give us a clear vision about the urban politics through the various evolution stages in the city.

Regarding the emigrant’s neighborhood, there is a clear problem about the disparities in the level of indicators. Here it can say that neglecting of the social ecological memory in a part of the city make it exposed to ecological practices strange to the city, and this is itself is a problem that reduces the urban resilience of the city.

Analysis of software application results

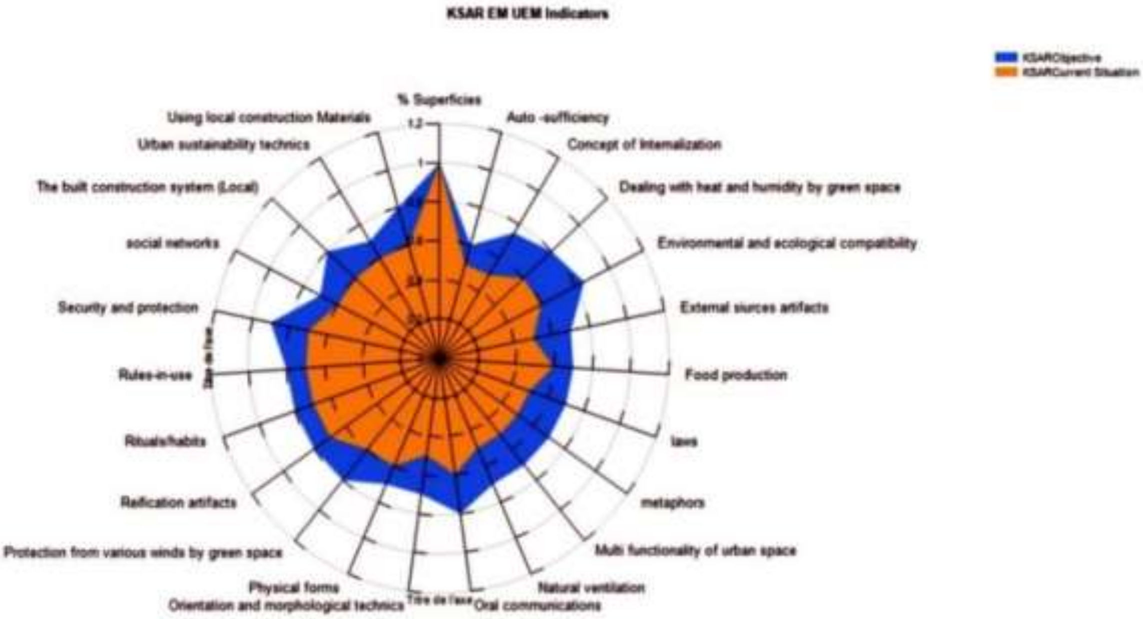


Figure V-17 Analysis of SEM indicators in Ksar

It observed in the results of the graph of the software application for the indicators of social ecological memory and urban ecological memory is that these indicators give us a clear vision of their status in the oasis KSAR, in addition to their homogeneity, although they need to be better developed in order to reach the desired goals, which proves the good ecological performance for this urban pattern in desert ecosystem and the possibility of reliance on it

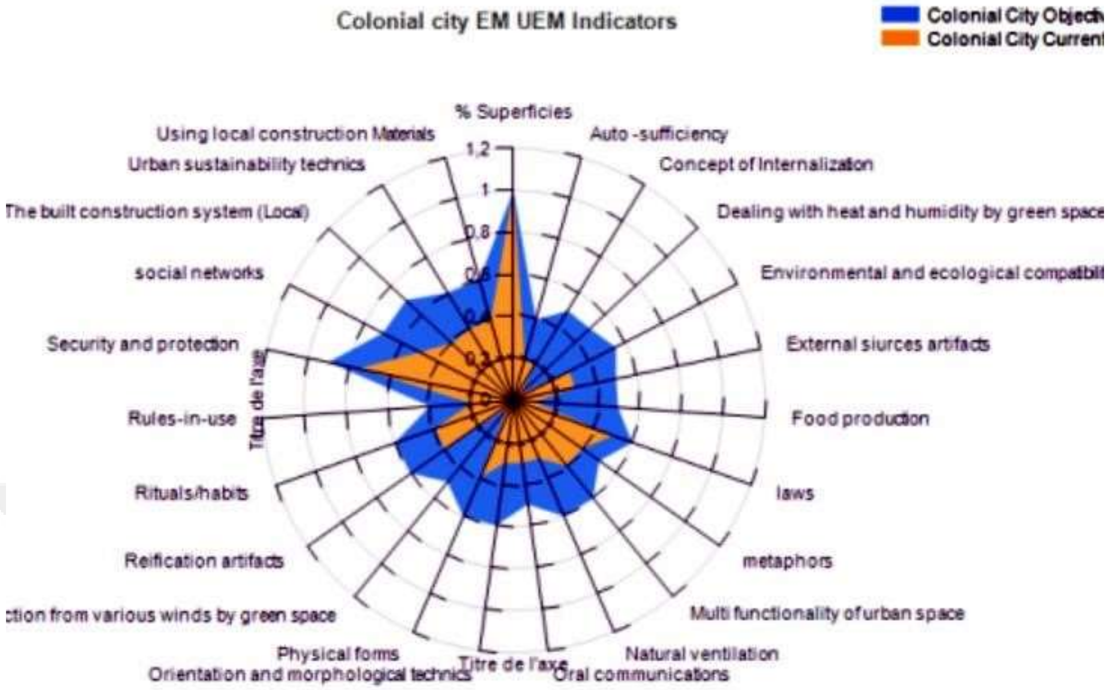


Figure V-18 Analysis of SEM indicators in Colonial urban pattern

Is observed also in the results of the graph of the application of the software for the indicators of social ecological memory and urban ecological memory is that these indicators give us a clear perception about their position in the colonial urban pattern in the city of Adrar, in addition to its heterogeneity and weakness compared to the traditional pattern, which shows the deterioration of the traditional urban pattern from the beginning of the stage. Colonialism, despite preserving some traditional factors in architecture, but it was not enough.

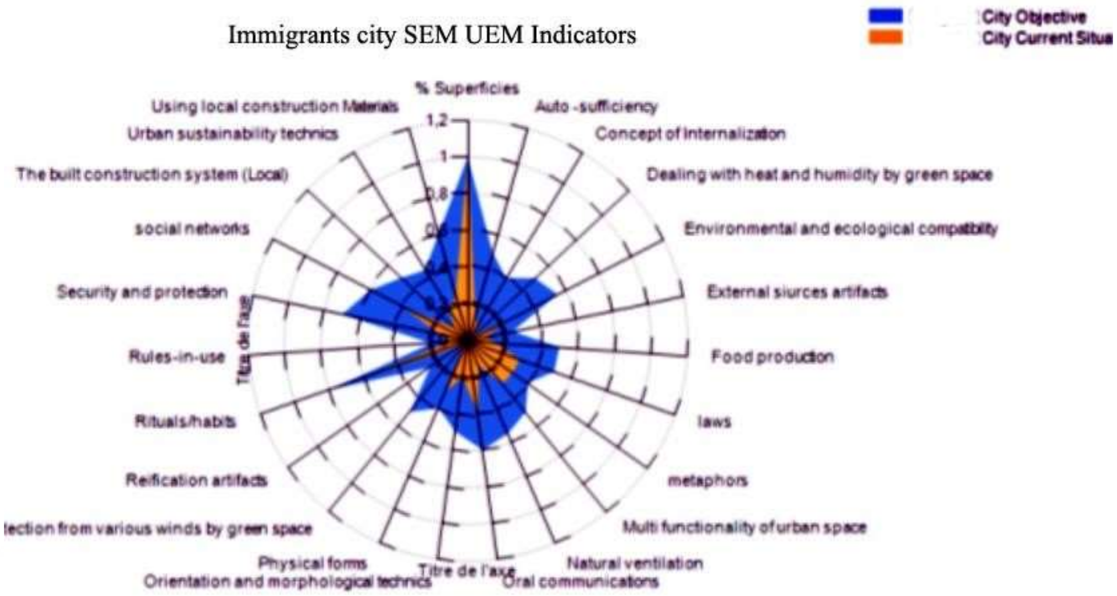


Figure V-19 Analysis of SEM indicators in emigrant urban pattern

It observed in the results of the graph of the application of the software for the indicators of social ecological memory and urban ecological memory is that these indicators give us a clear perception about their status in the urban pattern of the immigrant neighborhood in the city of Adrar in addition to their heterogeneity and weakness compared to the traditional pattern and the colonial urban pattern. Where this neighborhood constitutes an obsession for decision-makers due to the deterioration of the standard of living in it, poverty, and diseases**.**

It observed in the results of the graph of the application of the software for the indicators of social ecological memory and urban ecological memory is that these indicators give us a clear perception about their status in the social urban pattern in the city of Adrar, in addition to their heterogeneity and weakness compared to the traditional and colonial urban pattern. Despite the high cost of this method, it is ecologically bad and energy consuming in addition to social and economic problems.

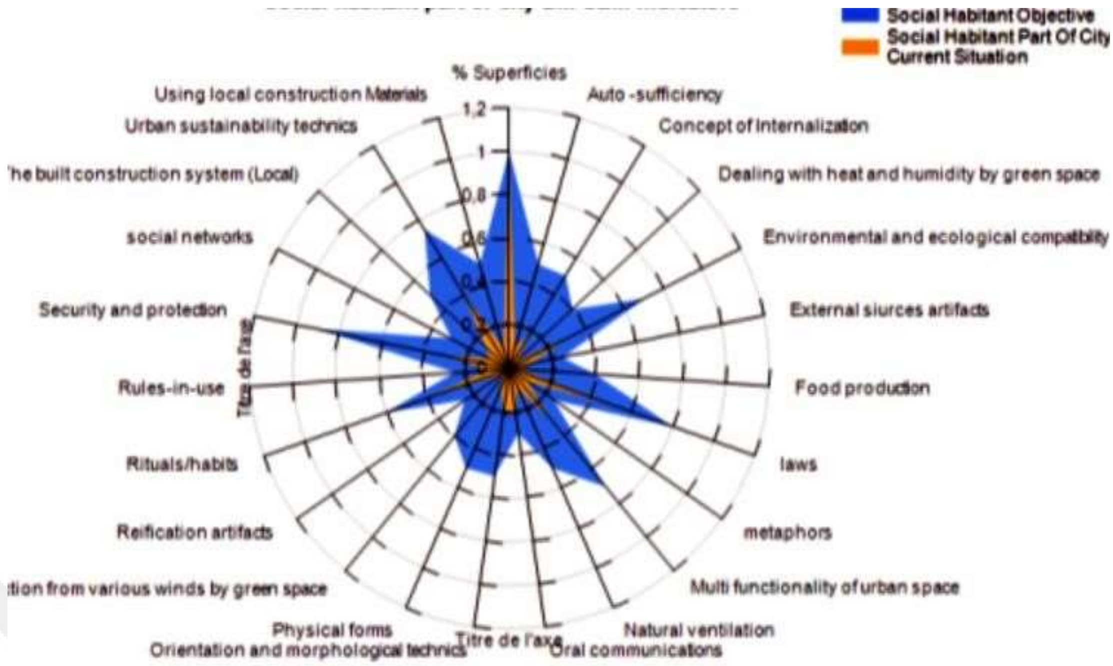


Figure V-20 Analysis of SEM indicators in social urban pattern

V.7 Conclusion

The African desert is the poorest place in resource on earth, the man of this part of the world achieved a self-sufficiency; and guaranty the continuity of social life for many centuries. Through our study, it noticed that whether palm Oasis or home gardens in desert cities is the hard disk that protects the collective and individual social ecological memory of society, these spaces are considered the living library of knowledge and social ecological memory and the main preservation not only for nonmaterial things, but even for the preservation of species of plants and seeds Soil quality. In addition to ecosystem services and rules for organizing urban landscapes.

In this chapter, the study shed light on the social and social ecological memory of palm groves in Adrar Ksours in Algeria, and it showed their great impact on the ability to manage ecosystem services in the past, but now they suffer despite that being linked to the social ecological memory of society, making them continue to perform them.

The study discussed where and how environmental practices and knowledge are preserved and transmitted by traditional societies that are in themselves considered a goal for developing environmental performance, and associated resettlement processes that result in artifacts, rules of use, and garden structures themselves.

Based on results, the study suggests trying to reintegrate palm groves and exploit environmental social memory in urban landscapes and contribute to generating ecosystem services and combating environmental illiteracy.

Without forgetting such physical sites, it follows that forgetfulness and social ecological memory. The concept of social ecological memory is relatively new in the world but has never been discussed in the field of urban planning in African cities. Through our research, the study tries to clarify the concepts of social ecological memory and make them simpler and evaluable, which helps decision-makers and urban designers to better understand their impacts on ecosystem services and their effects in achieving sustainability goals using technological technics through the software application.

VI. DEFINING SPATIAL PATTERNS AND GREEN INFRASTRUCTURE ELEMENTS

Urban phenomenon is primarily responsible for energy consumption and is considered responsible for gas emissions and environmental pollution , (Carter et al., 2015) Cities are a major cause of climate change taking place in the world, as its impact on city life has become clear. Which is increases the risks of climate change. In the same time cities ’need for infrastructure, the increase in the demand for buildings also the consumption of agricultural lands, as well need for industrial agriculture, all of these factors contribute directly to weakening the ecosystem.

Green infrastructure (GI), a concept that emerged in the 1990s(Firehock, 2010), is considered as a promising approach to address these challenges. Urban Green Infrastructure (UGI) planning is a strategic approach (Rall et al., 2019) UGI's strategy is an integrated approach that works towards finding solutions to environmental challenges in urban areas through multifunctional planning."such as **conserving biodiversity**, **adapting to climate change**, supporting the **green economy,** and improving **social cohesion** (Pauleit et al., 2017).

Studies have shown that a good understanding of the benefits that nature provides, in contrast to the exclusive use of expensive and limited-performance grey infrastructure, makes the use of UGI's strategy the ideal solution for economic, social and environmental sustainability in an urban environment. in the same time the grey infrastructure within cities remain important and necessary at the same time through the economic and social benefits it provides, but enhancing it with solutions provided by nature enhances the ability to provide many benefits.

Researchers have focused on studying and understanding the UGI strategy in major cities in the north of the globe in an unbalanced way, although many medium and small cities in the South of the globe suffer from many environmental problems resulting from climate change, which is what makes us need a green infrastructure in These cities.« There is a marginal form of works on the character and nature of urban sprawl in Sub-Saharan Africa (SSA), although the region is experiencing one of the fastest rates of sprawl"(Yiran et al., 2020).

VI.1 Definition of UGI principal and indicators

The analysis of green infrastructure principles, relied on previous academic studies of many scientists that are widely dealt with in many countries and that is through the source (Davies & Lafortezza, 2017). For high-performance urban GI analysis and successful planning and implementation capable of generating multiple benefits, it is essential to rely on a set of principles. Despite differences in the literature, the presented principles are commonly presented. Four of the principles presented relate to the planning content, while the other three principles refer to the planning process.

Principles of Planning Content

1. **Network/connectivity**: Urban GI planning aims for added values derived from linking green spaces functionally and physically.
2. **Multifunctionality**: It represents the ability of urban green infrastructure to provide many environmental, social, cultural, and economic benefits simultaneously.
3. **Gray-green integration**: Green urban green infrastructure is considered as a type of infrastructure and seeks to integrate and coordinate urban green with other urban infrastructures in terms of physical and functional relationships.
4. **Multiscale:** Urban green infrastructure planning can be considered for different spatial levels, ranging from city areas to local projects. The geographic planning of urban cities aims to link different spatial scales within and above urban areas.

Principles of the planning process are:

1.Strategic: Urban GI planning is based on long-term spatial visions supplemented by actions and means for implementation, but it remains flexible over time.

2.Interdisciplinary and transdisciplinary: Urban GI planning aims at linkages between disciplines, as well as between science, policy, and practice. It integrates knowledge and demands from different disciplines such as landscape ecology, urban and regional planning, and landscape architecture, and it is developed in partnership with different local authorities and stakeholders.

3.Socially inclusive: Urban GI planning aims for collaborative, socially inclusive processes. In the following discussion, four of these principles will be explored at the heart of urban geo-geographical planning.

As can be seen from the analysis of Adrar's infrastructure, these four principles contribute in various ways to addressing the major policy challenges previously presented.

VI.2 The context of UGI in African Sahara region

Urban systems are very complex and consist of a set of interactions between systems, such as physical parameters, terrain, transportation systems, commerce, and human social systems. All these interactions are in line with the latest ideas about green urban infrastructure (GI) and the associated ecosystem 'services'.

In the Africa Saharan in general and Southern Algeria in particular, green spaces are very few in the various urban patterns, despite the presence of palm Oasis in the traditional urban pattern. The achievement of green spaces is considered one of the most important demands of the population in the light of development of many theories on reconstruction. But this goal remains elusive, considering many failed experiments and many obstacles to establishing a green infrastructure that contributes to ecosystem services and achieving social, environmental, and green economy goals for these very poor and resource-poor areas.

On the other hand, with the past experiences it has been proven that especially in traditional settlements planning with green infrastructure might directly contributes to social relations and achieving the environmental and economic goals of the community. From this point of view, it is obvious that the real problem is embedded in current urban planning approach which must be reconsidered with the purpose of providing urban resilience for the desert cities that on the edge of climate change. Despite the development of thinking in finding new concepts for urban planning and green infrastructure, the cities of the sub-Saharan Africa live under the reality of failures in urban planning systems. These failures are attributed to the tendency to exist planning systems either as tools inherited from the colonial era or imported models and frameworks inappropriate for the emerging realities of urban Africa (Mitsch et al., 2013; UN-Habitat, 2014).

Through this chapter, the study will try to define in first step urban green infrastructure in Adrar city and their relationship with the urban system observed disparities in access to some services, the differences, diversity, and specificity.

Although there are commonalities among the green services that are provided in different cities around the world, in the context of Africa urban planning there are some exceptions, for instance Oasis as a pattern of urban agriculture are a de facto lifeline for the people beyond providing ecosystem services. In traditional agro towns of Africa, the existing social living system has been supporting green economy for its residents in its nature. These unique systems of ancient African settlements suffer from the threats of urban life changes and the deterioration of the irrigation system, which also threatens the social cohesion and economic life of the local population. The composition and extent of the urban green infrastructures themselves also affect the urban ecosystem services that are provided. Many cities in the African desert still have Oasis, natural ecosystems and indigenous flora and fauna which dependent to the ancient local system. Although it is partially degraded, these Oasis settlements play an important role in food production and supporting ecological equilibrium. But despite the acceptable performance of the original settlements in these areas for past ages, they are today more fragile and lost their resilience capability.

The Typologies of GI elements in Traditional African Desert Settlements

"Cities—As economic dynamos and increasingly important population concentrations, cities both contribute substantially, and often are very vulnerable to the impacts of (GEC)[9].. This applies strongly in Africa, one of the world's poorest regions (Simon, 2010)".

The Oasis in the Algerian desert effectively show how people managed to live in harsh conditions. Over the centuries, an effective and sustainable irrigation system has been implemented enabling Oasis residents to live even in extremely dry conditions while respecting the special characteristics of these unstable ecosystems. However, during the beginning of the last century, the desert Oasis witnessed the effects of colonial campaigns which changed the patterns of urbanization and were also followed by the stages of post-colonial planning. Furthermore, the stages of the crises of the civil wars and waves of migration because of famine or wars in sub-Saharan regions, as well as strong demographic growth along with intensive agricultural production, all of which had negative effects on these settlements." People working in the field of vernacular architecture located in arid zones acknowledge that these settlements have developed urban patterns and architectural morphologies well adapted to the extreme physical environment."(Daoudi et al., 2019).

[9] *GEC: Global Environmental Change*

Figure VI-1 Adrar Foggara irrigation systems

In the oasis, architectural concepts are more rational in terms of exploiting space and environmental data available such as light, wind and building materials available locally .The need for water for the creation of life, was the most important factor of man to invent the traditional irrigation systems, through which they establish palm grove for providing food and security by construction of KSAR. The important characteristic In

Saharan Oasis there are no water source but have the technic of draining tunnels (foggara) that collect the water preserved by the sand or in the rocky cavities of the subsoil through an immense network that functions as a condenser (Figure VI 1). There are thousands and thousands of kilometres of tunnels that are found under all the deserts and that communicate with each other, bringing to the surface a water that has condensed, perhaps, in a very distant place. In this arid desert, palm Oasis are a clear example of green infrastructure at various levels, regionally, within cities, and at the level of neighbourhoods. The Oasis settlements form in a chain connecting the north of the continent to its South along with historical trade routes, which is created a sustainable civilization that has resisted all shocks for hundreds of years (Figure VI 2.). And it has developed a special civilized pattern, in which sustainability, social relationship and economic activity constitute its most important axes.

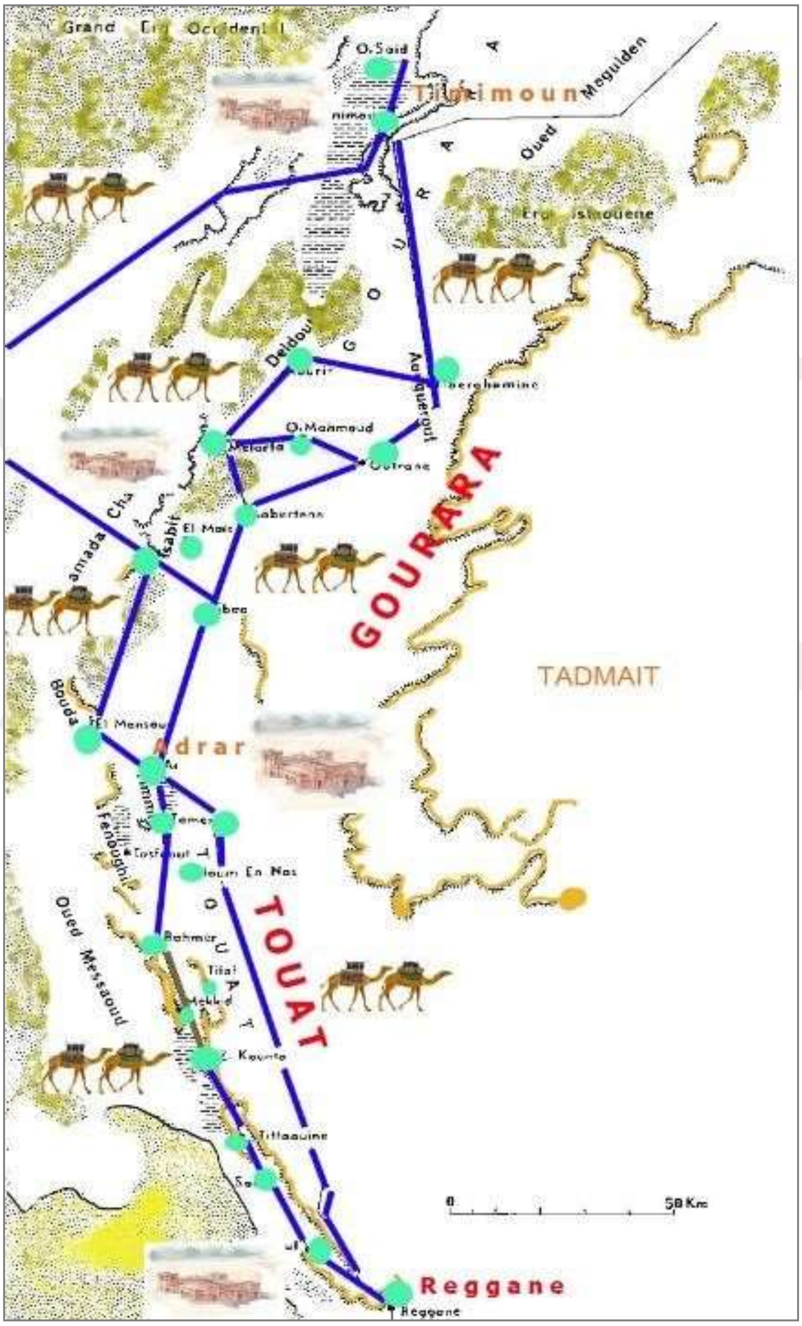


Figure VI-2Village structure of Touat territory

Palm Oasis, green spaces, water sources, irrigation systems, road trees, school grounds, public facilities, and even grey infrastructure in and around African cities have many benefits for their residents. Without this “green infrastructure" in the future these cities would be tougher than they are, more vulnerable to sandstorms, hotter, more disturbing, less producing food, and less useful for life, work, and investment.

It remarked the availability of some infrastructure components, such as green spaces, road trees, and rainwater streams. However, the lack of a clear and comprehensive strategy often causes poor performance of these services and the associated benefits (Figure VI 3).

VI.2.1 Defining of UGI in Adrar city

Figure VI-3 Private Garden in social habitation

The Adrar Oasis area is made up of one of the largest palm groves in the region; there were more than 250,000 feet at the beginning of the century occupying an area of 1,200 ha. From its inception until the 1970s, the indigenous inhabitants lived in Casbahs within the palm Oasis. Thus, it observed the presence of tens of Casbahs scattered in the palm grove; namely Berabaa, Adghagh, Ougdim. Ouled Ouchen, Ouled Oungal and Ouled Ali, dependent on Adrar, and those of Ouled Brahim, Ouled Ahmed, Ouled Aroussa, Ouled Aissa, Baabdellah and Boukane attached to the commune of Timmi. The foggaras of Adrar, like the other municipalities, have experienced very advanced states of degradation in recent years, this degradation is due to hydrogeological (lowering the piezometric level) and human factors (lack of maintenance and rehabilitation). The agricultural space which is very important to the town of Adrar characterized by its irrigation system by foggaras, is experiencing a situation of great crisis threatening its survival.

1. The scarcity and aging of the agricultural workers,
2. The fragmentation of farms following partitioning,
3. Irrigation system less efficient since the creation of wells,
4. soils exhausted by centuries of cultivation without fertilizers and progressively mined by salts and the sands.

These factors explain the abandonment of many gardens.

1. On the opposite side, modern farming is widespread in the region and has the following characteristics.
2. Modern farms consume tens of hectares.
3. Using large amounts of water. This affected the groundwater level, which led to the failure of traditional irrigation systems.
4. The farm is managed as a business using modern technologies and low job creation.
5. Modern farms are not interested in local knowledge and marginalize a large mass of local farmers.
6. The new farms, far from inhabited areas, do not contribute to the social cohesion of farmers.

The development of agriculture is certainly desirable, but its scale remains to be determined, in the form of land exploitation and regulation, in its incorporation into the

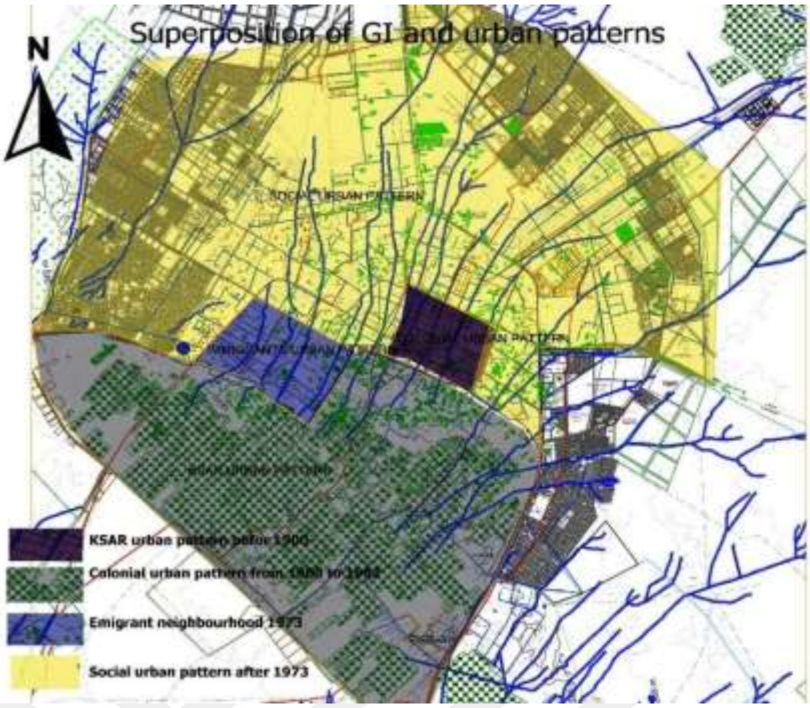


Figure VI-4Superposition of GI and urban land use (Large-scale map in the appendix) (A-5)

socio-economic realities of the environment and in its adaptation to local peculiarities and constraints. Desert cities are distinguished by the peculiarity of their urban space in the dual space that they constitute, the city and the Oasis. These two entities that now give each other functional back will have to merge to give the "Oasis city" that could form the nucleus of the eco-city in the Sahara of Africa (Figure VI 4).

The principal UGI elements in Adrar city are:

1- Palm grove and agriculture area

2- Parks and recreational spaces,

3- Institutional green spaces,

4- Foggaras as blue spaces.

1. **Palm grove and agricultural Areas in Adrar city:**

Urban agriculture is one of the most important components of green infrastructure, which aims to achieve sustainability goals, by providing food within cities, calming the atmosphere, and minimizing the effects of transportation, in addition to social and health benefits. African countries are witnessing high population growth rates, especially in cities, which has led to a large consumption of agricultural lands close to cities. The need to provide food has led to the pursuit of a policy of land reclamation near small and medium cities. In the case of our study of the city of Adrar, in Southern Algeria, this policy led to the creation of new agricultural areas near the city, without a real understanding of the ecosystem of the region. On the map in Figure VI. the traditional agricultural areas of the Oasis, as well as modern agricultural areas near Adrar City. This political strategy had many economic, social, and environmental impacts. It can summarise these effects in the tableVI-1:

Table VI-1 Impacts of transformed agricultural areas from «Oasis ecosystem» to Modern Agriculture

Environmental impacts	Socio-environmental impacts	Economic impacts
Low biometric level of water and weak traditional irrigation system **Decreasing the positive climatic impacts of the Oasis after the death of many trees due to lack of irrigation** **The decline in agricultural products, bio in the local market** **Increasing the environmental impacts of food transport and increasing congestion within cities**	Loss of social cohesion Loss of the ecological impact of the Oasis The emergence of social ills because of escape, unemployment, and deprivation	Loss of job positions in traditional farming, especially for women and the elderly, and a lack of dependence on humans in modern farming The emergence of unemployment problems Low income of families inside the Oasis due to the need to buy lunch and energy due to the rise of the thermal island inside the cities.

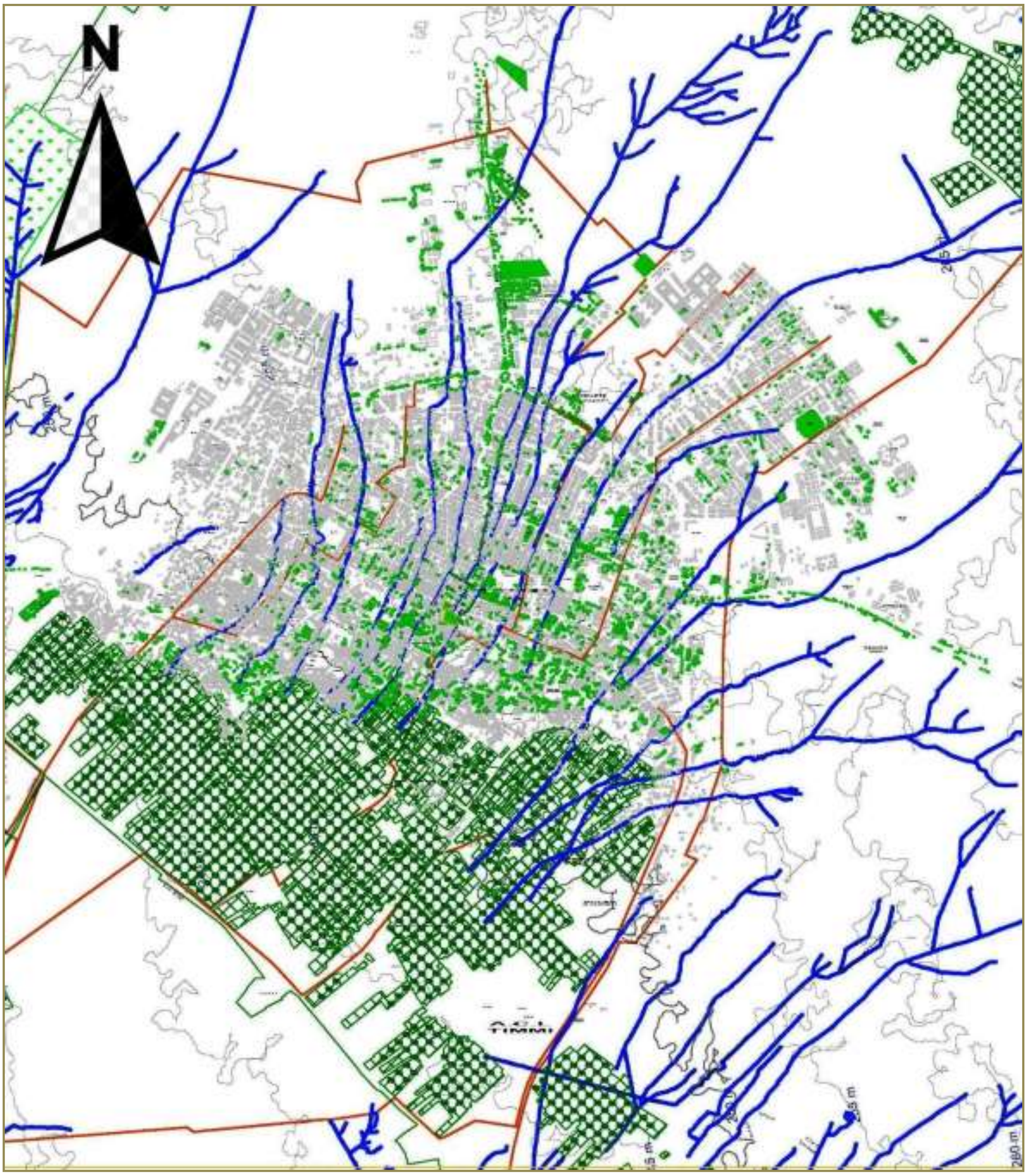


Figure VI-5Green infrastructure (Green spaces and foggara line) in Adrar City

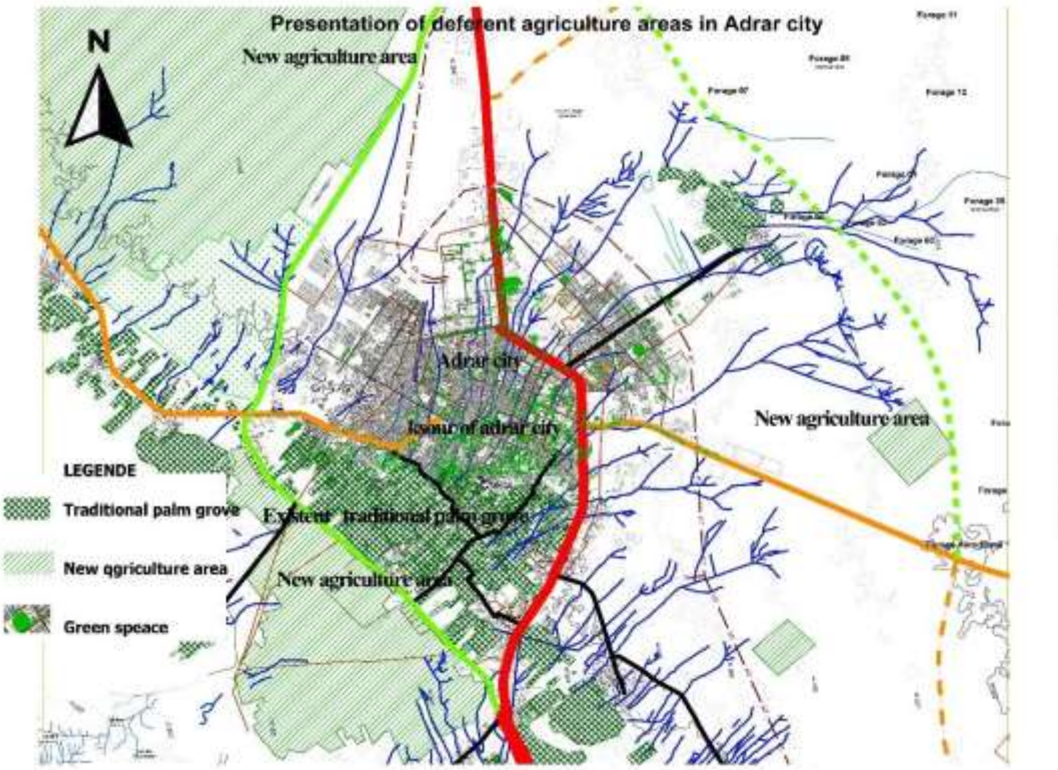


Figure VI-6 The conventional (new) and traditional agricultural land uses in Adrar. (Large-scale map in the appendix) (A-6)

2. Parks and Recreational Spaces

The original urban pattern of the city did not include public green spaces or public parks. On the contrary, there were some waqf[10] gardens for visitors, teachers, and Imam[11].After the colonization of Adrar, thinking was clear about the fundamentals of the European city; and creating green spaces for the Europeans in the city, so the major public square for the city of Adrar (Figure VI 8).

[10] *A **waqf** (Arabic: وَقْف; [ˈwaqf]), also known as hubous (حُبوس) or mortmain property, is an inalienable charitable endowment under Islamic law. It typically involves donating a building, plot of land or other assets for Muslim religious or charitable purposes with no intention of reclaiming the assets.*

[11] ***Imam** is an Islamic leadership position. It is most used as the title of a worship leader of a mosque and Muslim community among Sunni Muslims.*

In the following map, is observed that there are three parks in the colonial urban patterns, which is the AMIR Abdulkadir Park, the Independence Park, and the second Belkin Park and Garden (Figure VI 8). The roads connecting these gardens have been afforested to create shade in the streets.

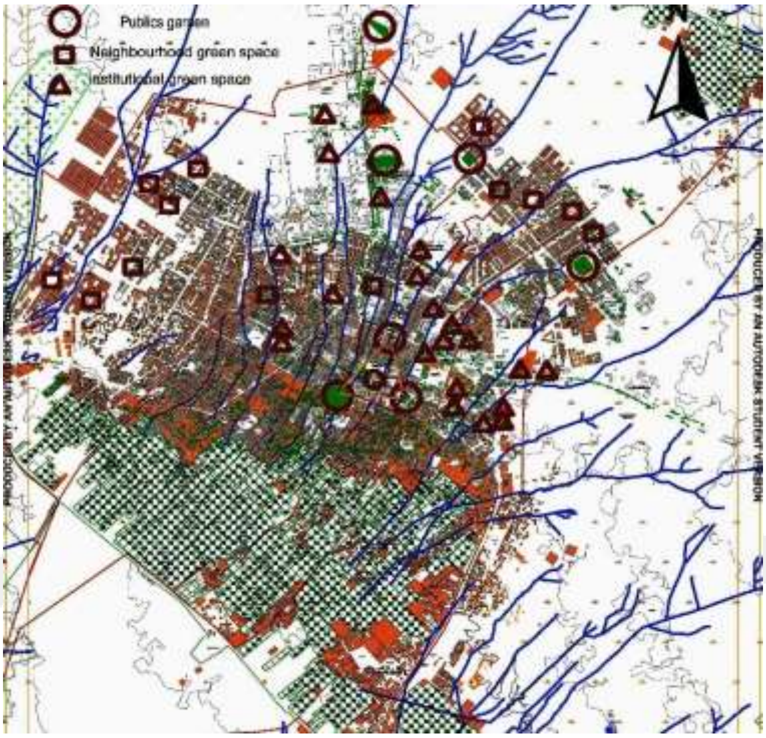


Figure VI-7 Public parks and recreational spaces in Adrar city. (Large-scale map in the appendix) (A-7) Figure VI-8 Temperature diagram

After independence, there was a complete absence of building new gardens except for green areas inside the residential neighbourhoods, which were often aesthetically insufficient and neglected due to the absence of a strategy to run them. But on the contrary, it was a source of pollution for dirt and diseases inside the residential neighbourhoods, except for the neighbourhood of four hundred houses, which created the difference in terms of organization and interdependence of the population to maintain this area.

Figure VI-9 The examples of green spaces of Adrar; Left: Emir Abdelkader public garden; Right: Green Neighborhood space 400 Houses City.

3. Institutional Green Spaces

"Urban green infrastructure supports resilience in cities and promotes sustainable resource management. Small green areas, including school green areas (SGAs)"(Iojă et al., 2014). Is remarked by the analyses of the map of the Adrar city, we observed the remarkable presence of institutional green spaces in schools and public facilities such as hospitals and the university (Figure VI 9). These areas are of great environmental importance, as they constitute a significant area of the total area of the city. The city's building codes dictate that at least thirty percent of the total building area is green space although planted trees are often considered foreign to the area and consume a large amount of potable water.

Figure VI-10 Examples of institutional green spaces (Adrar university); Left: Right. Green spaces in (Adrar square)

4. The Foggaras as Blue Infrastructures

Local inhabitants developed the FOGGARA irrigation system hundreds of years ago in the sub-Saharan Africa. This system consists of underground channels interspersed by the wells of the twentieth and thirty meters between the well and the other. This technology works by exploiting the natural slopes, where the Adrar Oasis is located at the bottom of the Tadmait plateau, and it is considered one of the largest and most important Oasis in the desert, with 23 FOGGARA. This technique was used of obtaining water throughout the year in a sustainable way and dividing the water at the level of a triangle basin called KASRI. The average water flow of one FOGGARA is 7.8 litres per second per FOGGARA.

The foggaras of Adrar, like the other municipalities in the region (Figure VI 13), have experienced very advanced states of degradation in recent years, this degradation

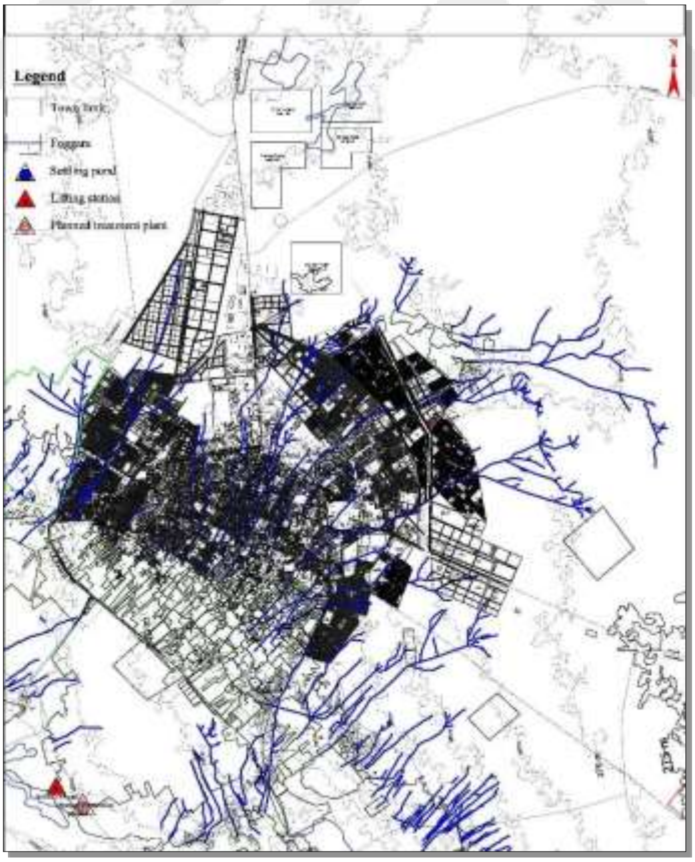


Figure VI-11 Underground waterlines which support the foggara network of Adrar city.

is due to hydrogeological (lowering the piezometric level) and human (lack of maintenance and rehabilitation) factors.

Besides, if nothing can be done to change the hydrogeological conditions, it can at least reduce the scourge of deterioration of the elements of the hydraulic heritage. (Figure VI 14) Likewise, if the historical facts are irreversible, those linked to the life of the man, to have the socio-economic conditions, are recoverable and curable. But, of all the ills that affect the hydraulic and architectural heritage of the Oasis domain, it is human abandonment that is the most painful. According to the results of the survey, the foggaras note (Dahar, Meknas, Massini and Arrekkas) presenting a dysfunction which can go as far as drying up, like the case of the foggara of Massini the functioning is disturbed by damage affects more than 50% galleries.

Figure VI-12Foggara of Massini in ADRAR city

VI.2.2 UGI typology analyses, in ADRAR CITY

Through this section the study tries to appreciate how green infrastructure can contribute to achieving the main goals of sustainable urban planning in a desert setting and a special urban pattern within four main areas of interest that can contribute to human well-being: (a) urban biological diversity; (b) Environmental quality, ecological footprint, and climate change; (c) social cohesion; (d) a green economy. For example, the urban GI promotes the physical and mental integrity of citizens They include support, nutrient cycling, food, and timber), climate moderation, and cultural services. Recreation. through the parts of the city of Adrar, which were formed on different historical stages and these stages formed three urban patterns that live in the same urban environment, but with different social and economic data, which resulted in different environmental, economic, and social problems .The study tries to apply these principles to different urban fabrics in ADRAR city. To make our study more realistic, the study conducted a spatial survey of the green infrastructure in all parts of the city and determined its performance through the contribution of its factors to the environmental, economic, and social benefits, which we are working to preserve and develop to conceive of an ecological city model in the African Sahara. It has summarized this survey in the following matrix. The table shows us the contribution of green infrastructure to the protection of biodiversity, the environment and ecological footprint, adaptation to climate change, social cohesion, and the green economy Through the principles of green infrastructure planning strategies, green and grey integration, multi-functionality, connectivity, and social inclusion in the city of Adrar through a photographic analysis in which the study gives a clearer picture of the process of analyzing green infrastructure.

contributing to	Green-Gray Integration	Multifunctionality	Connectivity	Social Inclusion
Biodiversity Protection			The Ecological communication network in the Oasis is also clearly available in the Oasis. As for the colonial fabric, despite the availability of this ecological network in the past, it was destroyed. The lack of an ecological network in modern urban expansion  Figure VI-19 Preservation of biodiversity  Figure VI-20 Urban green space biodiversity	Promote awareness of the values of biodiversity in the ecological memory of the Oasis, reflecting the loss of that in the rest of the city, which is what makes it difficult to preserve the biodiversity of modern parts.  Figure VI-21 The values of biodiversity in the ecological memory of the oasis  Figure VI-22 Urban space

Green infrastructure t contributing, in ADRAR CITY

Providing habitats; Oasis preserve all types of native plants and palm trees. Urban fabric keeps trees on the streets

Figure VI-13 Palme grove in Adrar

Figure VI-14 Palm tree in Adrar square

Figure VI-15 Street palm tree in colonial city

Figure VI-16Artisanal work in palm

Figure VI-17 Urban Food

Figure VI-18 Social Connectivity

Ecological function and habitat provision as an integral part of multi-functional planning. Where the Oasis forms a multifunctional space opposite the urban environment that provides housing only

Environmental, Ecological Footprint and Climate Change Adaptation	Gray-green measures, for example, maintaining floods,  Figure VI-23 Flood in modern part of city  Figure VI-24 Inundation after flood in ksar habitation  Figure VI-25Pesticide treatment of sewage Estuary urban cooling, reducing energy consumption and various ecosystem services, reflecting the expansion of the urban environment that led to floods due to climate change, increased energy consumption, and a thermal island	Regulating services that improve air, water and soil quality and avoiding disasters; promoting adaptation to climate change and providing the possibility of life and the welfare of the population as they were in the past because this affects a direct spit on the social, environmental, and economic aspect of the city.  Figure VI-26 Green space services  Figure VI-27 Protestation for water need	Connected green structures that enhance natural ventilation, environmentally friendly cooling and mobility, the use of walking on foot and the use of bicycles in the city, contrary to what has been known in modern urban enlargements  Figure VI-28 Walkability and use of  Figure VI-29 Use of cycling  Figure VI-30 Use of cycling.	Inclusion of vulnerable groups in urban green infrastructure planning, considering the needs of all segments of society and not dividing regions based on social classes to ensure greater social communication in the city and considering the needs of vulnerable groups for green infrastructure.   Figure VI-31 Social communication in the city

Social cohesion	Consider the values of use and comfort for integrated green urban infrastructure measures to enhance social cohesion, which is reflected in the use of irrigation systems, palm groves and gardens, for example.  Figure VI-32 Social cohesion  Figure VI-33Social cohesion	Providing various patterns of urban green infrastructure to meet the different demands and needs in the urban fabric of the Oasis, despite the absence of some of them and the absence of this in other urban patterns, which constitutes a lack of ecosystem services in the city.   Figure VI-34Lack of ecosystem services in the city	Provide equitable access to urban green spaces Although the Oasis is an abundance for every inhabitant of a vital green space, it is considered an area to provide daily, cultural, and social needs for man, but the urban style of the city did not provide this space.  Figure VI-35 Palm grove green space  Figure VI-36 Lake of green space	empowering citizens through collaborative planning of urban green infrastructure; secures the needs and demands of vulnerable and less vocal groups, which is evident in the cooperation of farmers and Oasis residents in hard work, their meanings, and protests in the urban milieu.  Figure VI-37 Collective work in palm  Figure VI-38 Protestation in urban area

Green economy	Reducing the costs of managing grey infrastructure through joint green-grey systems; avoiding costs by mitigating environmental risks, which is reflected in the reuse of animal and human waste in palm groves and the absorption of rainwater through irrigation and horticultural systems, unlike the failure of the urban pattern in Running the grey infrastructure  	Urban GI solutions are cost-effective by providing multiple benefits in the same area unlike the large consumption of spaces in the urban environment and the lack of benefits and lack of tolerance.  Figure VI-39 The lack of benefits and lack of tolerance	Promote sustainable transportation systems and green corridors (walkability and bikeability), whether in the Oasis or in the colonial style at its front, and the lack thereof in the urban style of social housing   Figure VI-40 Lack green corridors (walkability and bikeability),	Promote the social and green economy and establish and manage urban greenery as is the case in the Oasis as a successful model unlike the city that built its commercial economy on widespread consumption.   Figure VI-41 Promote the social and green economy.

VI.2.3 UGI practices in Adrar

The study will define three practices of green infrastructure: community gardens, the traditional irrigation system, and individual gardens.

The CORONA 19 virus crisis and before it the recent global economic crisis and persistent environmental challenges, such as climate change, have generated renewed interest in economies and alternative forms of growth. Among these, green growth and the transition to a green economy are the most widely discussed.

Figure VI-42 Traditional Garden food production

The concept of green economy is considered the most important supporter of a comprehensive sustainability approach, to achieve concurrent environmental, social, and economic benefits. In addition to the economic goals of avoiding costs, enhancing economic efficiency, competitiveness and employment opportunities, the main objective of the green economy is to contribute to improving the urban environment, by reducing energy consumption and global warming, in addition to providing job opportunities and social participation. This concept overlaps with many emerging urban strategies and theories, although many cities do have planning goals linked to related concepts such as sustainable planning, green jobs, a low carbon economy, or attractive public spaces. Although desert cities have a past in this type of economy through urban agriculture in the Oasis (Figure VI 43), he made the case for a green economy, and the study will address more clearly in this part of the research to urban agriculture in the Adrar Oasis.

Figure VI-44 Date production

Figure VI-44 Tomato's production in traditional Garden

Reflecting the ingenuity of a society that has managed to overcome a hostile environment unfavourable to settlement, Oasis agriculture is a fundamental element of the Saharan region (Bisson, 2003)(Bisson, 2003). It represented an essential activity for supplying both the Oasis populations and the caravanners who crisscrossed the Sahara. The ancestral economic organization changed over time, since the appearance of nonagricultural activities led to a diversification of jobs and a decline in the weight of Oasis agriculture, which was based on a well-defined social stratification (Marouf, 1980)(Marouf, 1980). Indeed, by the introduction of jobs, in the tertiary sector, but also in the secondary sector in the Southeast region of Algeria and more recently in that of the Southwest, the independent Algerian state has greatly disrupted this traditional agriculture. As a result of the upheaval of the social stratification established for centuries, agriculture has lost ground compared to new activities. Since 1983, national policy, based on the agricultural development of the steppes and the Sahara, aims to replace this traditional agriculture considered in difficulty and unprofitable, by cereal production, by denying the previous feudal social organization.

However, despite generous state subsidies, this new policy could not achieve the objectives set at the outset. In recent years, marked by a gradual disengagement from the state, new agricultural dynamics have appeared, both in the modern agricultural sector and in the traditional sector.

This new trend in Oasis cultivation seems to give it a new life at a time when the state no longer has the financial resources to maintain pre-existing support. Studies conducted so far on Oasis cultivation tend to "point the finger" of modern development as one of the most important factors leading to the decline of traditional farming. The aim of our research in the field of urban planning as an important part of green infrastructure is to understand more the new rural dynamics that characterize the area of Oasis in the city of Adrar in general. It is also a matter of providing a fresh overview of the current dynamics that give rise to new links between the traditional Oasis world and new agricultural technologies. The latest publications cover rural youth mobility, new social technologies, or the liberation of Oasis youth. The study tries through research aims to optimize the use of green infrastructure and that the agricultural systems (traditional and modern) no longer work in isolation. The spatial disruption caused by the geographical isolation of the Sahara, along with the social classes, are increasingly opposed to the exchange of knowledge and the sharing of natural resources. Consequently, the new agricultural knowledge transmitted by labor from the north, and the strong willingness to adapt expressed by the indigenous population, associated with the arrival of sub-Saharan employment, favours a marked development of practices. And hybrid technologies that represent socio-economic challenges but also represent environmental challenges for the city and make this city transform from a self-sustaining city to a city that consumes food and energy in a large way, which is reflected in the transport networks that have affected directly and indirectly the urban fabric.

Analysis an of urban agriculture social and traditional housing

In the urban fabric of Adrar city, it remarked a large area of traditional housing. In recent years, social housing has emerged as extensive programs by the Algerian state in recent years, and social neighborhoods at the micro level are beginning to be community groups or housing complexes. Public housing complexes

It often appears in low-income areas as these residences are legally designated for residents whose income is less than $ 200. The existence of these complexes forms the social and cultural landscape of these societies. When analyzing specific variables between the patterns of public housing and the resulting environment begin to take shape. It was noted that the densely populated urban density lacked green spaces and positive interaction between humans and the environment. Also, the western Neighborhood of the city, which is de high density, but the level of income is very weak, which made some of them depend on raising some animals to benefit from them, it observed at the social structure, most of them are poor and minorities. A search for the relationship between income levels and settlements yielded results that revealed: "Poor families cluster into certain types of housing or neighborhoods. It often leads to a combination of these factors. In the polarization of income and the type of settlement in the end. Suburban settlements are rated with better opportunities and higher quality than the services provided. The disproportionate negative effects present in urban society increase significantly when discussing food in relation to these types of settlements. Dense urban communities suffer more from food choices than other settlement structures such as traditional areas, Oasis, etc., and the lack of viable food resource options that have been identified as providing healthy food, fresh produce and nutritional options within their urban environment has become an increasingly worrying issue in the cities in the Algerian desert, due to their distance from the arable areas in the north of the country, which explains the large number of cancer cases. The options available to this population are not limited to healthy food options, but "the urban patterns poor society pay more for their food,

Especially production, whether in the suburbs or the countryside. The United Nations notes that the urban poor worldwide pay up to 30 percent more for their food than the rural poor society. The social and economic climate of these neighborhoods and the resulting inequality of the public environment in the public housing system. The data reflects that the concentration of poverty in public housing often leads to further deterioration in neighborhoods where these poverty pockets are located.

The Corona epidemic has changed many facts, that epidemics have become the primary enemy of cities and maintaining the safety of urban residents has become one of the priorities by isolating the population, but one of the most important obstacles to quarantine was providing lunch in safe places for the population and avoiding crowding in public places and thus the lack of urban food One of the most important downsides of cities is the opposite of the inhabitants of rural areas in addition to that Food resources and energy-rich food systems in cities

In 2006, the American Journal of Preventive Medicine published an article talking about the relationship between many food resources and health issues. The authors looked at observed obesity rates, high cholesterol, and other health conditions about food options and other environmental conditions. First, the authors distinguished between many food resources: supermarkets, shops, full-service restaurants, fast food, and limited-service restaurants. It has been found that semi-sized supermarkets classified as stores in this context easily fit the urban environment and have a higher percentage of heavily processed foods. But what is noticed in the Southern region of Algeria is the large increase in the problems of carcinogenic diseases and the imbalance of the diet, which largely depends on transportation from the north of the country and the desert environment, and sometimes most of the food is imported from abroad.

VI.2.4 Effects of UGI in Adrar city

Through this section the study try to understand how green infrastructure can contribute to achieving the main goals of sustainable urban planning in a desert setting and a special urban pattern within four main areas of interest that can contribute to human well-being: “(a) urban biological diversity; (b) environmental quality, ecological footprint, and climate change; (c) social cohesion; (d) a green economy”(Valente et al., 2020). In addition to the benefits, we can summarize the advantages of green infrastructure under the three dimensions. (Table VI 2)

Table VI-2 Effects of urban green infrastructures in Adrar city

Social Dimension	Economic Dimension	Environmental Dimension

Social problems abound in areas that do not have green spaces. Social ties decline in regions without green infrastructure. The lower temperatures due to the cooling of green infrastructure provide a respite for vulnerable citizens during periods of extreme heat. Proximity to green areas to the possibility of physical activity The design of an individual's physical environment influences social behaviours and social interactions. The urban poor society will be affected the most by climate change. Socio-economic disparities in mental health outcomes are higher among urban residents who indicated that they have difficulty accessing recreational and green spaces within their area (Mitchell et al., 2015) The spread of unemployment and social diseases	Residents of areas without green infrastructure find it difficult to provide food in terms of price and quality. Unemployment decreases in regions that have green infrastructure, especially women and the elderly. The costs of direct damage to health from climate change Health costs will grow over time. Flood's risk and its economic impacts	Reduced biodiversity in areas with low green infrastructure. High temperature and thermal island in areas with low infrastructure Loss of social ecological memory in areas with low green infrastructure Watching natural elements, such as trees and greenery, or experiencing the natural environment activates the parasympathetic nervous system to reduce levels of stress and excitement. Extreme temperatures increase the risk of death and illness, and they also exacerbate cardiovascular and respiratory diseases and stress.

Local floods risks problems as reason of need of UGI strategy

Climate change has become a major cause of local flooding of rainwater (Figure VI 44). in addition of the lack of green infrastructure and green areas in many parts of the city contribute to flood hazards for several reasons:

1. Green infrastructure could minimize surface runoff and increase flood storage that resulted from excessive stormwater runoff(Gill et al., 2007)
2. The expansion of the city towards the north enhances the floods towards the South.
3. Asphalting roads helps to flood.
4. Lack of an infrastructure strategy to reduce flood risks.

5. The presence of the Oasis in a low-lying area to benefit from the advantages of the hatching system also makes it more vulnerable to flooding.
6. Lack of green infrastructure increase runoff, which increases flood risks.

The map (Figure VI 45) shows the direction of surface runoff in the event of floods in the city of Adrar and how the Oasis and emigrants Neighbourhood could be the most dangerous areas in this event of floods. Climate changes pose a real threat to human life in these areas, there for a clear strategy for green infrastructure can clearly contribute to reducing these risks. “the impacts of CC on urban spatial development, policies for

Figure VI-45 Floods in Adrar city 2019

mitigation and adaptation to these impacts are open to new research aimed at enhancing the resilience of urban ecosystems and developing an integrated planning strategy for today's planning practices” (Tezer et al., 2012).

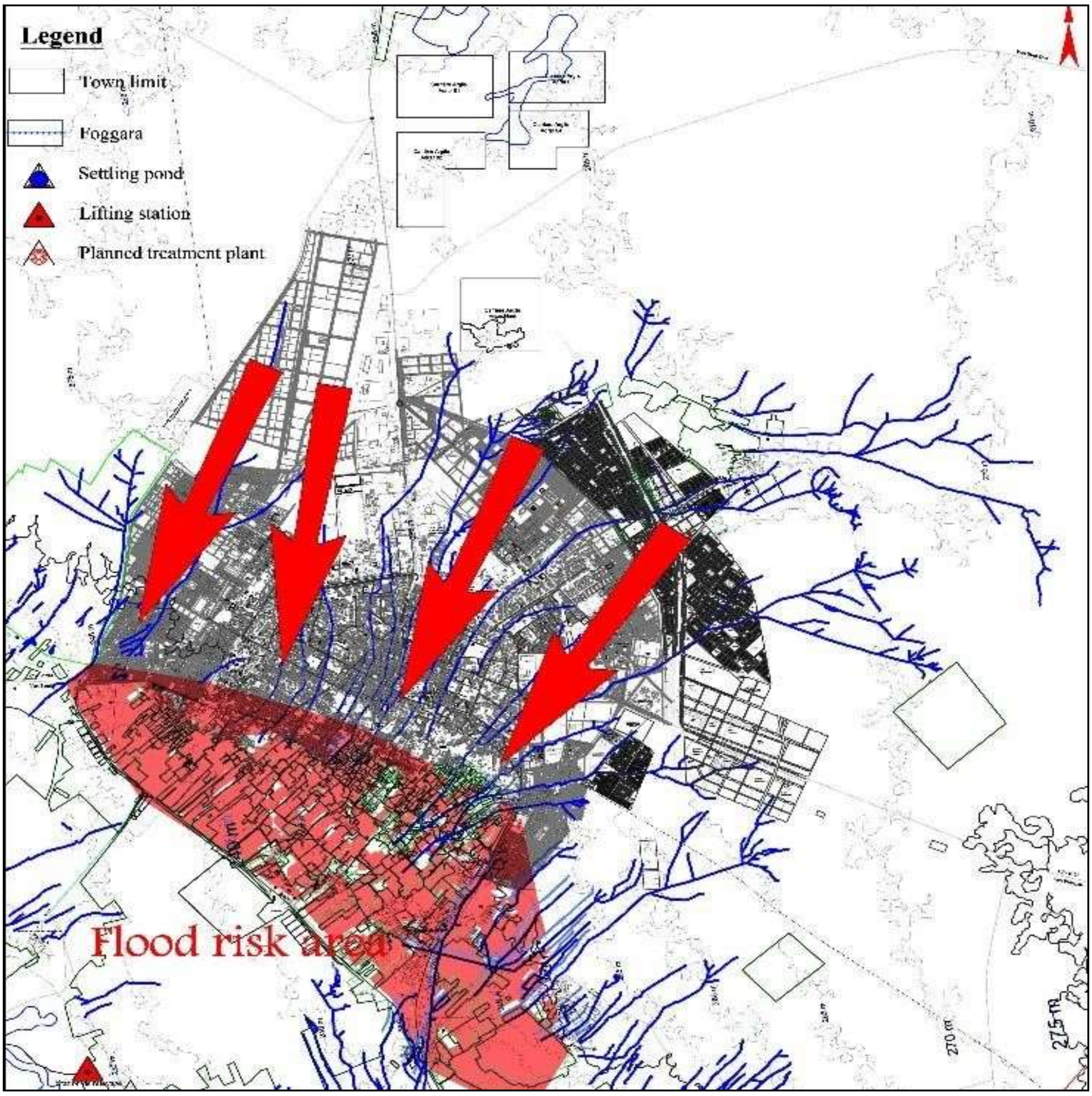


Figure VI-46 Map of flood risk in Adrar (Large-scale map in the appendix) (A-8)

VI.3 Software application evaluation

Cities are an important part of the ecosystem, but these have become unable to address many of the environmental impacts resulting from the phenomenon of rapid urbanization. Such as climate change and global warming. Africa is considered one of the most important continents that suffer from these effects, in addition to the problems of poverty and the increase in population, but unfortunately urban studies ignore the needs of this part of the world for more sustainable and viable cities.

The study of green infrastructure demonstrated through the case of the study; the most important benefits can be achieved by relying on the green infrastructure strategy. Through these data, the use of green infrastructure strategies is considered necessary to reach the main goal, which is to achieve the principles of sustainability in the new ecological urban model that the study want to achieve in the cities of African Sahara.

Why we use Software application analyse in analyse of UGI**?**

One of Software goals is to define clear indicators by which we can assess urban green infrastructure performance across city areas.

The Software application enables you to assist decision-makers in taking the right measures by evaluating the performance of green infrastructure across the city. And make a performant vision to the future needs of the city.

Definition of indicators of green infrastructure in city

Through the literature study of green infrastructure in different study and analysis of case study, it determined 25 indicators classed in 6 categories 1 Coordination of GI planning with other strategic domains -2 multi-functionality -3 Connectivity of GI elements -4 multi-scale planning of UGI -5 Diversity of GI elements -6 Identity building in the following graph.

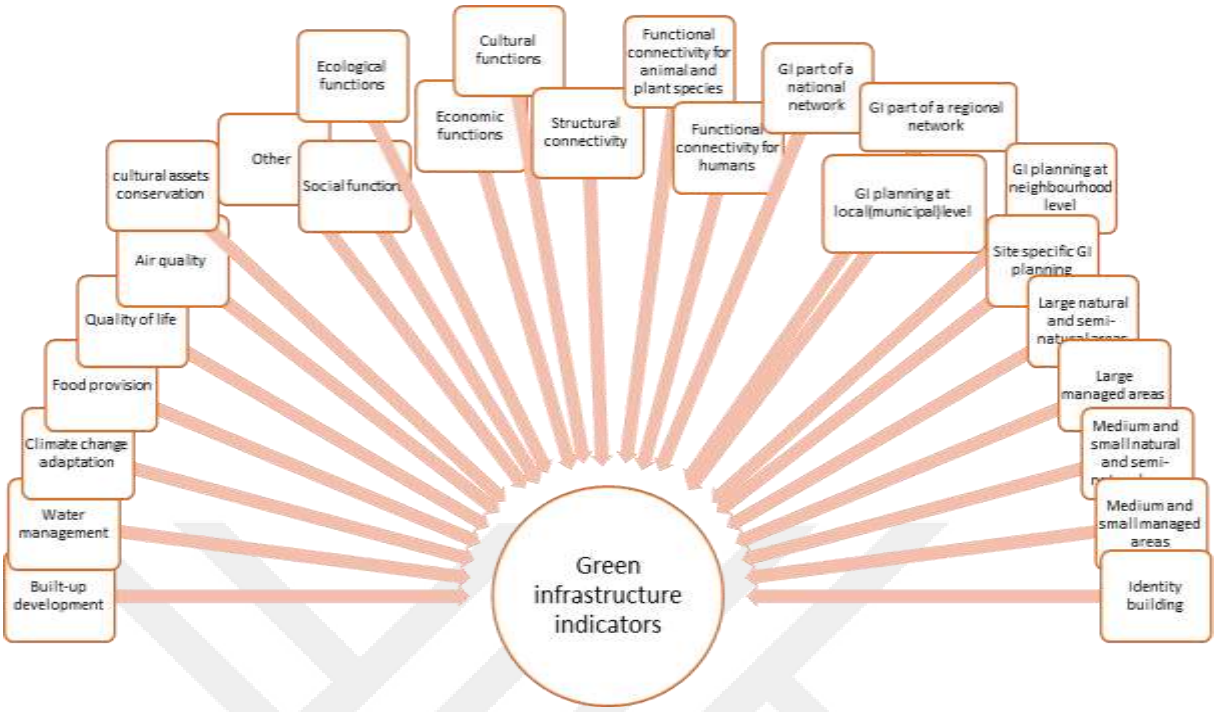


Figure VI-47 Green infrastructure indicators

Result of analyse of urban green infrastructures in Adrar city with Software application:

Ksar urban pattern:

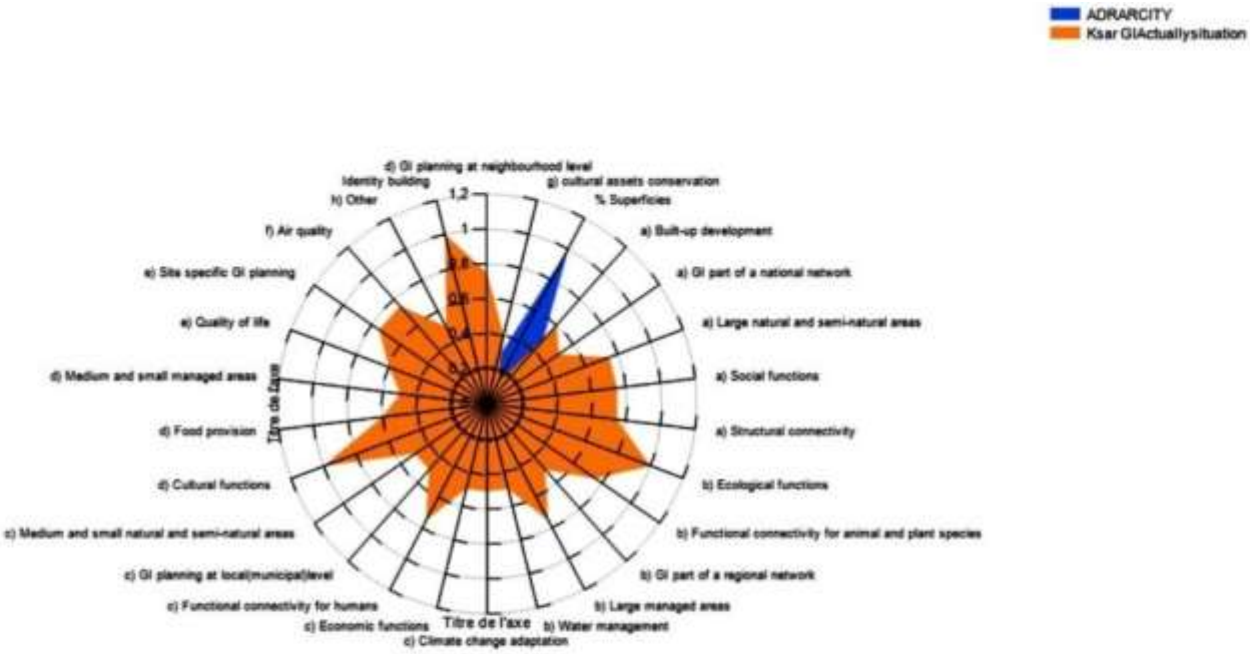


Figure VI-48 Analysis of UGI Indicators Ksar

Through the graph resulting from the use of software application on the urban pattern of the oasis, it remarked that the generally accepted performance of green infrastructure indicators, despite their heterogeneity, which gives us the idea that although some positive aspects in this pattern indicate that green infrastructure needs to be improved through the development of performance Indications.

Colonial urban pattern:

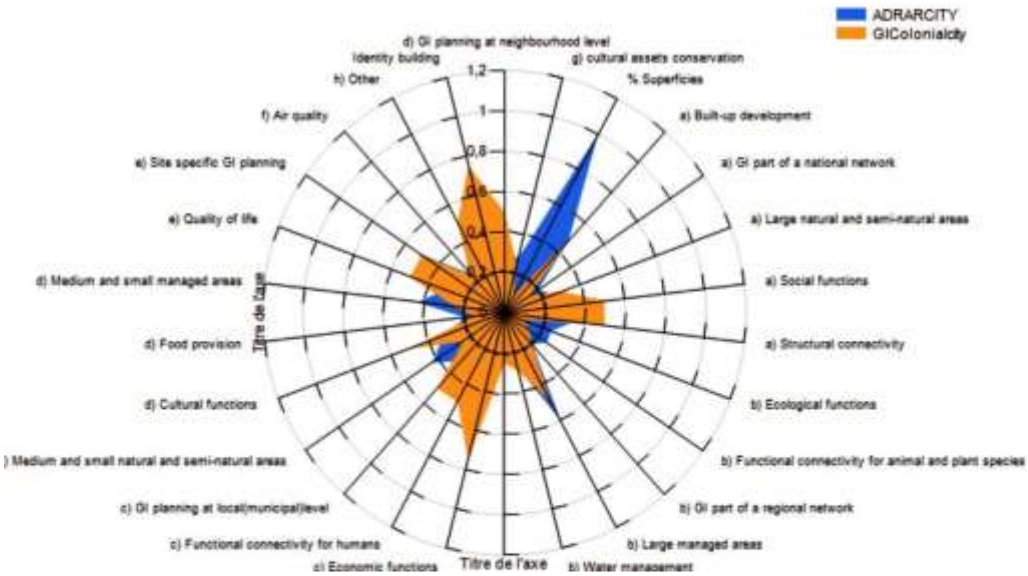


Figure VI-49 Analysis of UGI indicators colonial urban pattern

Through the graph resulting from the use of software on the colonial urban pattern, it observed the poor performance of green infrastructure indicators and their heterogeneity, which gives us the idea that although some aspects are acceptable in this style, the green infrastructure is bad in general, it needs improvement through developing performance indicators.

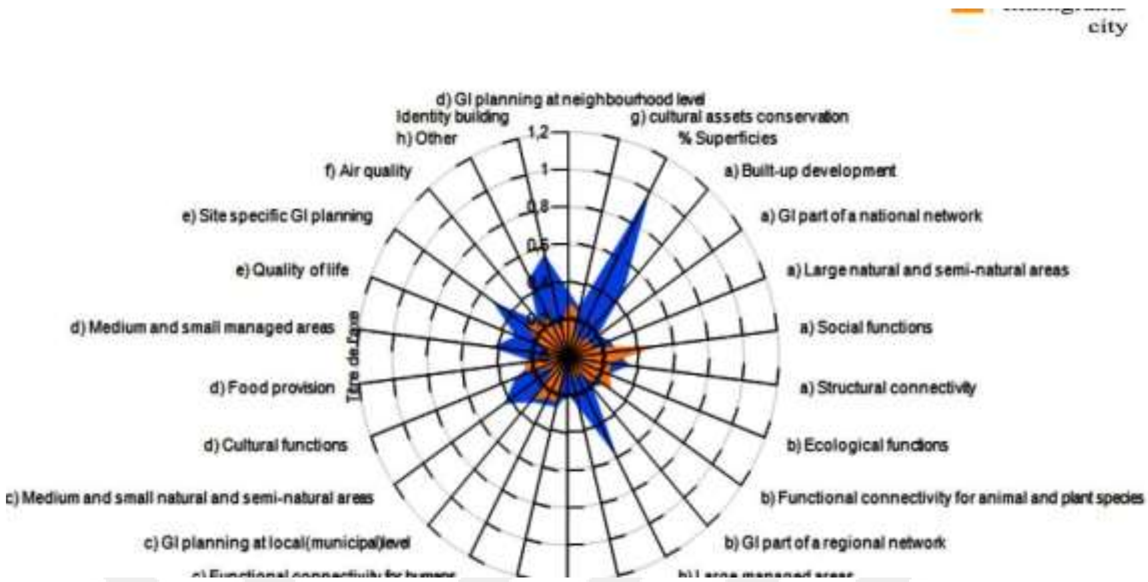


Figure VI-50 Analysis of UGI indicators immigrant neighborhood urban pattern

Immigrant neighborhood urban pattern:

Through the graph resulting from the use of the software application on the urban pattern of the immigrant neighborhood, it observed very poor performance of the green infrastructure indicators and their heterogeneity, which gives us the idea that the green infrastructure is very bad in general and needs to be improved through developing the performance of indicators.

Social urban patterns:

Through the graph resulting from the use of software application on the urban pattern of the social housing neighborhood, it noted poor performance of green infrastructure indicators and their heterogeneity, even though this urban expansion is newly established, which gives us an idea of the absence of green infrastructure strategies, which are generally in need of improvement by developing performance indicators.

Green infrastructure strategy is a relatively new concept and is characterized by great interest in studying the structure of infrastructure, green spaces, water management and ecosystem function in addition to maintaining ecosystem services in times of crisis and providing environmental benefits in urban areas. The conclusion is: in urban regions decision makers and supervisors are ignore the importance of green infrastructure. But the biggest problem for decision makers and urban designers is how it can evaluate the performance of green infrastructure and preserve its benefits, which is a key factor in achieving sustainability goals.

With Software Application, it attempted to define clear indicators through the study to assess the level of green infrastructure performance.

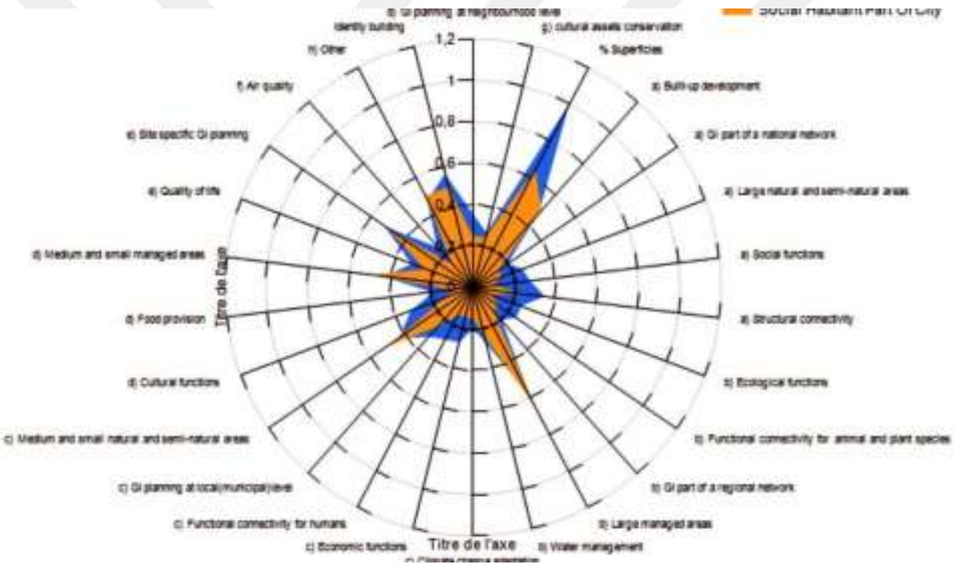


Figure VI-51 Analysis of UGI indicators in social habitat urban pattern

The homogeneity of indicators gives a clear indication of performance. It remarked through the results of the application clear disparities in the level of performance of indicators in every part of the city, which leads to real forms that impede the achievement of sustainable goals.

Note also how the original settlement performed at an acceptable level. But it remarked that opposite of colonial urban fabric and the social urban fabric.

These data give us a clear view of urban policy through the different stages of development in the city.

Regarding the immigrant population, there is an obvious problem with the discrepancies in the level of indicators. Here it can say that neglecting the green infrastructure in a part of the city or neglecting one of the indicators makes achieving the sustainable city goals difficult, in addition to the lack of environmental performance such as energy consumption and the lack of urban resilience of the city.

VI.4 A Model for managing the GI in Adrar

The strategic concept of green infrastructure is a new and unknown concept for decision-makers in Africa, especially in the case of the study.

The concept of UGI strategy must be linked to the process of reshaping the environmental process in the urban environment through green spaces, vegetation, soil, bacteria, rainwater utilization ... etc. To improve the urban environment, save water and air quality, and reduce pollution.

In addition to the positive effects socially and psychologically on the population and the local and national economic effects. The UGI strategy has come to be the most appropriate alternative to traditional engineering practices. But the question remains, how can decision-makers take measures to know the performance of green infrastructure in a city such as Adrar with urban mosaics and different urban planning patterns to reach this goal?

The study proposed a method based on identifying indicators of all urban patterns in the tide and monitoring the performance of these indicators and determining the overall performance of the city based on the average area of each type. To determine the general performance of green infrastructure performance indicators and work to define clear goals by developing a strategy to reach the objectives of improving the city's infrastructure within a timetable that guarantees a sustainable city in the Sahara of Africa by adopting the green infrastructure strategy Infrastructure in the (Table 2).

The state and municipalities in the cities of the Sahara Africa finance many infrastructure projects, green spaces, and methods of urban improvement, as most of the city's neighbourhoods benefited from funding opportunities, but this recurring funding did not reflect on the level of the citizen's quality of life. Therefore, the requires setting a clear strategy for green infrastructure for the city, according to indicators for each part according to the urban pattern. Decision-makers often find it difficult to assess the nature of these decisions due to the ignorance of the desired objectives in their specificity of green infrastructure strategy processes.

The strategy defines a vision for the future green infrastructure of the city and defines this vision in the medium and long term. For example, in developed countries the strategy is set over 20 years.

After studying the policy context and understanding the rich origins of green infrastructure for desert cities and the challenges they face.

The vision is sustainable cities Preserving its ecosystem, socially connected, and achieving the economic needs of the population is linked in a sustainable way to the integrated regional fabric, rich in landscapes, ecological knowledge, and irrigation systems that local people enjoy, enjoy and care for. Detailed objectives are set out to achieve the vision and guide the strategy's proposals set out for each of the strategy's seven key themes: • Give importance to sustainable movement; Adapting to climate change; • Preserving the original landscapes within the city; • enhancing biodiversity, water, and air quality; • providing opportunities Well-being; • Providing educational and economic capabilities.

Through the presented table, GI planning principles divided into six categories: 1-Coordination of GI planning with other strategic domains, 2-multi-functionality, 3Connectivity of GI elements, 4-multi-scale planning of GI, 5-Diversity of GI elements, 6-Identity building. On the other hand, the city divided according to the type of urban pattern for each part of the city, according to the superficial factor of the urban pattern.

This model helps decision makers in determining the performance indicators of green infrastructure for each part of the city. They can also develop a strategy to improve the performance of green infrastructure indicators according to a schedule specified. This application can be used in any city. Through this research software application is developed in the aim of tested on the case of the study in the city of Adrar, as shown in the table VI 2, and some indicators can be added according to the specificity of the cities. Where this application can be tested on any city in sub-Saharan Africa

The software application objective to help decision-makers understand tools to identify green infrastructure projects that pose a risk to the city's overall resilience and that must be stopped, postponed, or redesigned to respond to these risks. There is already real thinking and recognition for a vision of green infrastructure, but the lack of technical knowledge in these cities weakens the cities' dependence on environmental infrastructure, not only because they provide vital resources such as water but also because they can serve as a bulwark against the impacts of climate change in the future. Through the table, it remarked that the application works according to the principle of conditional formatting, which is the automatic formatting of cells based on the values that the cells contain. You can specify conditions that when the condition is positive the colour of the indicator changes. If the condition is false, then no formatting is applied. This is very useful for determining the value of indicators in any urban pattern in the city. For example, conditional formatting can be used to quickly identify all cells directly by colour, as Table 4 is a continuation of the second table, so that the colours vary gradually from red to green depending on - coordination of indicator planning green infrastructure with other strategic areas according to the following points:

1.Domain not considered in the plan (red colour)

2. No coordination (orange)

3. Weak coordination (yellow colour) 4. Strong coordination (green colour) the values of performance of the indicator of city are calculated from the average of the total values indicators for the different urban patterns in the city.

Table VI-3. Urban green infrastructure indicator evaluation matrix for Adrar city.

GI planning principles	Subcategories	Area	ref	KSAR	Colonial city	Emigrant city	Social habitant part of city	ADRAR CITY
		Period		before 1900	1900 TO 1960	1973 TO1986	1980 TO 2020	
		% Superficies		15%	10%	10%	65%	100%
	a) Palm grove management							
1.Coordination of GI planning with other strategic domains	b) Built-up development			60%	50%	15%	50%	48%
	c) Water management			50%	30%	15%	25%	41%
	d) Water irrigation system							
	e) Climate change adaptation			50%	25%	0%	15%	37%
	f) Food provision			60%	15%	25%	10%	45%
	g) Quality of life			60%	50%	15%	25%	49%

	h) Air quality		75%	25%	25%	15%	56%
	i) cultural assets conservation		40%	25%	25%	25%	35%
	j) Other		50%	50%	25%	50%	48%
2.Multifunctionality	a) Social functions		75%	50%	50%	10%	60%
	b) Ecological functions		100%	10%	25%	10%	70%
	c) Economic functions		50%	75%	25%	15%	45%
	d) Cultural functions		100%	50%	25%	15%	75%
3.Connectivity of GI elements	a) Structural connectivity		75%	50%	25%	25%	60%
	b) Functional connectivity for animal and plant species		75%	15%	30%	15%	56%
	c) Functional connectivity for humans		75%	50%	25%	15%	59%
4.Multi-scale planning of GI	a) GI part of a national network		50%	15%	15%	15%	38%
	b) GI part of a regional network		50%	20%	15%	15%	38%
	c) GI planning at local(municipal)level		50%	50%	30%	25%	44%
	d) GI planning at neighbourhood level		75%	50%	30%	25%	61%
	e) Site specific GI planning		75%	50%	30%	50%	64%
5.Diversity of GI elements	a) Large natural and semi-natural areas		75%	30%	15%	15%	56%
	b) Large managed areas		75%	50%	10%	65%	65%
	c) Medium and small natural and semi-natural areas		50%	25%	10%	50%	44%

Table VI-4. Legend of Coordination for UGI Planning with Other Strategic Domain

1.Coordination of GI planning with other strategic domains		2.Multifunctionality		3.Connectivity of GI elements		4.Multi-scale planning of GI		5.Diversity of GI elements		6.Identity building	
1. Domain not considered in the plan		1.Domain not considered in the plan		1.Domain not considered in the plan.		1. Domain not considered in the plan.		1. Domain not considered in the plan		1. Domain not considered in the plan	
2. No coordination		2. No coordination		2. No coordination		2. No coordination		2. No coordination		2. No coordination	
3. Weak coordination		3. Weak coordination		3. Weak coordination		3. Weak coordination		3. Weak coordination		3. Weak coordination	
4. Strong coordination		4. Strong coordination		4. Strong coordination		4. Strong coordination		4. Strong coordination		4. Strong coordination	

VI.5 Conclusion

This chapter has presented a review of the literature on the concept of GI, highlighting the goals and benefits of the green infrastructure strategy and how to define and analyse its components in African Sahara cities with a special space structure and urban pattern from the old Oasis settlements to the colonial urban pattern the social urban pattern to the slums of immigrants. And modern social style.

The spotlight was also shed on the agricultural system in the Oasis, the traditional irrigation systems, their complexities, and the dangers that these cities have faced, resulting from climate change, migration, and wars.

The green infrastructure in this complex ecosystem and harsh nature has enabled humans throughout the ages to achieve many benefits.

An in-depth study of green infrastructure in this part of the world needs further study and considering the ecological memory that considers green infrastructure an important carrier of EM to achieve the desired goals of health, comfort, social integration, and cities that are more resilient and sustainable.

To achieve the strategy for a more sustainable African desert cities, decisionmakers must remember that urban green infrastructure and the associated environmental and social requirements can vary spatially and temporally. Moreover, the changes and differences of urban patterns within the city should be carefully considered and the differences experienced by each urban pattern in the city.

"At the municipal level, planners and politicians lack indicators to measure whether the long-term goals of development plans and principles of sustainable development have been achieved." (Abolina & Zilans, 2002) .

Moreover, our study showed that neglecting the green infrastructure strategy very costly and for a long time and can affect the balance of cities at all levels, and the tradeoffs should be carefully considered in setting priorities through which climate change disasters can be avoided. The current state of Saharan research on GI in urban areas is insufficient to ensure "liveable" thriving cities. How to achieve green infrastructure strategies in the cities of Sahara Africa are important questions facing scientists and decision-makers today.

VII. DEFINING PLANNING CONCEPT GOALS AND PRINCIPLES FOR ECOLOGICAL URBAN PLANNING IN ADRAR

7.1 Introduction

This part of thesis is the most important the study try to summarize all the previous stages through analysis to apply these scientific data to the case study to generate a decision matrix and implement a decision matrix in the case of ADRAR city.

In the current situation of the desert settlements in Southern Algeria, there are need of a common language, between all concerned of city; residents; decision-makers, and planners, to the objective of insuring social justice, environmental equality, and the economic needs of residents of these cities. It is essential that this approach includes social economic and environmental concerns. Which need a clear model of planification and approach that can assist planners in analyzing the region's problems as they relate to each other, the landscape; economics factors; political structure. This is known in the world of urban planning as ecological urban planning. Each problem is related to society in one or more specific ways. The study aims to developed and define characteristics of this model of urban planning. In the precedent's chapters of this research, the study takes in consideration the social ecological memory factor, green infrastructure strategy, the urban resilience and original urban morphology as essential factors to reach the goals of the new proposal model of ecological urbanism.

To determine the model of planning in desert cities which the study seeking to reach since the beginning of the research, we will briefly mention the most used models in ecological planning with:

Hamid Shirvani (Shirvani, 1985) is considered one of the most important planner, who considered the additional method as another version of the synoptic method, where the designer sets a goal and then develops successive steps to achieve its goals. The segmented process is like the Synoptic process, except that it is incomplete. The designer can follow four of the seven proposed steps for the synoptic process. The pluralistic process is an approach that integrates in the design process a population value system and the social functional structure of the urban area involved in the design. Shervani final approach, the radical process, has a basic concept for understanding and designing a complex urban environment. Relationships and social processes must be understood and clarified first. Friedrich Steiner suggested the ecological planning process, which consists of eleven steps, in living landscapes. These are the most straightforward and simpler steps in the ecological planning approach.

These eleven interactive steps are as follows:

Step 1. Problem and/or opportunity identification

Step 2. Goal establishment

Step 3. Regional-level inventory and analysis

Step 4. Local-level inventory and analysis

Step 5. Detailed studies

Step 6. Planning concept

Step 7. Landscape plan

Step 8. Education and citizen involvement

Step 9. Detailed designs

Step 10. Plan and design implementation

Step 11. Administration

This ecological planning model groups other processes of regional and landscape planning according to an environmental reference that was formulated since the 1960s by Ian McCarg. This is what McCarg called "the superposition model". In the area of urban planning, Larz Anderson defines the process of urban planning as consisting of nine interrelated stages. The process of developing the plan was a continuous cycle that recognizes the iterative and interactive nature of planning:

1. Identify issues.
2. State goals, objectives, and priorities.
3. Collect and interpret data.
4. Prepare plans.

5. Draft programs for plan implementation.

6. Evaluate impacts of plans and implementation programs.

7. Review and adopt plans.

8. Review and adopt implementation programs.

9. Administer implementation programs.

Planning includes land use management in cities, agricultural areas, and forests. Planning is studied and practiced in practice. Natural resource planning and management can be accomplished using the principles of supervision, which can be defined as "advocating for the care of the earth", with human dependence and Individual responsibility "to guide individuals toward the shared goal of preserving the beauty of the Earth and its productivity for future generations and can be done, according to Sexton (Johnson et al., 1999), using a seven-step process summarized below.

Identify the problem, decision makers, their authorities, the stakeholders, and the decision-making process.

2. Define the problem and refine the objectives.

3. Develop alternative actions to achieve the objectives.

4. Compare each alternative with the objective.

5. Choose a preferred alternative.

6. Implement the chosen alternative.

7. Monitor and evaluate. for analyse and compare these approaches.

The first approach that can hardly be considered a process driven by the vision of "many designers who see themselves as more inclined to the artistic side. Therefore, the aesthetic aspect of the city is focused on large and often formal street layouts and landscaping interventions. This clearly returns the landscape to the decoration (" the landscape) “) In the grand plan, rather than the deeper meaning of landscapes as a synthesis of nature and cultural processes with clear environmental impacts. On the other hand, there is the Geddesian approach that design action is a problem-solving activity. It is concerned with the issue of spatial organization to meet job needs. The approach [also called "functional" because of its engineering origin] indicates that if we analyse design-specific problems to handle sufficient detail in a scientific way, a spatial solution of this analysis or "program" will appear. It is suggested that design is a linear process, if implemented strict enough, it will lead to one ideal solution.

Lloyd-Jones (Jones, 2014) suggests that there is a third option that overcomes inspiring and determinist approaches. This approach takes the form of a periodic process of analyzing the composition of the evaluation: "an attempt to reconcile factors that relate to the needs of the client or user, factors that relate to the site or region under study and its context, and factors that relate to constraints of planning policy and organizing local planning. It involves understanding the problems to be addressed Revising, summarizing, and prioritizing key issues the third option Lloyd Jones gives way to an ecological interpretation focused on the cyclical process and interaction. The following are the four steps of the urban design process:

defining the problem - starting with the assessment of the study area and the project summary 2. developing the rationale - considering the brief analysis of planning / social and economic context; Building look / city view; Land use / activity; Movement and access; Physical and natural environment; The public sphere and social space; Cognitive and cultural factors 3. Summarize development opportunities and constraints - balance the site’s potential for its expected uses 4. visualize and evaluate design options - visualize the possibilities for the study area with comparative advantages and disadvantages.

7.2 Defining of Processes for case study model

It can summarize this stage in the required steps, activities and what will be produced as a result. The study summarized these stages in nine steps.

Step 1. Prerequisites: To start any project, plan, or idea, three elements are needed: A client, a designer, and a mission. The customer does the designer job. This mission, which is usually written in a contract or specified in an outline, directs the designer to accomplish something at a specific time and on a specified budget. Regardless of the task, the designer needs to know the requirements that the customer sets in comparison to the environmental data primarily for the project. This part aims to present who determines, where to find, and how to revise the preconditions for an urban design project. Also, an explanation of how to present an organizational chart for a specific design process.

Step 2. Knowledge: This stage of quantity, quality and diversity of information often needs to be increased through original surveys and analyses. The designer needs to conduct independent surveys and analyses or engage the people involved in the urban design project to collect data and opinions. Site recognition is a crucial experience for a designer. An essential part of this step. Although environmental perception is not only valuable throughout the solution process, but also particularly so in this and next step. The environment includes the relationship of all living things, including human relationships. Ecological planning can be defined as the inclusion of biophysical, social, and cultural data to suggest opportunities and limitations for decision-making regarding the use of environmental planning in general.

Data analysis

The temporal factor in the development of cities is very important and analysis of city change throughout history are an important factor through which it can envision the future. Lynch combined the role of time in the city itself with our personal experience. He argues that as urban designers, it must think about how time affects the city and affects our observations.

In general, it can consider the intervention in an existing urban pattern by a relevant driving force of the expected urban transformation. An assessment of urban components can consider the issues illustrated in the following figure (VII 1):

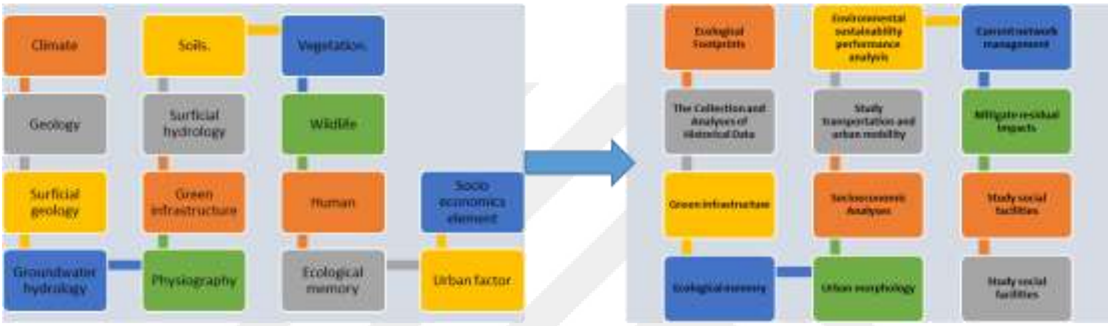


Figure VII-1Data necessary for ecological urban design in an existing urban pattern

In order to simplify and organize the collected data, the study use descriptive statistics techniques such as standard means, deviation and frequencies. While using qualitative data to enhance quantitative data, quantitative data will be presented using frequency tables and graphs.

On the other hand, due to the amount of data needed in study to use technological techniques, as part of the research, the objective of Software application development is to contribute to the analysis of green infrastructure data and ecological memory and the analysis of various social, environmental, and economic data for the case of the study, through the graphs that it obtained through the software application on Real insight into data analysis.

The Software for Multicriteria Evaluation:

Through study, Software application was developed. The principle of software application is based on the study built in theoretical knowledge of ecological urbanism

(Spatial patterns and GI element, Planning processes and morphology, social ecological memory) as is explain in (figure VII 2). In addition to the principles drawn from the study of green infrastructure and ecological memory in the case of the study.

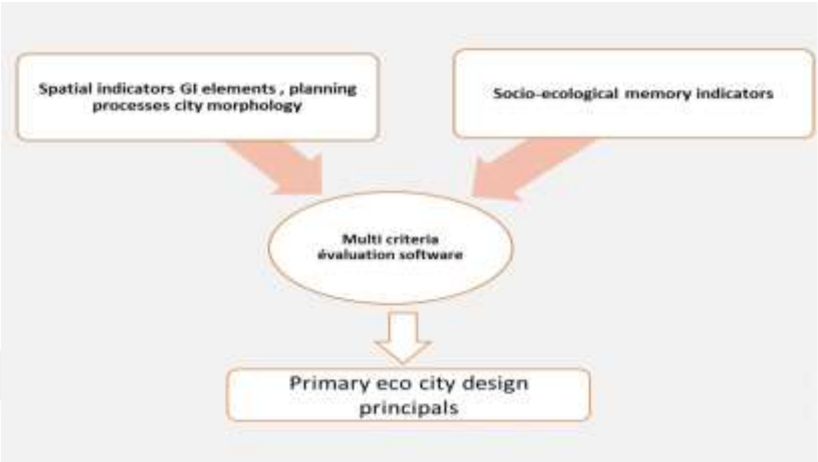


Figure VII-2 The Software for Multicriteria Evaluation design

The application will be realised with using of the system “windows 10”. With the compilation of database in Excel format contains 02 tables "Titres" and "Parameters". The application work principal based in two steps: the first one is opening and modifying parameters and the second one is display reports and indicators. Also, the first version of this program is in constant need of continuous revision and is likely to be tried in several cities in the future.

The main goal of this program is to provide a way to define a simple practical for Eco city with the participation of the local population, and by combining the main pillars of sustainability, also involving residents, and giving them the opportunity to define indicators of sustainability goals. Through our literature searches, it didn’t obtain a clear quantitative method for aggregating the effects of policy packages. Weight index scores serve to quantitatively express the significance of each indicator to others. While several methods have been adopted to determine the optimal weights of the indicators ,(Yang et al., 2010) . It has been argued that there are no standard criteria or methods for compiling and weighting sustainability indicators(Kahn, 2007). Usually, all index scores are weighted equally, to avoid controversy and ensure policy transparency.

However, through the software for multicriteria evaluation, the study aims to work according to the logic of public participation of residents and decision-makers for the possibility of changing weights. If the Software goals program is integrated into the urban design process from the start, it can give a clear view of the weaknesses and strengths of the urban ecosystem, which allows for the identification of goals, indicators, and the possibility of further improving the sustainability indicators of any city.

Step 3. Synthesis: This stage is a summary of the previous data. Also, SWOT analyses. Scenario. Burst Simulator graphics and suitability analysis. These five technologies are relatively easy and effective. Other parts of this chapter are dedicated to techniques for understanding the spatial dimension of a site, for approaching the design task, and for diagnosing appropriate uses.

Step 4. Options: This point of the process is characterized by the designation of project objectives and options by the designer. The designer needs to define the direction to be taken, the goals and strategies to be followed. According primarily on scientific and logical considerations, considering the ecological denaturation and economic potential of the studied environment, also considering the environmental perception, and needs of the population.

Step 5. Dialogues: Discussing and countering designer ideas, solutions, and methods of advancement with other stakeholders is a central point in any urban design process. **Step 6. Master plan:** The final form and composition of the urban design project is considered in a master plan. The master plan describes the proposed change to the field of study. It is a physical plan that demonstrates and establishes, through writing and graphics, the concept of a comprehensive development of the study area.

Step 7. Presentation: This section discusses the use of images, performance, physical models, and hand-drawn graphics to illustrate the results of urban design proposals.

Step 8. Details: It is often necessary to clarify more about some design components. This relates to movement and buildings, green and open areas, public places, street furniture, as well as topics such as economic valuation,

Step 9. Implementation: This section presents some of the tools and techniques used to implement and implement the project.

7.3 Model projection

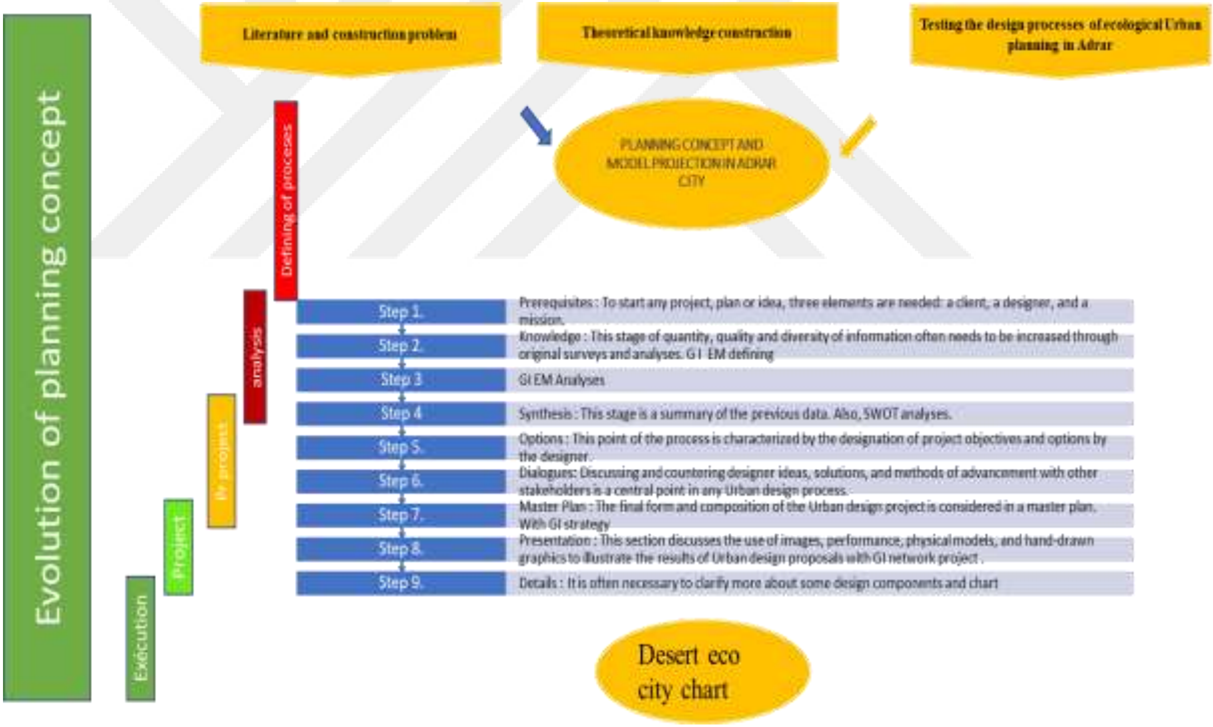


Figure VII-3 Process Diagram for A Model Projection The figure VII 3 shows the various stages of ecological planning, which were the result of the previous chapters of the study.

Which it summarized in nine stages as shown and concluded with the charter of the eco-city in the desert, which is also the result of the nine stages of ecological planning.

The data presented in the previous chapters is an introduction to urban design as a framework of knowledge through which it can begin the initial design stage and conclude the analysis. Any additional data collection and analytical investigation depends on factors such as the nature and dimensions of the urban design mission, the time and information available, and although the design is a collective work of a group of specialists, the designers try to reach the goal by which study seek to lay the foundations for the ecological design stage in a desert urban area that has a lot of particularity, the knowledge gained must be summarized for its effective use. There are many techniques to summarize and analyse the knowledge gathered about the site.

7.3.1 Synthesis Techniques

These tools are characterized by simplicity and effectiveness. Starting with an examination of the information gathered in the previous stages, it is becoming able to gain a deeper understanding of the state of the study. it can use the most available technological applications such as GIS and BIM to store and process specific data. In the assembly stage, volume comparison and perception of physical models are two methods that help the designer to be aware of spatial dimensions and interactions of different areas of the site. Our reliance on the work of previous designers, the study of the previous example and the literary study will allow the collection of similar case studies for designers to compare their mission with the precedents that urban design has gained through previous practice. Through this stage, the study tries to link all the results of the surveys that were conducted in the stage of knowledge in a comprehensive picture of the site to obtain a broad perspective and a clearer and more comprehensive vision. Ideally, this synthesis will lead to a more effective urban ecological project.

Many designers have demonstrated tuning techniques that depend on how the information collected is collected based on time and resources available and on the techniques the designer decides to use. The time is affected by the type of design. Time is usually at its best, and rapid technologies are usually necessary.

The figure VII 3 briefly and clearly shows the various components of this stage of the study

SWOT analysis of Adrar urban patterns:

SWOT Analysis is a method commonly used to help identify strategic directions

Figure VII-4 Synthesis Techniques process

for Organization or in practice. Strengths can be defined as the availability of a resource that can be used to improve its performance. Weaknesses are the defects / deficiencies of any system that cause a loss of environmental performance in the city. Through this analysis, it can obtain indicators of spatial analysis, and these data can be transferred first to the Software application, in addition to transferring them to the definition of the framework of the study of suitability and the use of the hills in the use of the GIS system to determine the ecological planning strategies of the city.

Spatial SWOT analysis of Adrar city

Desert ecosystem data

Process of urban planning in Adrar

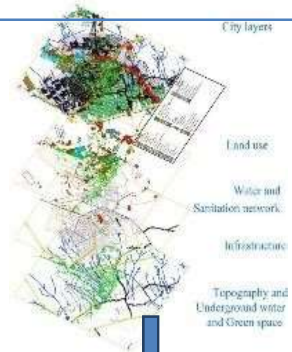
Green infrastructure data

Socio-ecological memory data

SWOT Analysis

Constraints and opportunities maps

Spatial suitability analyses



The Software for Multicriteria Evaluation.

Figure VII-5 Methodological flowchart for the analysis

Defining Ecological indicators from spatial SWOT analysis: (For the full SWOT analysis see appendix (B-1), (B-2), (B-3), (B-4)). Many analytical systems provide the ability to guide decision-makers. In this regard, one of the most widely used measures of system sustainability is the criteria and indicators approach. An indicator is a parameter associated with a phenomenon, which can provide information about specific characteristics. The indicator system consists of many linked indicators with a logical and functional point of view, capable of describing and providing information about many phenomena related to each other, Which needs to be interpreted in a coordinated manner.

The SWOT analysis is a commonly used tool for analyzing urban environments. Spatial SWOT analysis results allow to identify the most vulnerable elements in the territories (weaknesses) that need defence intervention, monitoring, monitoring measures, environmental and physical factors experiencing the highest impact of human intervention (threats), as well as the most valuable areas (strengths and opportunities) within the area under investigation, which should be visualized monitoring and protection measures. Through the results of the analysis, it can be identified interesting indicators to support the strategic planning stage.

Table VII-1SWOT Analyses results

SWOT Analyses results	Software app Indicators	SWOT Analyses results	**Software app Indicators**
Strengths The essential advantages of the area are in their actual condition. Economic importance geographic situation green space open space large road urban structure What differentiates it from its surroundings? What distinguishes it from its surroundings? Leak of green space Social cohesion Number of open spaces Population density Economic activity What is well organized? Urban space Economic activity What is doing well? social organisation spatial organisation of habitat ecological memory preserving What are the good characteristics? Urban structure Economic interest social organization What are the ecosystem services already provided? flooding Cultural - economic prosperity	C 29 C 30 C 31 C 08 NE3 NE4 NE4 ST1 ST4 C16 NE3 NE4 NE5 NE6 NE7 COM1 COM2 COM3 COM4 COM5 COM1 COM2 COM3 COM4 COM5 C29 C30 C9	Weaknesses What can be improved? Housing improvement Building framework improvement Irrigation system overhaul Green infrastructure improvement Waste treatment of all kinds Improve the economic level. Create service activities such as tourism. Development of the transportation system What is done poorly or inconsistently? Lack of hygiene Building Materials Pathology Lack of spaces Land properties The deterioration of the economic level of the population Neglect of the traditional built framework and the loss of knowledge in the field of construction What should be avoided? Use of unsustainable building materials. Construction in agricultural lands What intrinsic ecosystem services have been compromised by current or past uses? Unplanned urbanism Unsustainable water consumption Energy consumption Wastewater and discarding it without treatment.	BL1 BL2 B8 B9 B10 C2 C3 C4 C1 C2 C3 C29 C30 B4 B5 B6 B7 B8 B9 B8 B9 BL2 BL3

Opportunities What are the interesting trends and favourable possibilities? Preserving the ecological memory Reinforcement of the green infrastructure through its modernization and modernization of residences in the Ksar What are the changes in urban or regional government policy related to the study area or to the greater area? Using sustainable building materials that provide energy and safety in their uses.	C9 C10 C1 C2 B6 B7 B8	Threats What are the obstacles the area faces? The most significant problems of the site and the surrounding area are related to. • environment: Pollution: water quality Green spaces Social perception	C 29 C 30 C 31 C 08 NE3 NE4 C6 C18 BL3 COM5 COM6 COM7
Prevent construction with cement, e groves. What are the changes in ultural and trends? What are the changes in social markets events? How might the health and local and restored? What ecosystem services can ology be be (Provisioning services) Food, fibre and fuel created? Genetic resources Biochemicals Fresh water REGULATING SERVICES Pollination Seed Dispersal Climate regulation CULTURAL SERVICES SUPPORTING SERVICES Provision of habitat Nutrient cycling Soil formation and retention Production of atmospheric oxygen ` cycling	C16 C18 C19 C20 C21 C29 C30 C31 C14 C15 C7 C8 C9 C18 C10 C10 C10	Urban landscapes: land-or building-use conflicts: what indications of the city plan or what urban policies that are going to be implemented will negatively affect the study area? • transport and communication infrastructure: • public spaces and infrastructure: social and cultural facilities, places to walk or stand safely, lighting in bad situation • management issues: lack of image or negative perception, prescriptive regulations • demographic issues.	B9 ST11 ST4 ST5 ST6 ST7 ST8 COM5 COM6 COM7 COM9

2. Defining of Map of opportunities and constraints

A map of opportunities (or possibilities) and constraints (or limitations) is an approach in which the study try to outline the previous information. constraints are the obstacles to a well-developed Eco-city, such as the presence of oases that guarantee us in the city to eat and benefit the ecosystem but besides the oases there are odours of wastewater, and historical structures.

To determine the constraints that hinder the achievement of urban design goals, the study rely on the Constraints identified in the previous chapters EM and GI and visualizing weaknesses and threats from SWOT analysis. Opportunities generally present design and be a visual representation of the strengths and opportunities of SWOT Analysis. The map, for example, can help direct the most suitable places for community services, buildings, or paths. This reduces negative environmental impacts and development costs. The opportunities and limitations map can also be used as an illustration among the various stakeholders in the design project. To clarify what to do and what not to do urban level, these changes have been directly reflected in the life of the city through the map. Throughout the various historical periods, Adrar city has experienced changes at the urban level, these changes have been directly reflected in the life of the city through the map.

3. Defining of the constraints:

To identify the obstacles that reduce the factors of sustainability in the case study, the study mainly relies on the previous chapters, and these obstacles are summarized in the following factors:

- Constraints related to ecosystem.
- Constraints related to neglecting the ecological memory and the principles of original urban and architectural design.
- Constraints related to neglecting the green infrastructure strategy.
- Constraints resulting to SWOT analysis.

Table VII-2 Table of constraints

Constraints related to ecosystem	**Constraints related to ecological memory**	**Constraints related to green infrastructure strategy**	**Constraints resulting to SWOT analysis**

Preserving of resources Underground water protection Global warming Climate change Sustainable materials Energy consumption	Orientation and morphological technics Multi functionality of space Sustainability technics Environmental and ecological compatibility Auto - sufficiency The built construction system (Local) Natural ventilation Concept of Internalization Security and protection Using local Building Materials Food production Protection from various winds by green space Dealing with heat and humidity by green space Participation Reification	Built-up development Water management Climate change adaptation Food provision Quality of life Air quality cultural assets conservation Other Social functions Ecological functions Economic functions Cultural functions Structural connectivity Functional connectivity for animal and plant species Functional connectivity for humans GI part of a national network GI part of a regional network GI planning at local(municipal)level GI planning at neighbourhood level Site specific GI planning Large natural and seminatural areas Large managed areas Medium and small natural and semi-natural areas Medium and small managed areas Identity building	Environment: pollution, water quality, green spaces, urban heating, criminality, social perception, urban landscape land- or building-use conflicts: uncontrolled development around the area urbanization: what indications of the city plan or what urban policies that are going to be implemented will negatively affect the study area transport and communication infrastructure: connection of the area with other parts of the city; parking places, sidewalks, bicycle lanes, public transportation public spaces and infrastructure: social and cultural facilities, places to walk or stand safely, lighting management issues: lack of image or negative perception, prescriptive regulations demographic issues: population income, age profile, professional base, workforce What natural phenomena (floods, earthquakes, hurricanes) pose a danger to human health, safety, or welfare?

The map of constraint (Figure VII 6) clearly reflects the list of constrains cited and the largest restriction is the presence of drinking water wells near the traditional irrigating system in addition to urban expansion towards water sources, which constitutes a clear pressure for the preservation of the traditional irregation system.Also, there is the problem of wastewater and filter tanks that place environmental shapes in the palm groves and traditional buildings.The expansion imposed by the urban growth plans greatly affected the means of transportation and neglected the basis for the establishment of the Oasis city, which is the irrigation system and palm groves.

Also, the social, architectural and economic situation of the Oasis area and the refugee neighborhood also constitutes a clear pressure on the well-being of the residents of the city clearly.Preserving the irrigation system, traditional dwellings, and the Oasis in addition to the irrigation system are very important to preserve the ecological memory and contain green infrastructure, although its condition is not good, but it is one of the sites protected by law for its historical or cultural values and landscapes or architectural also the need for highways outside the city because the city is an important economic transit center and its provision is essential to economic life. Road expansion or new road projects (when it could adversely affect or limit development).

All urban expansions constitute environmental, energy and social pressure on the city, and it is necessary to take into account contraintes, land use, environmental networks or ecological corridors (when they impose borders or distances on development). A group of power lines and national and administrative roads that are protected by legal regulations are also considered obstacles such as gas lines and highvoltage electricity

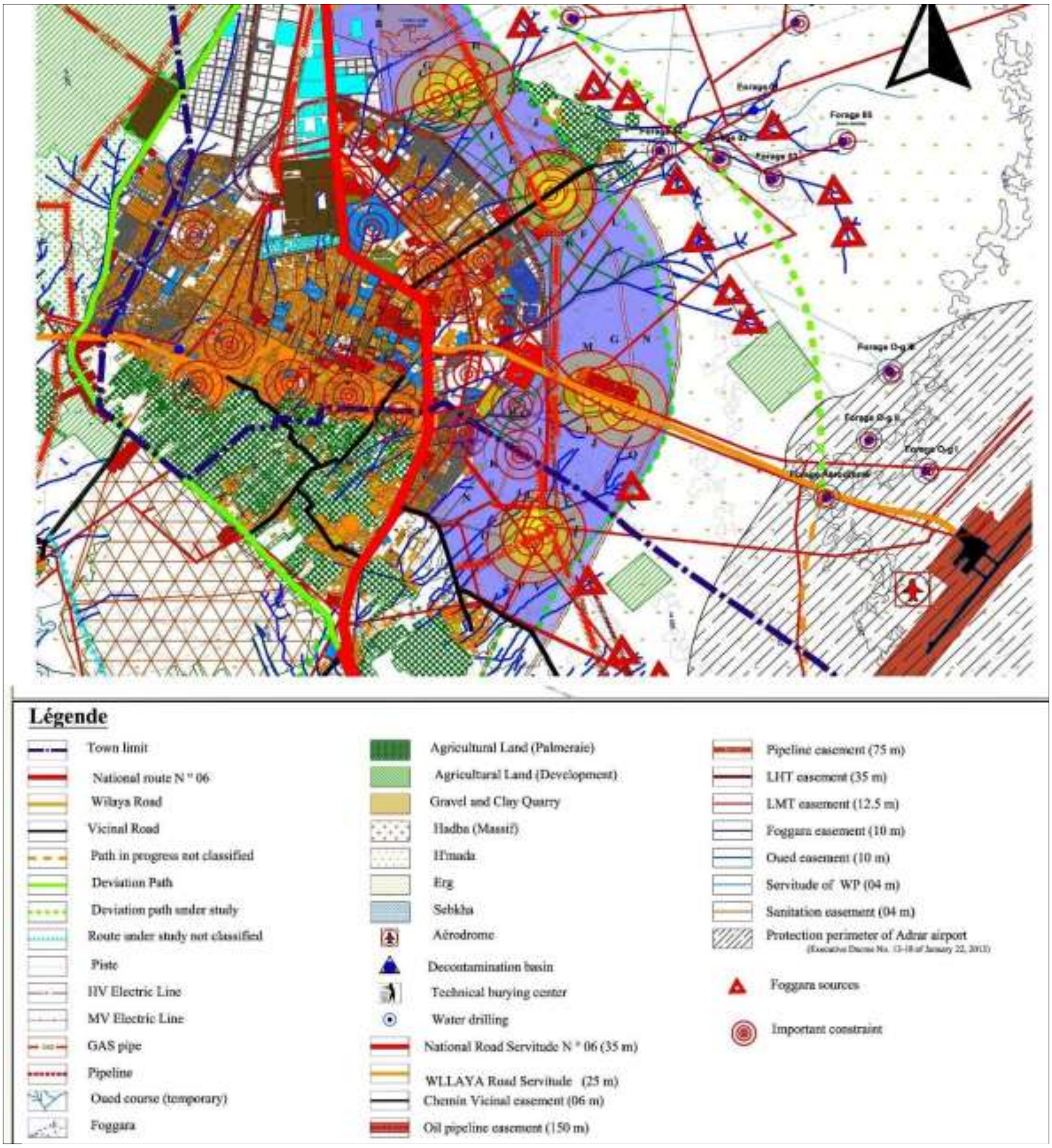


Figure VII-6 Constraint source author (Large-scale map in the appendix)

4. Areas of opportunities :

An opportunities (or possibilities) map is a useful tool to summarize collected information. Opportunities generally advance the design and can be seen as a visual representation of strengths and opportunities from the SWOT analysis.

Land ownership (availability of public or private lands): Although the terrain allows expansion in the northern part of the city due to the ease of construction in it, this expansion is a fatal mistake and the approach to construction in the low lands in the South has become more rational for the benefit it provides from the services of the ecosystem And take advantage of the wastewater And the irregation system.

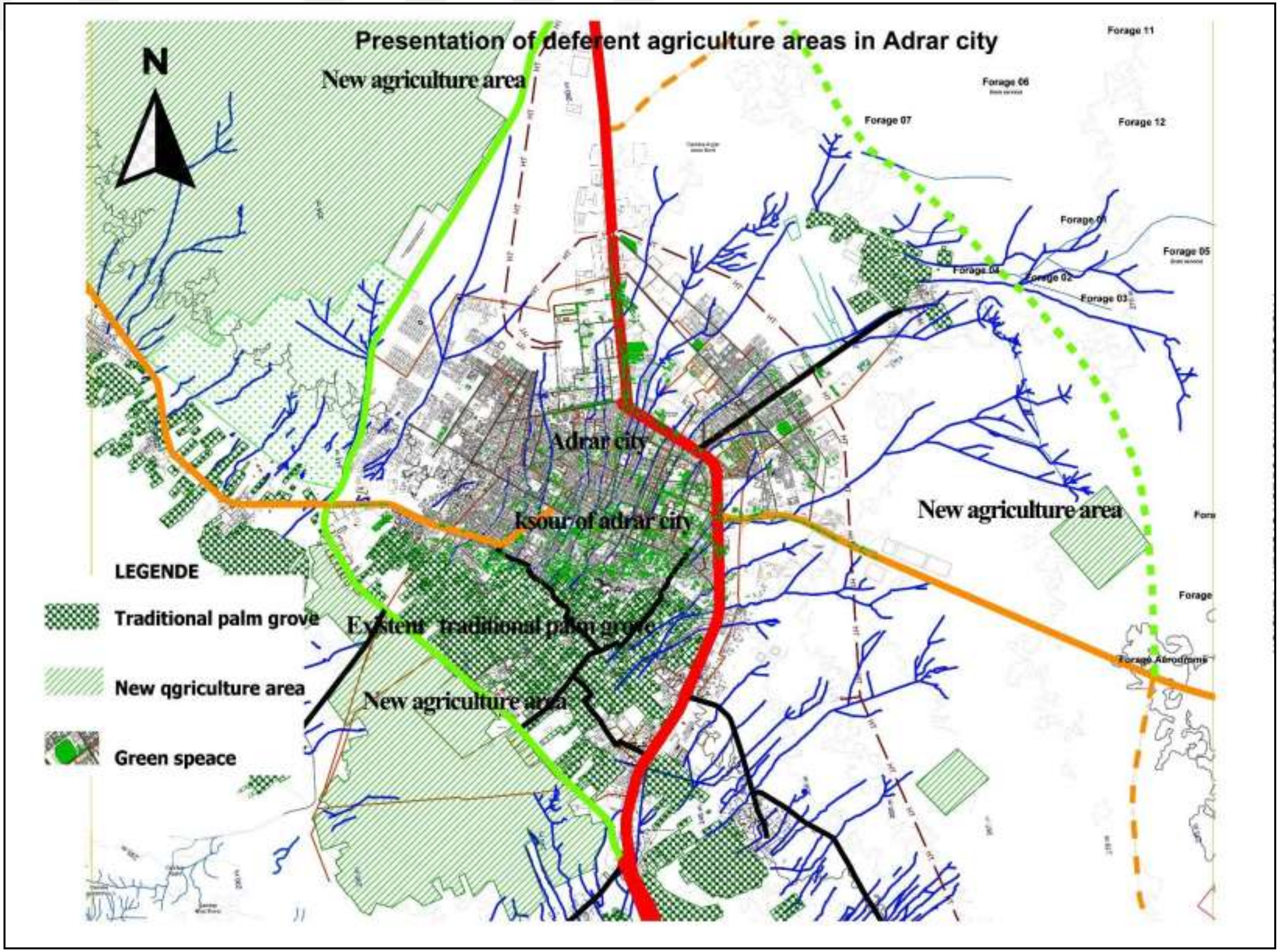
Access to existing land uses for services (such as hospitals, schools, and museums): In the recent period, the state has implemented many facilities in the new expansion, such as the medical pole, university, and many departments, which calls for thinking about more sustainable means of transportation between these facilities and various parts of city. The ancient city and the immigrant neighborhood have important lack of green infrastructure, such as green roads and green spaces, and it is necessary to provide these services.

Environmental and historical points: The heritage areas in the city have a special importance (for example, heritage monument or environmental networks and corridors) are represented in the Oasis and the irrigation system that must be developed and preserved, but on the contrary it is a duty it should inviteed to the structures of the population economy development by developing the traditional irrigation system and; supporting tourism by preserving buildings of architectural importance that can be renewed and used for new job projects planned in the surrounding areas and that can add value to the site under transformation. There is a creation of agricultural areas far from the city outside it, but there are no facilities, no schools, and the absence of residences. It forces the population to live in it for the economic motivation. It is necessary to merge the urban life of these areas in order to preserve the ecological memory and try to create a modern sustainable irrigation system.

Through the data obtained, the principles of thinking about intervention in this urban environment can defined.

- Northwest, West, Southwest, and South: Agricultural constraints, but farms in the South have positive goals unlike the North. Where it remarked the presence of modern palm grove is a target factor for a sustainable agricultural system as well. Its presence near the source of the traditional irrigation system is negative and must be corrected. (Figure VII 7)
- The emergence of a residential property, a "new city" in Tililan, and an important population centre, but trying to develop a sustainable reconstruction program could turn this area into an eco-urban centre.
- Maintaining the road network while trying to cultivate these roads, according to scientific standards.
- Trying to develop the idea of renewing the traditional irrigation system and thinking about reuse of wastewater in the city.

Considering the choice of land for the selected programs (sub-divisions and facilities) and thinking in the South of the city, unlike the previous expansion, but using ecological urbanism techniques the present urban form has many unsustainable data that need to be rectified. It is preferable to keep the existing urban form and proceed to fill the ring road and to keep the concept of blocks, streets, and create spaces of centrality that could not be implemented. These data can be seen from the following maps Figure VII 8 :



Presentation of deferent agriculture areas in Adrar city
N
New agriculture area
Forage 11
Forage 06
Forage 07
Forage 12
Forage 01
Forage 05
Forage 04
Forage 02
Forage 03
Adrar city
Ksour of adrar city
New agriculture area
LEGENDE
Traditional palm grove
New qgriculture area
Green speace
Existent traditional palm grove
New agriculture area
Forage Aérodrome
Forage

Figure VII-7Green area in Adrar city (Large-scale map in the appendix)

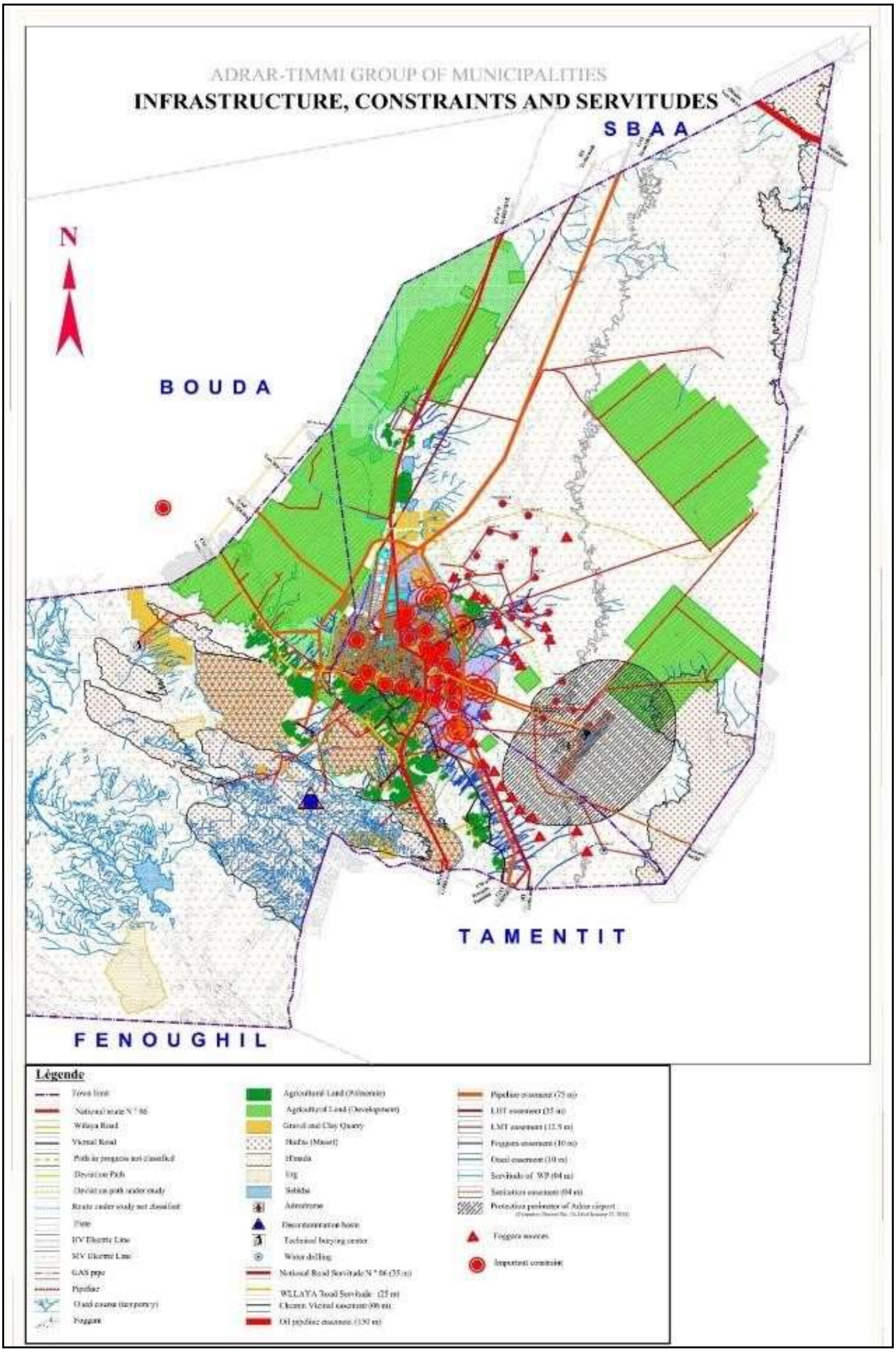
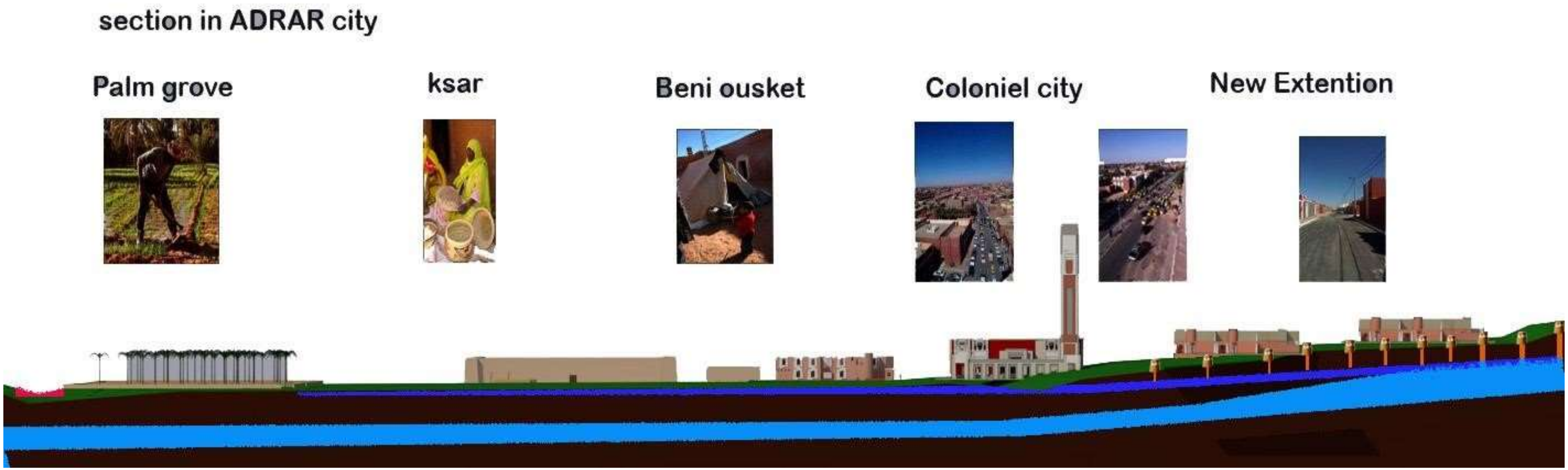

ADRAR-TIMMI GROUP OF MUNICIPALITIES
INFRASTRUCTURE, CONSTRAINTS AND SERVITUDES
SBAA
N
BOUDA
TAMENTIT
FENOUGHIL
Légende
Town limit
Wilaya Road
Vicinal Road
Deviation Path
HV Electric Line
MV Electric Line
GAS pipe
Pipeline
Foggara
Agricultural Land (Development)
Gravel and Clay Quarry
Sebkha
Aerodrome
Decontamination basin
Technical burying center
Water drilling
National Road Servitude N ° 06 (35 m)
Oil pipeline easement (130 m)
Pipeline easement (75 m)
LHT easement (35 m)
LMT easement (12.5 m)
Foggara easement (10 m)
Servitude of WP (04 m)
Protection perimeter of Adrar airport
Foggara sources
Important constraint

Figure VII-8 Infrastructure constraint and servitude (Large-scale map in the appendix)

5. Sections

Sections are a line across the landscape through which the designer records the related phenomena of study, such as the foundation, plants, buildings, and roads. Sections are a very important cross-section of a cross-section of a place. This method has been used by many designers as the locations within each geographical area are evaluated and described according to its location. Many urban engineers, landscape designers, and landscape architects have followed in the footsteps of Geddes, including Ian McHarg, trying through the syllables to analyse the natural and cultural factors of the place. For example, it remarked the relationship between the irrigation system and the Oasis; green areas in the city; the roads. The sections are very important. But we will accomplish a hypothetical passage through which we try to clarify the relationship between the various components of the urban fabric.

This section in (FigureVII 8) explains the interrelationships between the different urban spaces, groundwater, and the traditional irrigation system. It explains how the new expansions over the traditional irrigation water sources are a well thought out choice. These areas are also exposed to the hot winds in the summer and the cold winds in the winter season, which makes it more energy-consuming and a living presence of immigrants during plots, and is now in the city centre, making a major imbalance in the environmental and social balance, which is what calls for work to develop it. The problem of used water must be solved by placing filter stations during the neighbourhoods to use it to irrigate green areas and reduce their impact on the Oasis and the layer of groundwater that the city's residents use for drinking.



FigureVII-9 Section of Adrar city shows different urban patterns and hydrogeological layer

6. Suitability Analysis of Adrar city

Suitability analysis is one of the best known and most effective methods to synthesize the collected information. A broadly defined land use suitability analysis aims to determine the most appropriate spatial pattern for future land uses according to the identification of requirements, preferences, or predictors of certain activities.
GIS-based land use suitability analysis has been applied in a variety of situations including environmental methods to determine the suitability of land / habitat for animal and plant species, geological preference, suitability of land for agricultural activities, landscaping and planning assessment, environmental impact assessment, and selection of the best site for facilities. Public and private sectors, and regional planning. This study focuses on analyzing land use appropriateness as applied in urban / regional / environmental planning and management rather than agricultural / environmental / geological applications.

The economic need and the growing population impose the increasing need for land year after year in most countries. However, this need negatively affected the quality of life within cities and negatively affected the environmental aspect of cities. To counter environmental, social, and economic constraints, an analysis of the suitability of urban residential land has become essential for urban planners to improve urban residential environments.

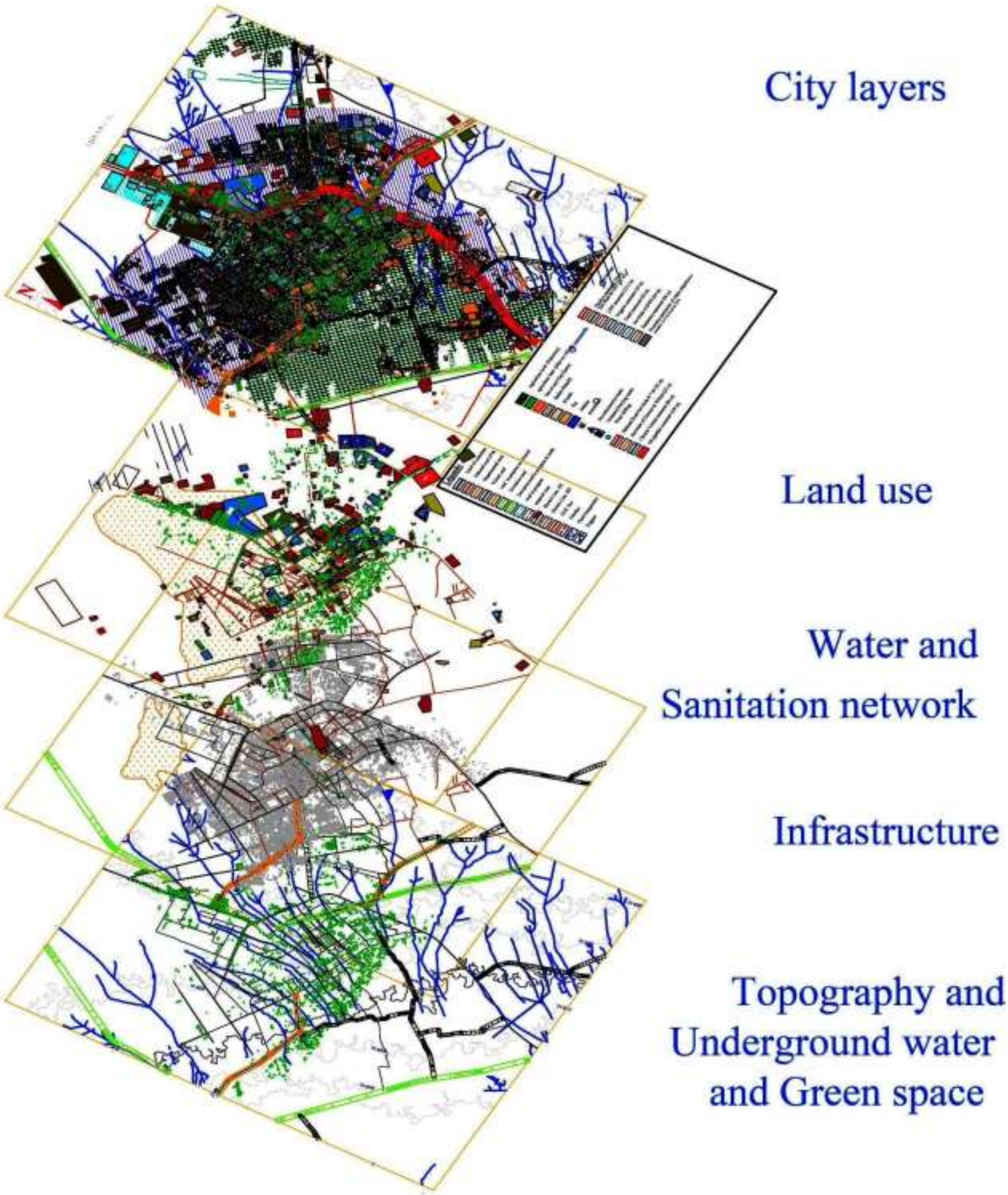


Figure VII-10 Map of superposition of layers (Large-scale map in the appendix)

Land use suitability analysis is the process of determining the eligibility of a particular plot of land for a particular use according to specific requirements, preferences, or predictions of certain activities. If an urban residential land suitability analysis is designed with the aim of identifying the best potential sites for land planning. Relying on geographic information system (GIS) technology, land use suitability analysis has implemented a shift from qualitative to quantitative analysis with the aim of gathering different types of information to help make better, high-quality decisions.

The model of ecological urbanism proposed can compare each factor according to its significance and create weights for each factor. Therefore, incorporating **MultiCriteria Evaluation MCE** methods into GIS is the most popular method for creating a final whiting map. The research direction in GIS- based into two categories: First, the field of application is broadening; Second, more Multi-Criteria Evaluation MCE methods have been added to the GIS-based land use suitability analysis. In terms of applications suitability of land for agricultural activities; evaluation of a specific suitability of land use (such as land use, urban residential land, public squares). The proposed Ecological urbanism suitability analyses model is based on the following steps in graph:

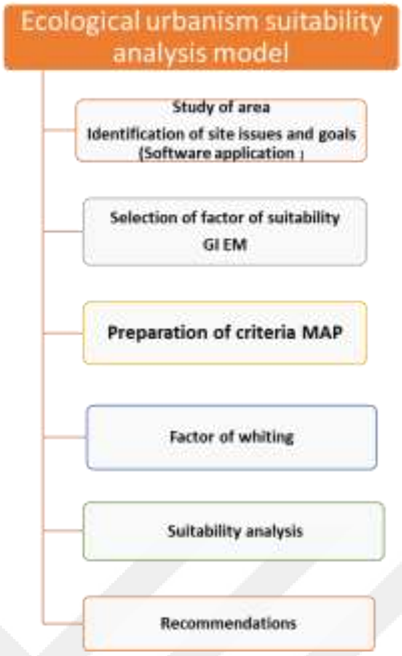


Figure VII-11 Ecological urbanism suitability analyses model

Quantitative monitoring of urban planning: The main issue in MCE based on geographic information systems is to find a better way to set and achieve the objectives set through the software application in the analysis of land use suitability based on GIS in the context of respecting selected natural, economic, and social factors. The Influencing factors are usually available to conduct a land use appropriateness analysis. However, the influencing factors extracted from the above data sources can only represent the external physical and physical properties of the urban components. Often the influencing factors in terms of residential safety, comfort, and convenience in the suitability analysis of urban residential land have a strong link with human social and economic activities, the need to preserve the ecological sphere and create public spaces that are difficult to extract, and therefore reliance on the Software application, make this task. much easier.

Study area: The city of Adrar is considered an average city in the African Sahara with a low population density. There are different types of urban lands and a diversity of urban fabric patterns, surrounded by a group of oases, urban villages, and rural settlements. The ecosystem in the African Sahara in general is weak and resource poor. Consequently, it is difficult to create a comfortable and liveable urban environment at the time of the enormous number of people residing in different types of residential land. Through Software app analysis of green infrastructure and ecological memory, in addition to public spaces and Software app indicators, inferred from indicators of sustainable development and the new reconstruction agenda, which show the poor environmental performance of new urban expansion patten and the neighborhood of immigrants.

The suitability analysis will be based on two main aspects. The first is the comparison and conformity of the plans, in addition to studying the suitability of the green infrastructure. Comparison of landscape data, agricultural lands, and irrigation system. Where the analysis shows the principle of the oasis's obtaining of groundwater through the exploitation of geographical data, in addition to the fact that sustainable groundwater channels formed a water network within the urban environment and encouraged people to develop life for several years. Green infrastructure and agricultural land development It are imperative to maintain the same logic followed in KSAR and the original oasis and stop the urban expansion towards the north. Preserving the oases on the Southern side helps protect the city from the influence of the Southern winds. The suitability of the terrain and its concentration on the Southern side of the city helps to allocate the Southern side for the expansion of the oasis and the development of the idea of creating a modern sustainable irrigation system based on available technologies .

- Superposition of urban water network layer and traditional irrigating system layer

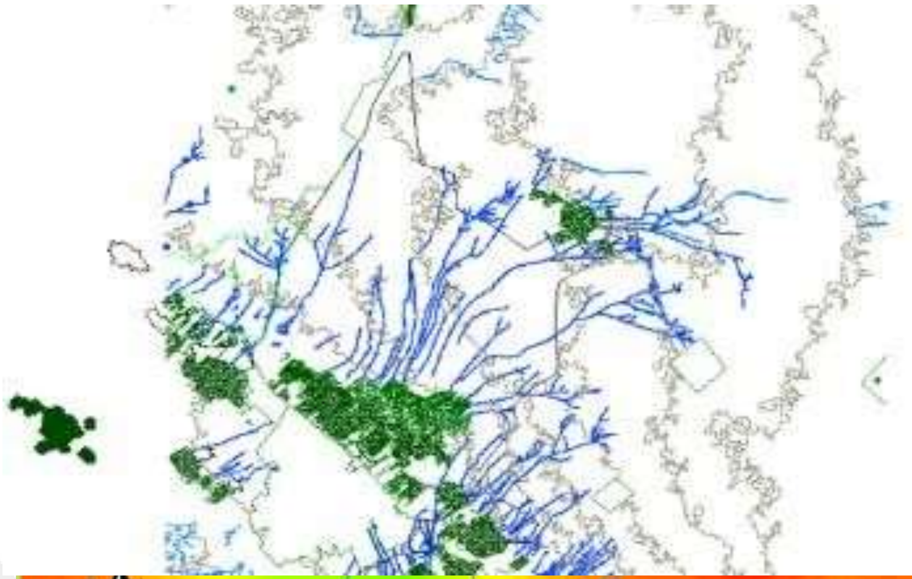


Figure VII-13 Foggara MAP produced with use of ArcGIS application

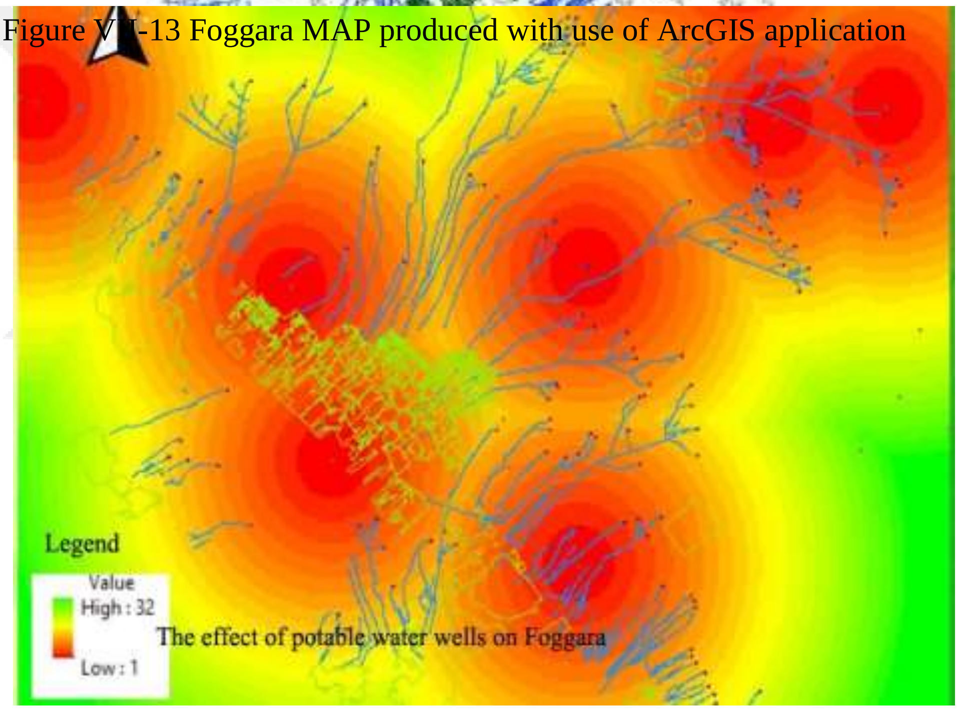


Figure VII-12 Impact of Potable water wells to traditional irrigation system (ArcGIS application)

It observed that the Potable water wells near to sources of irrigating systems, this situation is negatively affected oases and positive impact on environmental indicators in the urban centre and therefore should stop urban expansion in north of city.

Superposition of used water network layer and irrigating system and oasis layer (Figure VII). Used waters have negative environmental impact in the oases, also the final point of wastewater near to the palm grove area increase the possibility of polluting the underground water, this phenomenon will be environmental disaster at all levels. This factor makes us think the idea of circular urban design city extension will be catastrophic (Figure VII 11).

- Superposition residential areas, oasis, and green spaces

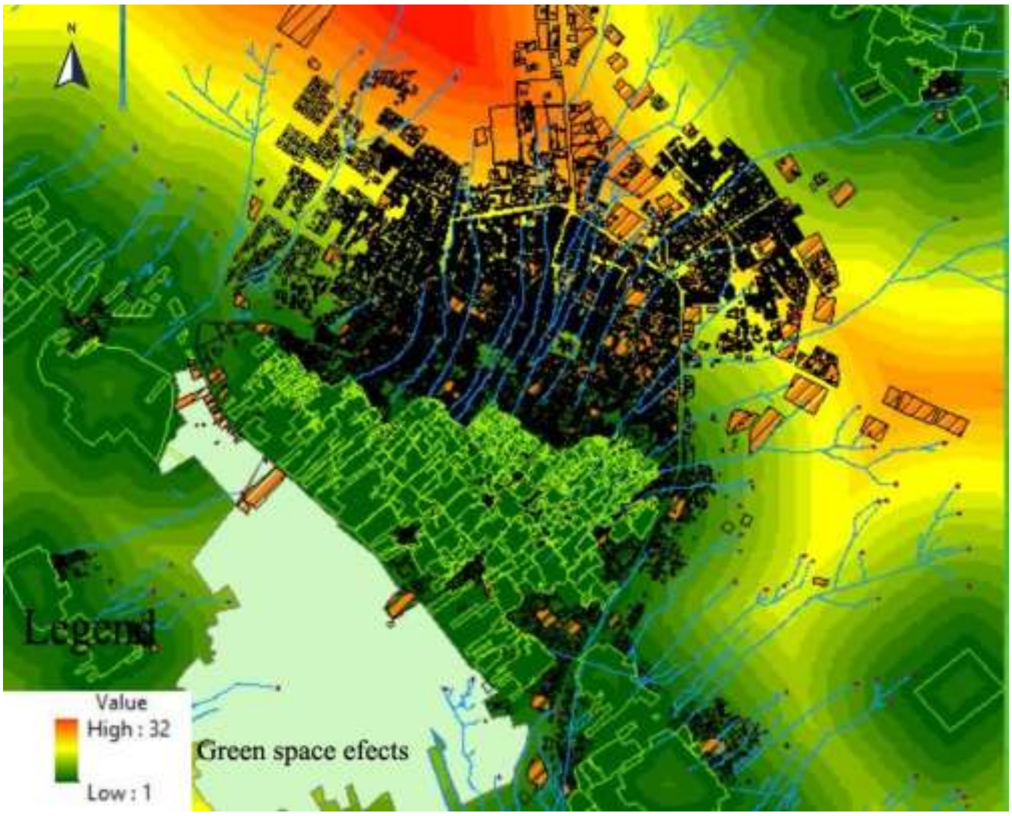


Figure VII-14 The impact of green infrastructure to heat island to Adrar city. Produced (with use of ArcGIS application)

The Oasis is the most important green area in the city, although there are some green spaces it mentioned in previous chapters, but they do not meet the widgets and standards in force in urban design laws. The direction of future residential areas across the eastern axe, this idea will be able to improve the advantage of oases, as well as the possibility of developing future irrigating systems, which is capable of irrigating and creating a nice atmosphere in the city can improve the city's urban life. (Figure VII 13)

Superposition of public facilities layers and oasis layers

All public facilities are based in the northeast of the city far from all residential areas in the city and is what gives us an idea of the need for transport in the city dramatically. The lack of public facilities near the original oasis and the neighborhood of immigrants , decrease of the lifestyle in these areas . for this raison that public facilities should be near to residential areas. The suitability analysis aims to determine residential land use based on availability of networks and accessibility to green spaces in addition to accessibility to public facilities, shopping centres and medical care. Green spaces should be subject to PS indicators, in addition to the possibilities of integrating them with the Oasis system. It is possible to separate the irrigated areas with treated water and underground water. Based on previous analysis, it remarked a clear retention of the population with urban expansions, in contrast to the apparent rise of the population density in the oasis and the immigrant's neighborhood, which directs us to try to preserve the logic of the natural expansion of the oasis and try to create a population balance for all areas of the city accordingly.

Distances to parks, shopping malls, medical services, and workplaces, If the residential land is close to the urban facilities, it is considered more liveable. Several studies have shown that access to urban facilities is one of the most important factors when people choose places to live. The analysis of the impacts of urban expansions are clear factors through which can observe the effects of future uses of land specialties and their impact on the city's ecosystem using modern technologies.

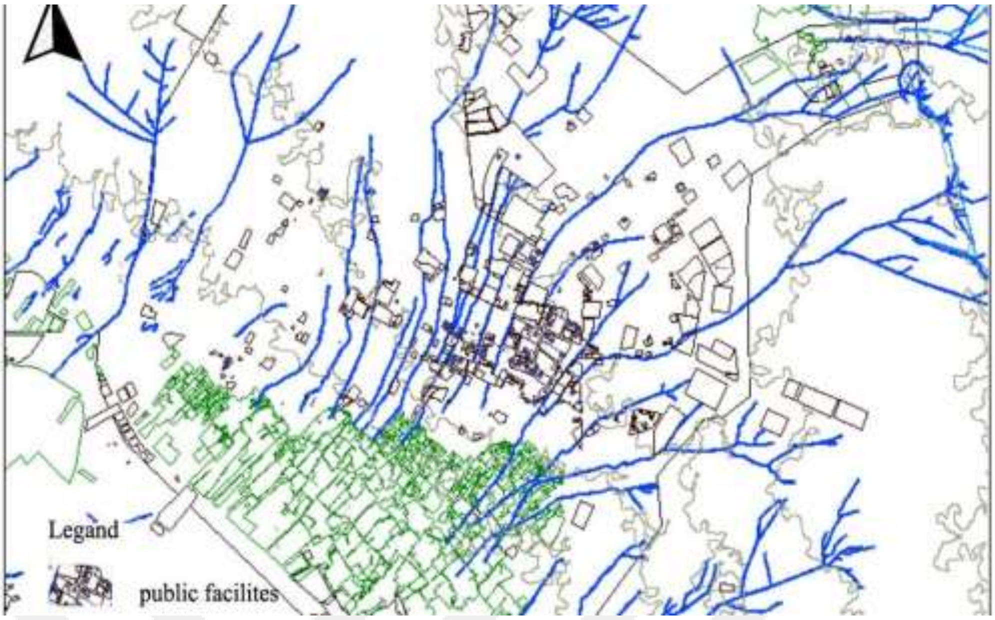


Figure VII-15 Public Facilities Adrar city Produced (with use of ArcGIS application)

Suitability Analysis and Planning of Green Infrastructure

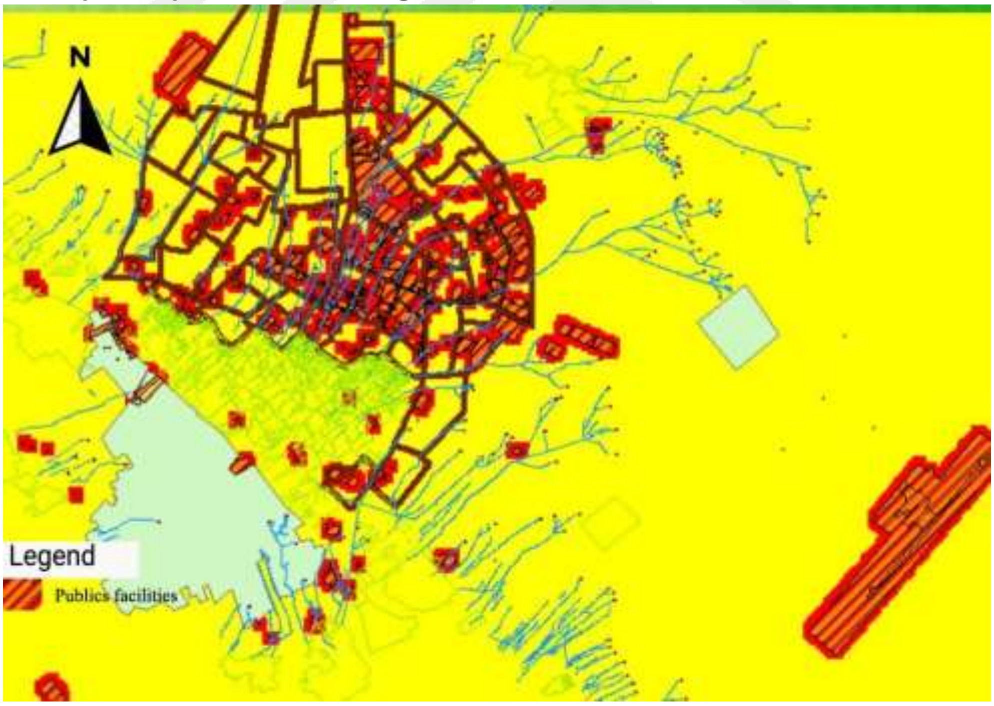


Figure VII-16 Situation of public facilities in the city (with use of ArcGIS application)

Our study proved through the previous chapters the importance of green infrastructure to improve the social, economic, and environmental conditions of life within the city in addition to urban resilience and food provision. Through the implementation of Software application, it remarked the disparity in the availability of green infrastructure in all parts of the city in addition to the GIS technology demonstrating the clear weakness of the infrastructure. Through the study of ecological memory, it observed that the suitability analysis showed the importance of realizing the infrastructure in different urban settings and developing a clear strategy for green infrastructure, as this strategy is considered the key to sustainable ecological planning by setting a clear vision of its availability in any urban expansion according to an appropriate study that makes urban model choices More efficient, convenient and allows for more urban resilience.

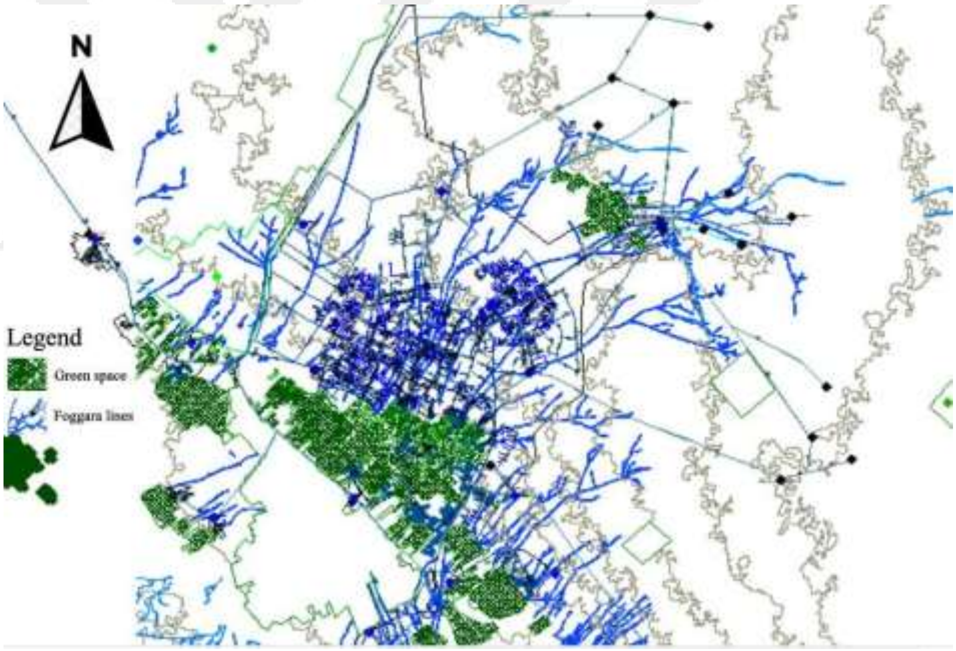


Figure VII-17 Green infrastructure map Adrar city (ArcGIS application)

Suitability methodologies generally involve six main steps, which include: identifying site issues. and goals, finding existing sources and available data; establishing of criteria (or appropriate factors to be evaluated); ranking and weighing the criteria, analyzing the data with geographic information systems (GIS); and evaluating outputs and results .

The methodology developed in parallel with the development of the Software application is based on the selection and combination of different factors to assess and analyse an area by combining different layers of spatial data with the purpose of creating a single assessment indicator. The model aims to reveal the spatial priorities of the GI site, considering some of the specific issues the region faces and needs to be addressed. The priority areas need to localize GI in places where the benefits are maximized so that the role and value of green infrastructure in the region is enhanced. The most appropriate model will identify areas of need in GI localization. As for the case of study in the desert environment, saving water is the backbone of life and the channels of the irrigation system represent the most sustainable technology that enables us to save life. Preserving the green infrastructure and its performance should be through preserving the irrigation system. The terrain is more encouraging to create new channels using modern technological technologies.

Suitability of green areas

In addition to the goals that have been set using the principles of specific infrastructure and principles of public spaces, it can propose more green spaces according to the principles identified through the study. Urban resilience is a key factor in any future conception of urban planning to confront climate change and illegal migration. The aim of the green infrastructure suitability analysis is to identify priority areas in which green infrastructure (GI) development is focused. The model is envisioned as a first approach to this issue and essential in determining geographic locations that need green areas. After this first analysis, and preceding implementation of GI, deeper examination at the local or district level should follow .It is necessary to study the risks that result from climate change, and through them, the green infrastructure in the city must be considered and the role it should play. After completing the analysis process based on GIS techniques, we can obtain a map of areas suitable for urban expansion and the status of all urban areas.

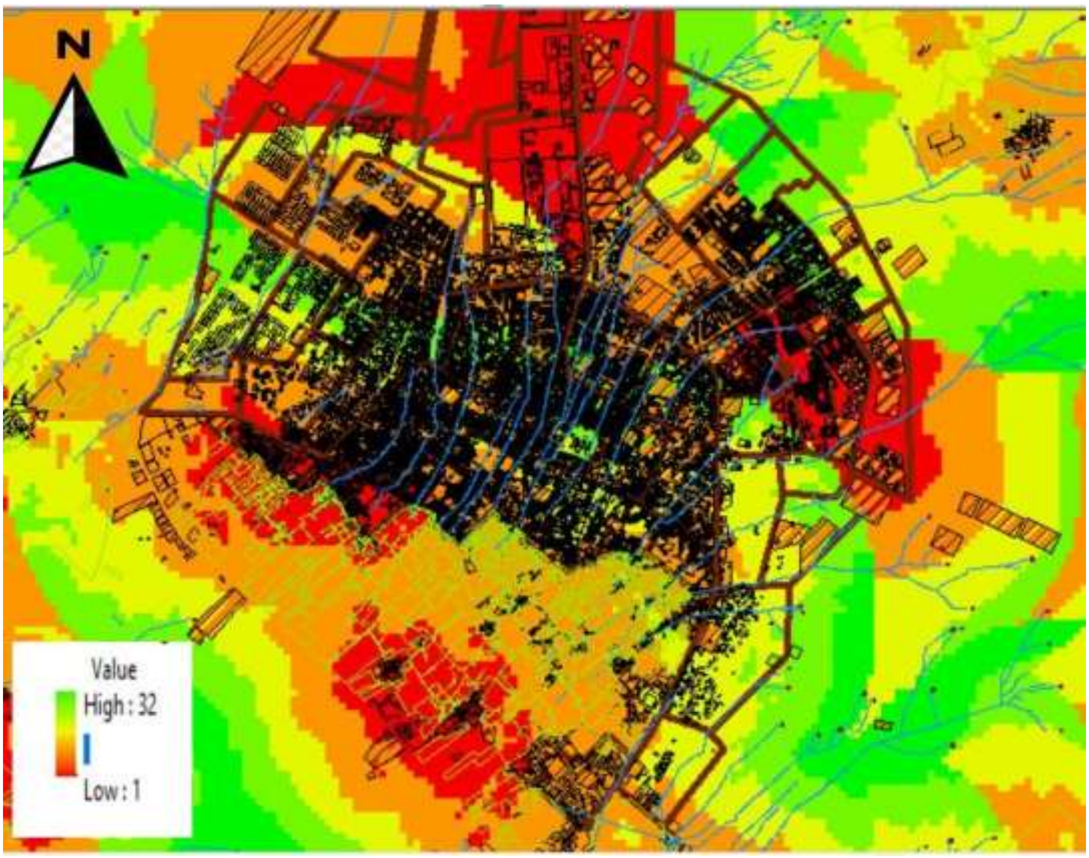


Figure VII-18 Suitability Analyse whiting MAP Adrar city
(ArcGIS application)

From our proposal for an appropriate model of ecological planning, considering the specific ecosystem data for these areas. Data and weights can be updated or Replacement in response to other challenges that the region face in the future or newly available. Also, the developed model can be modified to a different context, according to the data of each city. Therefore, the advanced model is not limited to desert cities but can be extended to other regions.

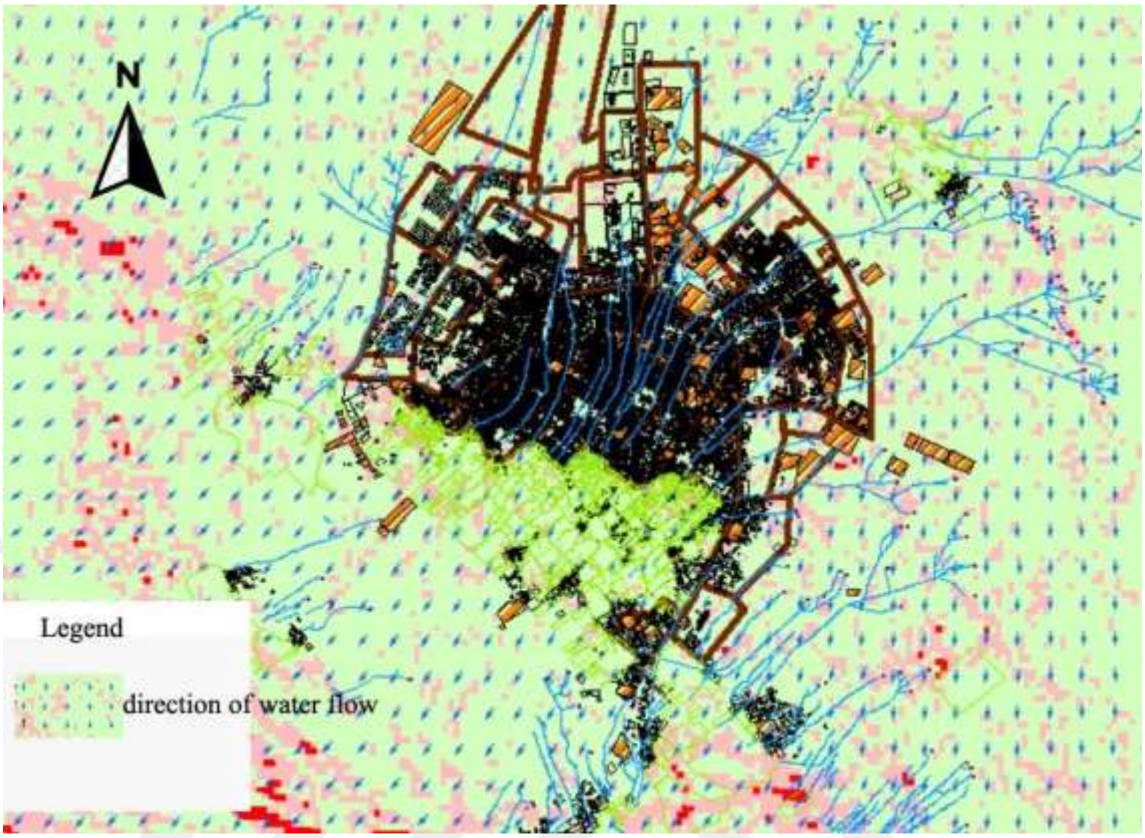


Figure VII-19 Flood risk map (Produced with use of ArcGIS application) Suitability analysis can play an important role as an effective decision -making tool in policymaking and empowering decision-makers to address climate change. Can be the resulting trapping maps. It is used as a tool to contribute to future or strategies for developing the area. Region's classification is the same as with the suitability of the confined and flood area. And plans to develop GI in the region.

The study of suitability enables us to determine the importance of the proposed green infrastructure and what it should proposed to preserve ecosystems, support the increase of biodiversity, and can provide environmental, social, and economic benefits to the entire region.

7.3.2 Diagnosis

Having largely completed the synthesis stage, it can envisage the next process in our study. The clear conclusion in our study is to synthesize information essentially two incentives: the first to diagnose design and the second to communicate. The first corresponds to the need to identify the basic project requirements and the requirements of residents and decision-makers. Through the collected data and data, it has a strict and necessary conceptualization and commitment to determine what is important and appropriate for the subsequent design steps. The second motivation relates to the relationship with the public and decision makers. The main goal of this diagnosis is to understand the place want to convert to play a positive role in the lives of the city's residents and all living things that occupy this space. In addition to our analyses of the current urban fabric and its environmental, social, and economic problems, to understand the reality of any bad scenario that interference in the urban environment can constitute, and therefore, after summarizing all these data, it can enter dialogues about the future.

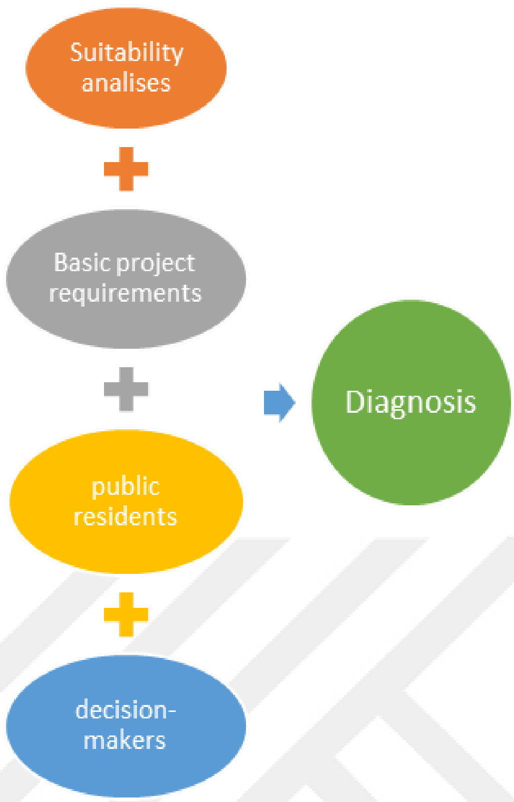


Figure VII-20 Diagnosis Principals

7.3.3 Options

Based on previous knowledge and analytical data, this stage of design is considered very important, as our aim will be to define the project objectives and strategies to a greater degree to a greater degree, and thus it can define the directions of urban ecological design for the study area. So that the plan clearly aims to give a future vision to the needs of the city for decades and to fix existing problems. Usually, the designer will work with the population and make the decision to select an option from these possibilities or to create a new option, the study will focus through a questionnaire and contact with a specific sample of the population, such as engineers and locals who were contacted previously in the data collection stage.

At this point, the study attempts to distinguish preferences and priorities. Also give the environmental layout and its important results, as well as the assumptions and results from the synthesis. Also, our choices must depend primarily on scientific and logical considerations, considering the ecological denaturation and economic potential of the studied environment, also considering the environmental perception. Understanding the needs of the population is of great importance, for example there are some spaces in the city that it perceived at first sight useless, but, have important role during religious ceremony once a year, and this celebration is very important for the population and therefore it is necessary to give importance to the opinion of the population and decision makers.

Tools for Making Choices

To present the options clearly, we are working on presenting a hard work and design blueprints, which are sometimes described in meta-project terms or preliminary design. The goals and strategy that will be adopted to achieve a specific set of design goals where the study try based on considerations and conclusions of ecological design to explain the task and adjust the relative importance of different requirements and expectations. This work is a first step when embarking on a design. Then the designer's view of the task leads to a concept. The concept does not need to mention anything about the form the design will take. Through all design processes, the study tries to stick to the ecological approach, through various forms that the concept can take. Dangerous goals and insights help define the concept plan.

Defining General Goal Lists

To draw up a conceptual plan, it renews commitment and attempt to reach the goals presented in the project problem. The study defines the objectives of the study mainly by achieving the objectives of the basic ecological city based on the needs of the project. However, it be useful to benefit from the work of previous designers to review the lists of goals and the general and most common dimensions taken from the various urban design anthologies studied in the third chapter. The Public Places Project (PPS)[12] provides four categories for consideration, from studying many designers' works, it is often considered. Suggested categories of PPS are Comfort, Accessibility, Vitality, and Image. By setting our goals, the study tries to shed light on the local implementation of the 2030 Agenda. It particularly (SDG11)The Sustainable Development Goal (SDG11) can be integrated with the New Urban Agenda (NUA).

The world has known the COVID-19 pandemic, which will be more devastating in poor and densely populated urban areas, as in poor and densely populated areas, it is difficult to apply precautionary measures such as social distancing, therefor it was remarked that the progress of the integration of urban planning is very important priority. Many designers have worked out a list of community and regional planning principles to reach the goals of eco-design. The study aim is developing the Software app Goals program. The principle of application is based on the study developed in theoretical knowledge of ecological urbanism (various urban theories and, The Various Planning Movements and models). in addition to the principles drawn from the study of green infrastructure and ecological memory in the case of the study.

Vision definition: An urban design project can often carry many hopes for many societies, such as developing cities or investing in investment, as is the case in many

[12] The Public Places Project (PPS) Goals

1. Comfort - Accessibility - Vitality - Image - Security. -Maintenance. - Sense of place- Sustainability- Implementation. -Carefully - Incorporating - Design the city space to be attractive - Open the edges between the city and buildings -Work to strengthen

cities around the world, as well as being targeted to address critical environmental, cultural, and social issues.

The process of vision: The study area is considered a very sensitive area through the data available to us, the study links the perception of city's future based on a total density of 15 homes / hectares, the land requirements will be about 436 hectares in the short term, 278 hectares in the medium term and 716 hectares in the long run, for a total need of 1,430 hectares. But in same time there are three scenarios before us in which the study tries to develop as concepts of growth in the future, which will result in a preferred scenario for growth in the future. Takes concepts of spatial design and application of sustainability indicators. To create a common vision for the entire city on joint strategies for resolving critical issues, Scenarios can be seen as stories or dates for the future. To develop trends and expectations to address the realization of scenarios, economic models of land use and transportation were used while considering environmental concerns, such as the protection of aquifers and major agricultural lands. The scenarios highlighted the differences between different growth policies and subsequent development patterns.

The first scenario: This scenario depends on the natural growth of the city and its population is increasing naturally and this scenario is very unlikely.

The second scenario: in addition to natural growth, the region generates many natural and energy capabilities, making it a clear investment area in the future. Its population will be double at least five times in the next twenty years and must receive a huge number of immigrants from the north of the country.

The third scenario: This city was a transit point for commercial caravans and knew waves of immigration, whether from sub-Saharan countries due to climatic changes and famine, adding waves of migration from the north, whether during French colonialism or before that added to that giant project that China seeks to accomplish and which seeks to Connecting Africa to the Mediterranean and then that this city can know a high population density and it is the most possible scenario to achieve in light of the geopolitical changes.

Concept plan:

The strengths of the ecological design of the city Adrar:

Through summarizing all data obtained from literary studies and analyses of the reality of the study case represented in the city of Adrar located in the South of Algeria, which is a special model for desert cities in Africa and to achieve the goals by developing the approach of urban ecological design the study tries to achieve the objectives presented with the selection Following element:

Scenario Choices:

It can inspire the planner to set priorities, identify vision, and create a project plan designed to determine how various choices impact the final configuration of the master plan. Making, looking at alternatives and evaluating their benefits and drawbacks is a helpful method for making a final presentation. The evaluation of the various options should be part of the dialogue. This stage shows, more than any other stage, that there is not only one solution to the problem of design. This stage is based on the results of the Software application analysis and suitability analysis.

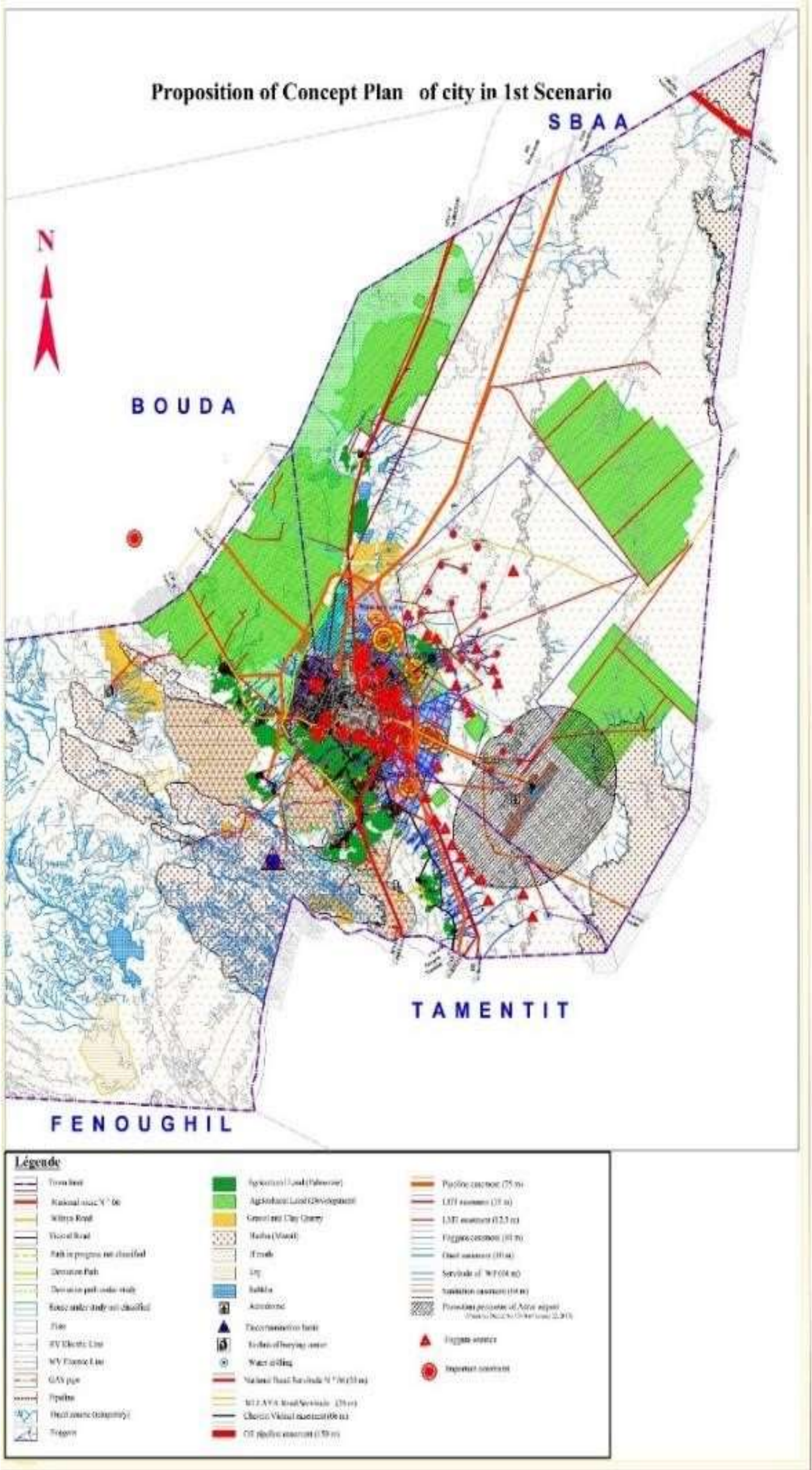


Fig ale map in
ure VII-21 Proposition of concept plan 1st scenario (Largethe appendix) (A-8)

1st Scenario

A conceptual plan (Figure VII 22) is a tool for transforming drawings and ideas that the designer and decision-makers want to pursue. In this first scenario it considering that the case study knows normal growth of population, according to data gated by study and ecological design principles, the case study will know radial expansion of the city and that by respecting the natural obstacles and infrastructure obstacles and work to fix the problems present at the city level in its various parts according to the principles previously announced.

3rd Scenario

The study will take in consideration third scenario (Figure VII 23) with no focus on the second scenario previously mentioned because in all cases the third scenario includes it on considering the natural growth of the city's population with the possibilities of emigration from northern Algeria for employment positions due to energy discoveries and the possibility of migration from sub-Saharan Africa, which makes the city in need of expansion that is not be normal. This proposal is considered very bold by adopting the establishment of ecological neighborhoods in agricultural areas that have recently been established and did not perform the desired role and trying to restore the vitality of these areas to reduce the pressure on the city in addition to linking them with public transport networks with sustainable means of transportation capable of creating ecological links between these Collections can help create wealth and economic activity. Also, in addition to the natural growth of the urban areas, the study proposes the growth of palm groves to keep its cultural, economic, and environmental roles in city. The palm groves can also preserve the social ecological memory and the exploitation of green infrastructure in preserving the city from the effects of climate changes and reducing irrational energy consumption. This scenario could be more economically and environmentally effective and less risky.

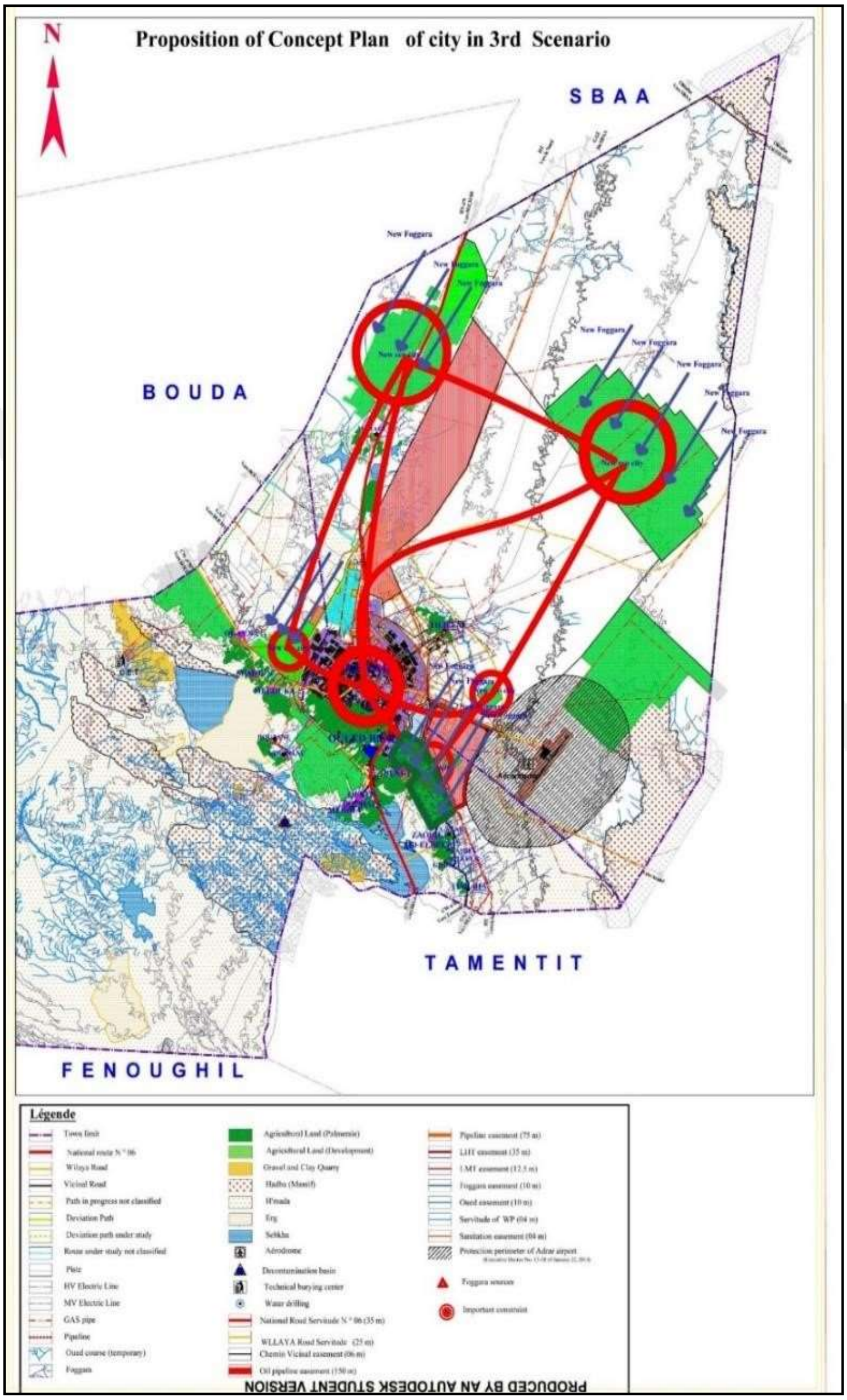


Figure VII-22Principal of concept plan scenario 3 (Large-scale map in the appendix) (A-10)

7.3.4 Dialogues with residents:

Dialogue is an important stage in any civilizational design. The term dialogue refers to a strong relationship between the designer, decision makers, and the various users of the studied place. The dialogue stage has proven its effectiveness and success in many urban projects beginning in the seventies of the last century, and this relationship lies between the designer and the decision-maker in the media and participation. “The difference is that the purpose of the media is to inform the public while the purpose of the audience’s participation is not only to inform the audience but also to ask the audience’s response regarding the audience’s needs and values and to evaluate the proposed solutions.” Participation involves a particularly deep form of participation, through which citizens engage in Score the result. The level of information, sharing and sharing depends on the circumstances. Under certain circumstances, public participation is a form of protest. Urban transformations, as described Eleanor Smith Morris (1997, 209)(Morris, 1997)

Public participation

Public participation in urban design processes, as in planning in general, is a way to address change that affects people's lives. Although the laws in Algeria are very clear, whereby the call for residents and rationing from the various departments concerned with the design project is required to express an opinion or approval in the presence of the mayor, and sometimes the presidency be required, but despite all these laws, the actual involvement of the population remains absent, but rather it is sufficient. By inviting associations that not represent the real opinion of the citizen, and therefore it is not possible to reach good design work in the absence of real awareness of the population.

That is why from the beginning of the academic work in our study and from the first stage of the research the study tried by dialogue with stakeholder to understand the needs of citizens and their fears through talks with various groups of society, including children, youth, workers, and professionals in various fields in addition to dialogues with decision-makers.

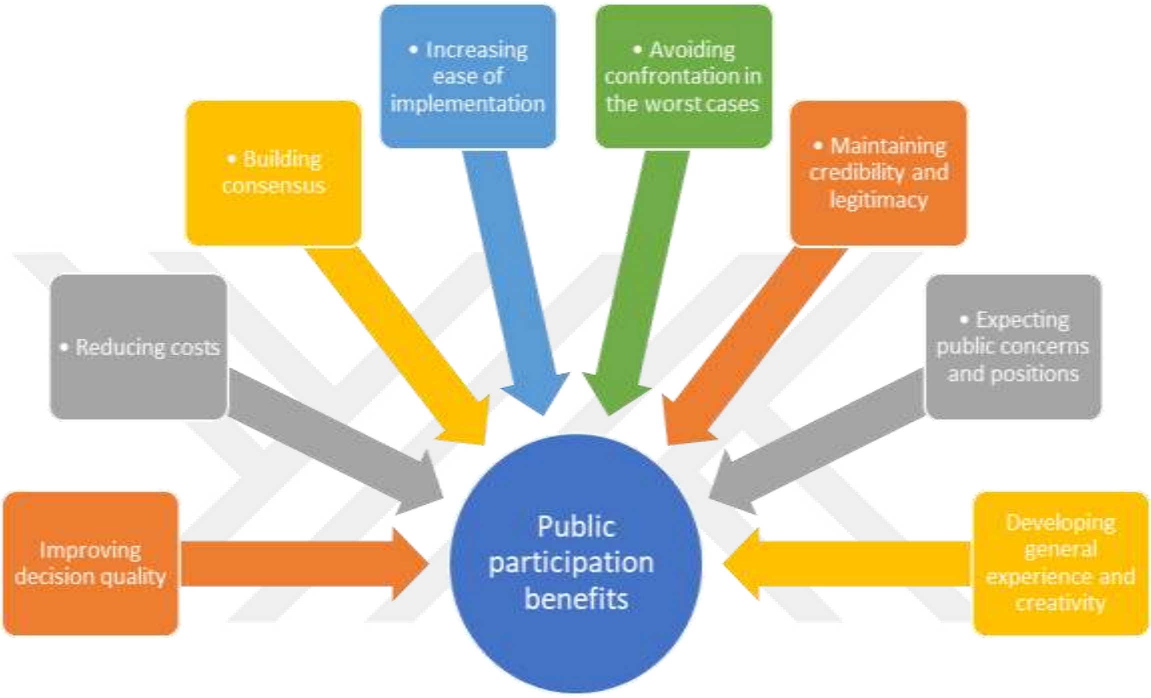


Figure VII-23 Public participation benefits

Experiences of public participation in urban design indicate that motivations are linked to a desire to make proposals for change and to participate in that change.

Two indicators of performance in urban design are how well they are perceived, first by the consumer and then, by all those influenced by the concept: people who stay, function, or rebuild in modern urban settings. The inhabitants of the desert areas of Southern Algeria have lived for a long time and are accustomed to discussing the problems of their social life. it cannot find any Oasis devoid of the group council headed by the sheikh of the KSAR and it is the wisest man and this to find a balance within the communities.

7.3.5 Master Plan

The master plan is the outcome of the previous steps from literature, data collection and analysis. Although the data are specific to each project and its specificity, there is a set of common principles among the greatest projects. The master plan describes and plans the concept of a comprehensive development of the study area, finding solutions to current problems and forecasting the future, guidelines for design and allocation of land use, the quality and characteristics of buildings, green areas, agricultural production sites, green infrastructure, infrastructure, public services, and their form. However, the accuracy of the details will vary from project to project, and the need to clarify the idea to be conveyed. The study tries to give a clearer idea by place a clear vision of the ecological city in the desert environment, whatever the differences in its problems.

Our perception of the master plan is not the glory of giving a very aesthetic fee, but rather it is to clarify more the eco-city within a specific environmental framework and according to previously defined problems with real-world analyses. Many designers considered the master plan much more than a different approach to the city's problems. For them, the plan symbolized a completely new way of thinking about the world. The problems that the plan was intended to address were the problems that all people faced .The master plan indicates that urban residents do not live as individuals, but as citizens, as members of the city. The plan was a public announcement of a public thing - that represented a conscious choice of the kind of world that citizens wanted to live in. The aim of the master plan is to change the city's environmental, social, and economic reality, that is, to reflect the extent of control of the urban belt, according to ecological controls.

Objectives of the master plan

The objectives of the master plan change according to the data of each project and the requests of decision makers also according to results of the Software application analysis and suitability analysis for draw the final concept of the main idea of the project. Participatory work and considering the ideas, reality, and privacy of the population. Urbanism of the studied space according to the environmental and ecological characteristics of the site. Looking forward to the future needs of the study area, including climate change, reducing dependence on fossil fuels, urbanism, food production, UGI strategy UEM; SEM strategy …etc.

The Master Plan Contents

A final master plan generally consists of a report, generously enriched by images, maps, artist and computer simulations, diagrams, and other visual communication. It also contains land use plans and explanatory clips, in addition to infrastructure plans and their visualization, and all the illustrations that communicate the idea.

The scale of the maps is according to the size of the project and the details that must be clarified. Through our study, which aims primarily to reach the most ideal model for finding true solutions and given the size of the field of study, the study will lay out a clear scheme for the fields of study and try to divide each side of the field of study according to its requirements and compare it to the current situation in addition to giving justifications for every suggestion and action. During our work, the study will work to complete the urbanism plan for the city, in addition to modelling ecological corridors and modelling buildings and ecological neighborhoods.

Characteristics and objectives of case of study master plan:

Although the goals of the comprehensive plan have been mentioned in the general reconstruction laws of the state of the study state and are included with clear legal texts, they do not prevent the regenerative conception of urban ecological design. Through the case study, the research explains in following map the principals of master plan:

1. Trying to develop a sustainable irrigation system by proposing a modern idea to develop this system.
2. The land-use plan component that determines the current land use and specifies the proposed distribution and location and the relationship between public and private land use.
3. Trying to preserve the ecological memory through a residential pattern in modern oases that depend on clean energy. These housing contain areas that can be grown with vegetables. Also, palm trees can be planted that reduce the consumption of energy and benefit the population economically.
4. Local materials are used in the construction and development to ensure safety in the event of floods.
5. . The element of economic development is very important considering economic crises and the escalation of diseases. It has become necessary to support clean biological agriculture, as the study propose converting modern farms mixed spaces between housing and public facilities that could in the future be places that reduce pressure on the city in the event of any displacement from neighboring countries.
6. A proposal to preserve the KSAR, oasis and restore the buildings that preserved their original identity, to support the tourist and cultural aspect while rebuilding public facilities in this area, reducing movements and internal congestion in the city, and creating ecological corridors that allow the mechanic circulation and favourite the use of bicycles and animals.

7. The element of open space and recreation, which provides an inventory of the most important areas of natural, cultural, and historical resources, as it is clear to reconstruct and preserve the ecological corridors in the colonial fabric and to prepare the major square in the city to allow the well-being of the population.
8. Public services facilities occupy large areas, mostly untapped, by planting foreign beautiful trees, where it is necessary to exploit these spaces considering the availability of public spaces and hand. The water used in these facilities can be used to irrigate crops due to their strong consumption of water such as hotels, schools, and Hospitals and barracks.
9. Placing a network of small biological stations and allocating special spaces for them within the wastewater network that works to water the ecological corridors by using clean energy within the framework of a plan for green and grey infrastructure.
10. Working to keep the water wells away from the water supply system is a very necessary thing.
11. Encouraging the establishment of clean energy stations considering the availability of sun and wind

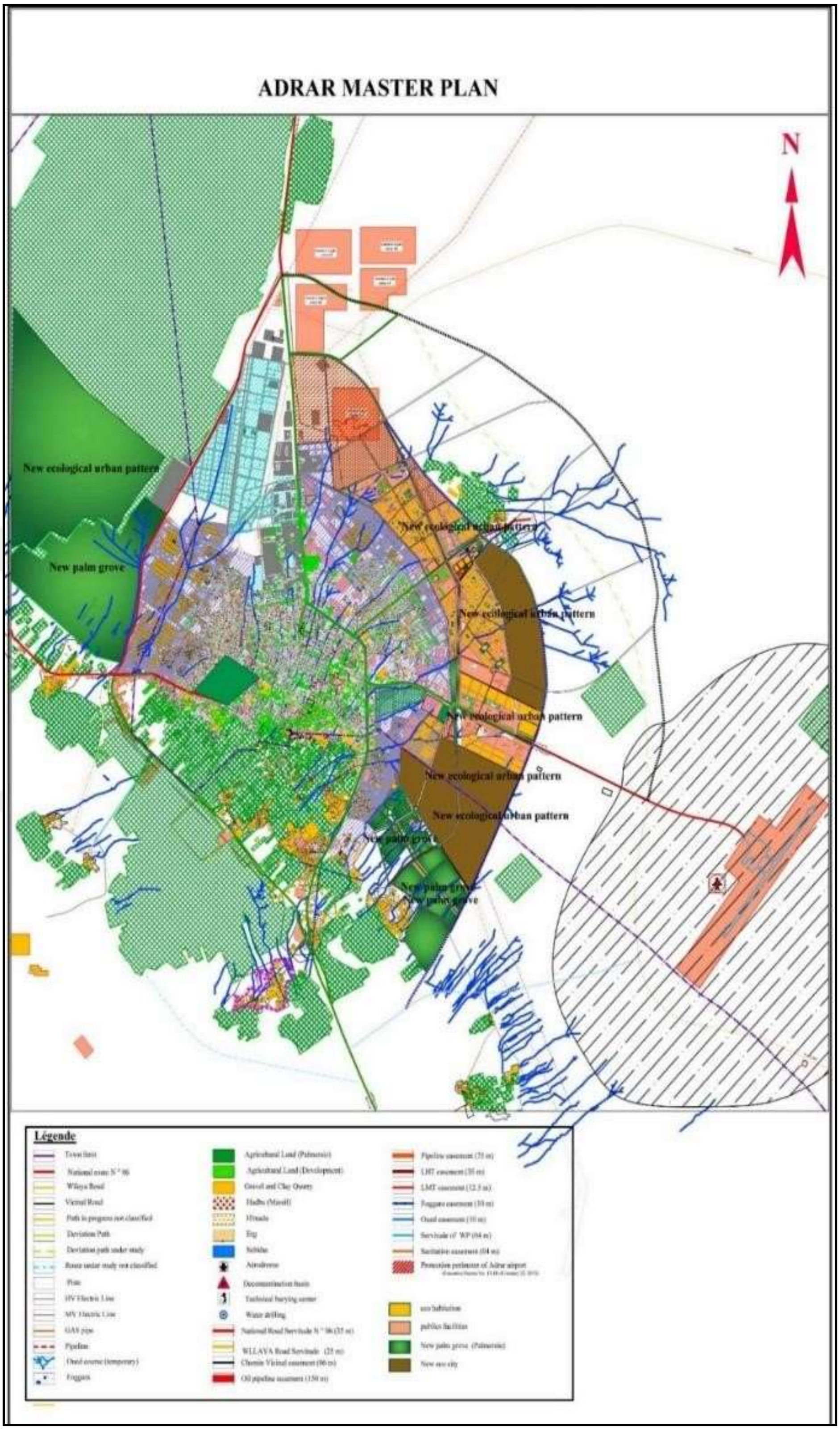


Figure VII-24Adrar master plan for ecological planning proposal (Large-scale map in the appendix (A-11))

7.3.6 Detail

Urban development criteria were defined as a basis for calculating future absorptive capacity and thinking about what a desert city might be in an ecosystem with special characteristics, by preparing estimates for a possible scenario for the city. This visualization is supported by an eco-spatial design approach that adheres to environmental conservation and sustainable systems, which is further detailed in this chapter. Detailed design of urban ecological design is very important. Where the designer generally works, giving the study the most importance and clarification, often. More definition is needed to guide the design of the elements carefully within a plan, such as buildings and open spaces; Or the economic viability of the plan must be determined. Irrigation network or ecological pathway section development suggestions although detailed design quickly follow the master plan, or sometimes years - after the master plan is presented.

7.4 Ecological Urbanism Principals for Desert Settlements

This charter contains 16 parts through which the study tries to set clear recommendations through which can create a clear framework for ecological urbanization in desert cities, depending on the problems that the case study experiences through studying the urban situation and analyzing of city ecosystem in addition to green infrastructure and social ecological memory analyses.

Charter Contains 16 Parts: Site design; Public space, Buildings, Landscape, GI Network Strategy Green Blue, feasibility of mobility, Ecological corridors, Modern irrigation system, Urban Ecological Farming, Automatic water, Urban heating island, zero carbon schedule, Affordability, Environmental and social impact, renewable energy.

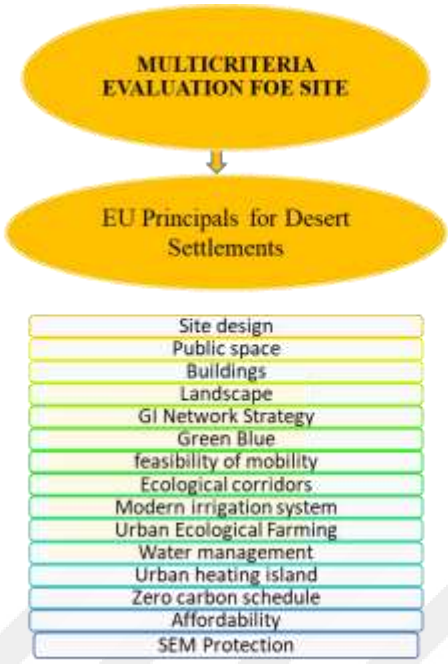


Figure VII-25EU Principals in Deserts Settlements Diagram

From the beginning of the research, the aim of study to appreciate the consequences of the historical stages faced by the case study and the findings that contributed to the rates of misery, inequality and social disparities that exist in the desert of Africa like any region, given the oil wells on its lands.

The ecological planning project will have a meaningful effect on people's wellbeing and build a more sustainable environment for social and economic transformation by collaborating through industries, layers, and stakeholders. The project is planned to be transformative, not only for the city, but also for its people. The new ecological district and modern Oasis will include houses, commercial areas, and light industrial sites. Schools and hospitals are just as important as recreational facilities, which include sports and green spaces.

This chart divis in:

1. Site design

1. Respecting the principles of sustainable development in site planning
2. Ensure that the Southern side of the city is an extension of the Oasis, because of its positive environmental impact.
3. Respect for the environment, the original nature of the place, as it is originally an Oasis, and that must be strengthened by preserving all components of the environment.
4. The planning is according to a clear urban structure and a horizon that aims to enhance the identity of the city.
5. The city has a special urban planning and architectural style in terms of urban form and building design that must be preserved.
6. Urban layouts are designed with green infrastructure and sustainable systems in mind through urban design.
7. Prioritize walking and biking, then public transportation, and sustainable alternative styles over private cars in the urban structure.
8. Maximize communication, accessibility and local permeability between the Oasis and the various regions, with a special focus on the linkages between the new ecological centres.
9. Create a safe and holistic environment for walking, cycling and public transportation of all types, ages, and abilities.

2. Public space

1. Bringing civic events and shared areas back to restore public space and build resources for social engagement.

2. Designing attractive public environments to have a venue for social engagement.
3. Build a healthy and welcoming public space for all ages and abilities.
4. Public areas will be clear and involved to safeguard people from street crime and abuse.
5. Reducing road congestion in public spaces as much as necessary
6. Build uninterrupted shaded walking and bike paths with tree canopies, colours of buildings and other structures.
7. Encourage opportunities for artistic expression and group art in line with the lively art scene of the area.
8. Propose sturdy and repair free street furniture in public areas.

3. Buildings

1. Preserving the traditional architectural style and the red paint of the façades
2. Build a combination of densities and sizes that emphasize urban centres and build desirable human-level environments.
3. Attach width and height ratios to street parts that improve shaded pathways.
4. Using ground-level non-residential uses of buildings to construct productive street fronts and passive observation and control of streets and public areas.

4. Landscape

1. Create green spaces interconnected with each other by afforestation paths, according to spatial capabilities and enhancing the performance of green infrastructure.

2. Promote the work of green spaces in absorbing disasters and improving the environmental performance by removing waste and wastewater.
3. Encouraging interaction and learning between the city's residents and the environment that reflects and respects the rural and agricultural traditions of Adrar.
4. Encourage greening of building facades and roofs, as appropriate.
5. Use local species of plants because of their role to preserve the ecosystem.

Figure VII-26 Adrar urban eco city Landscape

5. Urban green infrastructure strategy:

Any urban model should consider urban green infrastructure strategies. Based on the analysis and identification of its components and work on developing them to reach specific goals**.**

6. Social ecological memory and urban ecological memory preservation strategy:

The concept of social ecological memory is relatively new in the world but has never been discussed in the field of urban planning in African cities. In any urban model, the social ecological memory and urban ecological factors must be taken in consideration. which helps decision-makers and urban designers to better understand their effects on ecosystem services and their effects in achieving sustainability goals.

Figure VII-27 Difference between social housing and eco housing

7. Strategy of eco-smart city

Ecological thinking means smart thinking. The downtown neighborhoods in addition to the new ecological cities of the city must be smart buildings that accommodate the largest number of inhabitants in addition to the facilities provided by playgrounds, markets, and commercial centres., And common areas to play, breathe, and share life and intense plants on and around buildings and along hiking and cycling tracks will give the neighborhood. Green face with using of modern technologies.

8. The necessities for the proposed residential buildings for the city of Adrar: It is mandatory to achieve 50 percent more energy efficiency than will be achieved, according to the recommendations of the study.

1. According to the study of the electrical consumption of buildings in the previous chapters, the consumption cycle in the summer is the result of consumption resulting from the use of refrigerants, and therefore the use of photovoltaic energy is required on each building to produce fifty percent of the consumption.
2. The electrical distribution system for each new building must be designed to allow maximum use of demand-response technologies and strategies.
3. Apartments should have 50% natural lighting and natural ventilation, using traditional techniques.
4. Thermal insulation should be one of the most important building blocks, in addition to the possibilities of using green roofs and green walls and adopting a system of surrounding passages used in traditional architecture.
5. Employ a recycle program for all waste materials generated during the construction process.
6. Locally produced building materials must be used to reduce transportation energy use.
7. Consider the bicycle storage space.
8. Homes must provide the ability to charge electric cars and rely on renewable energies.
9. Any house contains at least fifty percent of the total area designated for urban agriculture and the promotion of rooftop agriculture to reduce energy costs and food consumption. As a result of the potential of nature, such as wind and solar energy, work must be done on. The combination of appropriate technologies which provides a sector of work for a wide segment of engineers graduating from Adrar University and progressive thinking and the use of local skills and materials to

show that this urban environment has everything you need to preserve its society and live green.

9. Feasibility of mobility

Figure VII-28 Axonometry Adrar eco city

Our conception of the ecological city cannot be devoid of our conception of future transport and movement within the urban milieu. The master plan needs to go into depth in handling and infrastructure issues. Where the ecological urban project must focus in urban development, to develop and improve mobility in it. Also, due attention must be paid to special needs, whether the height or size of the sidewalks, and thinking about the comfort and safety of this group of society. The main goal of the design should be to renew interest in the hub of tourists who visit many buildings and places that make up the historic centre of the city. The paths of tourist passage from the Oasis to the outskirts of the city and new centres should be developed by creating ecological corridors.

The identification of the route therefore be established by means of signs to direct visitors and horizontal or unique (floor) signage systems. Signs and this design are the most popular ways of leading visitors in the historic core of the region. For order to be successful, the signals must be clear, Provide information in a succinct manner and in a graphic format. The concern is that such signs can soon become part of this invisible "noise" of wallpaper in traditional centres and cities in general. Maps present a variety of challenges, including vocabulary. That tourism industry includes tourists from various countries and cultures. Language, Arabic or French, is not the mother tongue of many tourists.

10. Ecological corridors:

Corridors in terms of practical linkages between sites — are basically instruments for preserving or restoring a degree of coherence in fractured environments. In general, connecting isolated habitat patches will help improve the viability of local communities of species in a variety of ways:

1. Allowing individual animals exposure to a greater region of land — for example, foraging, promoting the dispersal of juveniles, or supporting the re-colonization of "soft" land areas.
2. Encouraging natural migration
3. facilitating genetic interchange with other local communities of the same species (although this usually involves only very occasional contact)
4. by creating incentives for individuals to migrate away from a declining environment or a region under pressure (which will become particularly necessary if climate change continues to have a significant effect on ecosystems)
5. Ensuring the quality of specific environmental mechanisms that are important to the needs of some organisms (such as regular flooding) Ecological corridors are built according to the importance of the roads. The importance of the quality of plants and trees is very important. Local species of palm trees must be planted to withstand the harsh climatic conditions and the lack of water consumption in

addition to preserving the species and vaccines. These corridors link the ancient and modern oases and green areas of the city.

Figure VII-29 Ecological corridors

11. Modern irrigation system:

The traditional irrigation system is one of the most important sustainable systems in the world, although it was found hundreds of years ago. The effects of the modern city are still resisting in our conception of the environmental extent in the desert. This system is still very effective. it has noticed the deterioration of the oases and his social ecological memory. Considering this deterioration, it suggested the creating modern system by preserving the same principles but with using of modern methods,

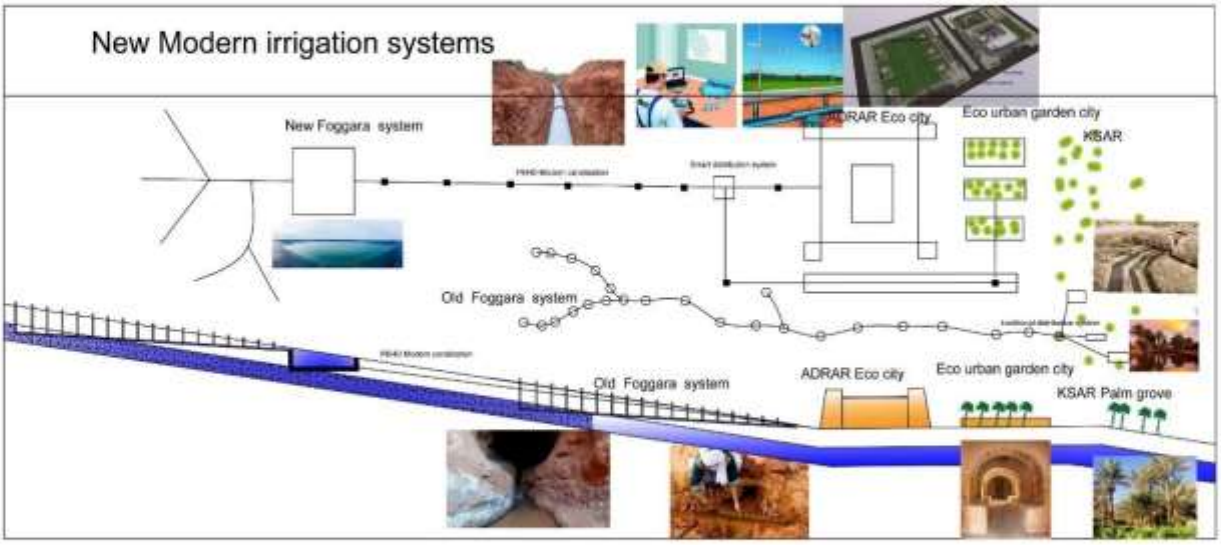


Figure VII-30 Proposition of modernisation of irrigation system

Trough the study of irrigation system in terms of performance and the important role plays in green infrastructure and social ecological memory, the study proposes an innovative modern model of irrigation system that does not need energy in the collection and access of water to the ecological city depends on alternative energy in the distribution system. The idea of the system is to dig wells far from the urban area with a choice of the topographic difference in height between the city and the aquifer, according to the drawing and create a reservoir that can collect the water from the channels linking the wells, and we can create several channels to increase the quantities of water.

After this, the water is transported on Friday in these tanks via modern highdensity polyethylene pipes that guarantee no leakage to the eco-city and are distributed through a modern and smart distribution system.

12. Urban ecological farming

The study proposes a special style of housing in the city that tries to preserve the large family lifestyle and preserves the ecological memory, according to preserving the architectural style of the city with an area of two thousand square meters. These agricultural housing mixes science and new engineering with sanctification of nature and biological diversity. Ensures safe cultivation and a balanced lifestyle. Protects the soil, water, and climate. Does not pollute the environment with chemical inputs or using genetically modified crops. By doing so, individuals bring many farmers - customers and suppliers, rather than companies that already organize our food - at their core, a vision of sustainability, equity, and food sovereignty in which safe and healthy food is grown to meet basic human needs and were control of food and agriculture rests with communities, rather than Transnational corporations. It uses clean energy and keeps animals like the birds and local breeds of sheep in addition to using animal waste as fertilizer.

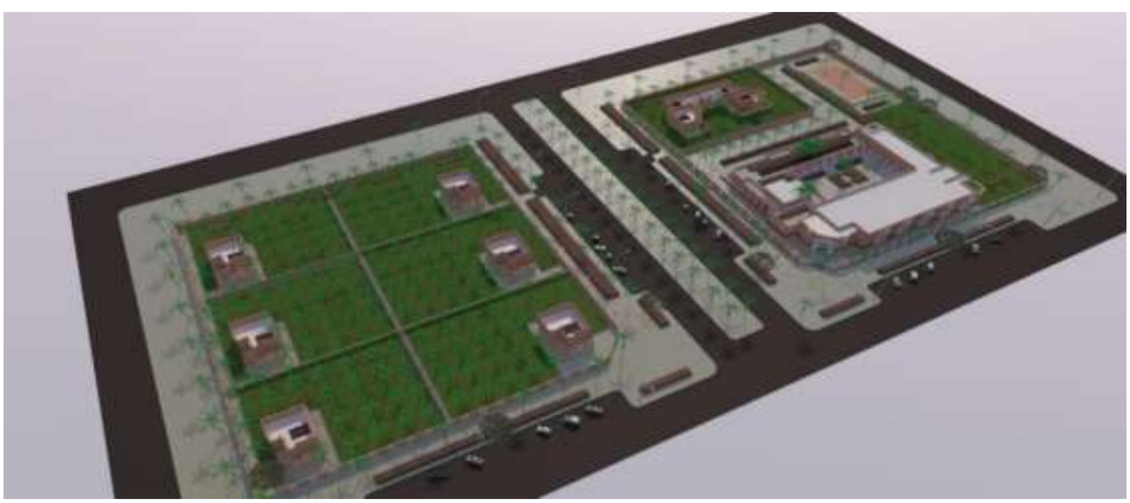


Figure VII-31Urban Ecological Farming in Adrar eco city

13. Sustainable transportation

Adrar city design clearly seeks to improve the corridors, encourage walking, give more importance to landscapes and streets, and free up space for more homes. This high building density is then combined with an urban planning that directly enhances shorter walking paths. A good public transportation system will provide people from A to B when distances are longer. benefit? The study also proposes the establishment of tram hills between the various proposed ecological centres in a way that serves sustainable mobility and greatly reduces the use of cars and even trucks to transport agricultural products.

14. Automatic water

The project aims to achieve water independence. By providing water through the traditional system of the paragraph and proposing that it be used to recharge fresh water. This avoids the need to import water from remote, limited, and local sources that dry out. As a result, water use will be reduced to less than half the usual work level.

13. Urban heating island

Urban infrastructure contributes significantly to increasing urban temperatures. But the use of green roofs and green spaces within an integrated network of green infrastructure to reduce the impact of the thermal island in half.

14. Zero carbon schedule

The Adrar region is the first region in which solar energy was tried from the eighties in the last century, where there are now three stations for producing solar energy and the power production plant by irrigation. Public production of clean energy plants increased.

The goal is to reduce demand and link it to renewable electricity generation. The project seeks to demonstrate that urban planning and prosperity can be achieved in the future without investing in central energy generation and associated infrastructure.

15. Affordability

Despite the Algerian state's attempts to provide social housing for the low-income classes, it failed due to the large demand and burdens of housing these homes due to their high energy consumption, but the eco-city provides housing with a productive agricultural family system and low cost of delivery and less energy consumption also for ordinary people. In the category affordable housing and lower middle-income people are eligible to rent or rent their own products.

16. Environmental and social impact

Security during an ecological planning. The city aims to equalize all members of society, especially women and children, and those with special needs, and to ensure the largest volume of normal life for children through safe play areas and to ensure that women reach workplaces through a design that considers safety.

Conclusion:

At the beginning of this research our goal was to define a new paradigm for ecological urban design in African cities. The objective of study is to propose a new, multidisciplinary practical vision. The objective of study has relied on the case of the study to approach the realities of the problems that most desert cities suffer to identify steps to help transform African desert cities located in a very difficult environmental framework into attractive and sustainable urban places.

The study was achieved, through the meticulous steps of urban ecological design in African cities, a true and accurate model of the urban design process. The design process reflects the evolution of thought in various areas of planning and design. Strictly written and systematic manner

The process of setting the principles of ecological urban design as a design policy in this region of the world will allow residents and decision-makers to improve the standard of living and preserve the environment in addition to providing these cities with urban resilience in the event of disasters.

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Economic factor

It is clear the economic importance of the project is very important as the amount of energy consumption increases dramatically and the adoption of mechanisms of ecological design is one of the important goals to achieve economic results:

Creating urban centers in agricultural areas that gives the owners of these lands more value for their lands in terms of real estate value in addition to creating a transportation network between these areas that helps create new lands that can be invested, which helps create wealth and provide new job positions in addition to the possibility of developing a network Sustainable transportation as electric trains.

The ecological corridors will be more sustainable, by planting many palm trees that are watered from the transmitted water, which will open job opportunities for emerging institutions that exploit these ecological corridors.

Creating a sustainable and racing construction pattern in a particular region will be inspiring at the national and regional levels, which will allow the marketing of building materials or studies for the whole region. The low value of renewable energy makes agricultural and industrial production in addition to tourism services very competitive at the global level, which attracts investments. All these factors compare the economic feasibility of the expected costs of implementing urban design projects with the projected revenues for the project.

Urban renewal programs, in the city center and the ancient city of the Oasis (usually, infrastructure and facilities) that will be implemented by public entities (municipalities, regional agencies, or state governments) The city knows many religious festivals at different times of the year and infrastructure development makes Including a tourist kiss par excellence. Creating urban agriculture that develops the economic capacity of the population, improving the health and social advantages.

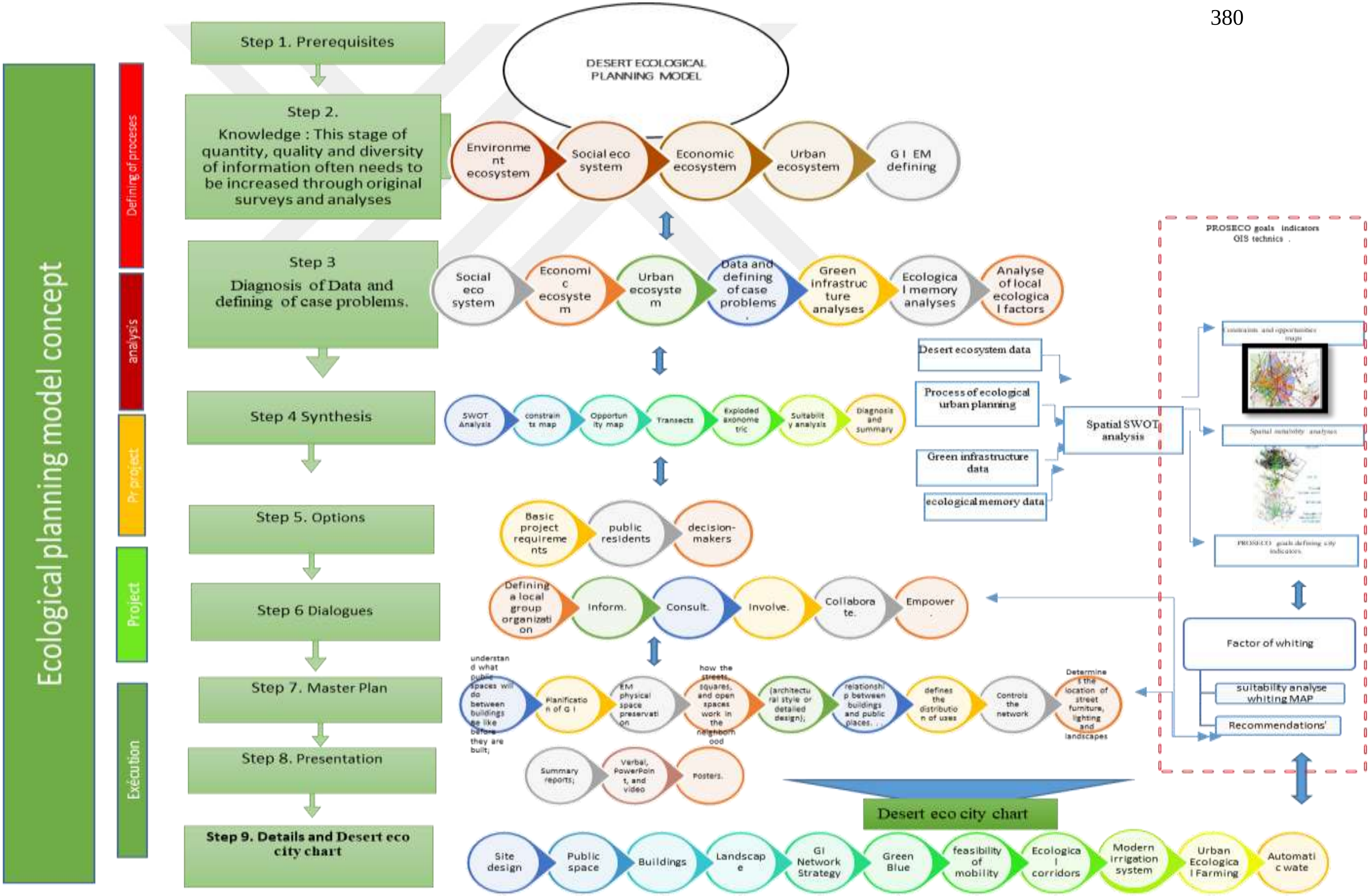
VIII. CONCLUSION

Through our study of the development of ecological planning, it noticed that it has not fully developed in addition to its neglect of the reality of the environmental problems that the South of the world suffers from. In addition to the lack of a theoretical and clear framework for ecological planning, the study has been working on proposing an ecological planning model for the African city. the conclusion from the beginning of the research that ecological planning is not the same as ecological design, both in the field of ecological urban development and in planning theory. and opposes the ecological view. On the other hand, the study provides ample evidence of ecosystem specificity in Africa and socioeconomic requirements .Environmental planning is more than just a new idea. The proposed ecological model is more than just an idea, it is a scientific work based on many disciplines. In addition, this study has proven in environmental affairs that matters are very complex and need accurate analysis and understanding of many indicators to reach the ecological urban model. Therefore, any ecological urban design needs to use modern technics. to achieve this goal, the study developed Software application as well as using GIS technology.

The proposed model for ecological planning in African cities is a new and evolving concept integrated between science and practice. It is considered a practical model for ecological planning, so that the model aims to define urban problems based on an understanding of the regional context and the peculiarities of the historical, natural, social and economic study area, and defining objectives, based on in-depth analyzes according to suggested indicators that can change and that through a dialogue between citizens

Decision-makers, local and regional data and analysis, detailed studies, planning concepts, and landscape plan, The proposed model relies on an enormous quantity of data so it is necessary to make use of the available technologies. The problems of planning in Africa are closely related to the policies of these countries.

Africa is the continent that will witness the biggest revolution in construction, and therefore it is imperative to integrate politicians and decision-makers in the urban perception and give them clear indications about the future. In contrast, the proposed model is a practical method that can be used in urban construction and management at the same time as it can be During which projects are proposed according to real-time data and not according to long-term programs. The model combines planning, design, and the environment. It consists of nine parallel and similar steps that are common in all areas: understanding and assessing current conditions, seeing, and making decisions about new actions, implementation, products, and provisions, and creating a new understanding. By synchronizing these steps, the proposed process model creates the potential for communication, coordination, and cooperation between disparate regions in a single city, which simultaneously generates ecological knowledge and a positive impact on the urban environment.



Ecological planning model concept
Defining of processes
analysis
Pr project
Project
Exécution
DESERT ECOLOGICAL PLANNING MODEL
Step 1. Prerequisites
Step 2.
Knowledge : This stage of quantity, quality and diversity of information often needs to be increased through original surveys and analyses
Environment ecosystem
Social eco system
Economic ecosystem
Urban ecosystem
G I EM defining
Step 3
Diagnosis of Data and defining of case problems.
Social eco system
Economic ecosystem
Urban ecosystem
Data and defining of case problems
Green infrastructure analyses
Ecological memory analyses
Analyse of local ecological factors
Step 4 Synthesis
SWOT Analysis
constraints map
Opportunity map
Transects
Exploded axonometric
Suitability analysis
Diagnosis and summary
Desert ecosystem data
Process of ecological urban planning
Green infrastructure data
ecological memory data
Spatial SWOT analysis
PROSECO goals indicators
GIS technics .
Spatial suitability analyses
Step 5. Options
Basic project requirements
public residents
decision-makers
Step 6 Dialogues
Defining a local group organization
Inform.
Consult.
Involve.
Collaborate.
Empower
Factor of whiting
suitability analyse whiting MAP
Recommendations'
Step 7. Master Plan
understand what public spaces will do between buildings be like before they are built;
Planification of G I
EM physical space preservation
how the streets, squares, and open spaces work in the neighborhood
(architectural style or detailed design);
relationship between buildings and public places. ...
defines the distribution of uses
Controls the network
Determines the location of street furniture, lighting and landscapes
Step 8. Presentation
Summary reports;
Verbal, PowerPoint, and video
Posters.
Desert eco city chart
Step 9. Details and Desert eco city chart
Site design
Public space
Buildings
Landscape
GI Network Strategy
Green Blue
feasibility of mobility
Ecological corridors
Modern Irrigation system
Urban Ecological Farming
Automatic wate

Figure VIII-1 Desert ecological planning model

The figure VIII-1 shows the proposed final ecological planning model. It consists of nine stages, with an explanation of the components of each stage, in addition to showing the techniques used.

More than seventy years have passed since Algeria's independence from the French occupation, but theories of urban design are still derived from the ancient perceptions of European cities, although these countries themselves have abandoned them and directed to eco-design and sustainable cities, but in most African countries there is no perception of Futuristic cities are more sustainable, which complicates life’s complications.

Our perception of ecological urbanism was the beginning of the academic and scientific thinking of the model of ecological urbanism that considers the environmental, social, and economic reality of the city of Adrar in the Algerian desert, where our thinking was on how to benefit from the experiences across in the world. Where in the previous chapters the study sought to present and analyse the pioneering experiences of the ecological city in all parts of the world, and even the emerging experience in Ronda, also Algerian agriculture village as previous experience in Southern Algeria.

In this final chapter, the study wishes to summarize and link the findings of the various previous chapters. Through this research, this thesis strive to set the beginning of a vision to the stages of urban ecological planning and technics that should not be neglected, which is what can be benefited from in many cities in the African Sahara, and which constitute a third of the African continent, as most cities, despite their different countries, are cities in the South of the world It has common challenges, similarities, and reciprocal relationships with international actors.

The urban heritage and the original centres of life are rich in ecological technologies that have developed over the years, which it can extract, reintegrate, and develop, but it always need real assessments and clear indicators about their performance.

The reintegration of ecological memory and sustainable traditional architecture cannot be of benefit without a true understanding of the ecosystem and providing a green infrastructure capable of providing ecosystem services.

Considering the rapid changes that the world knows and the complexities of life in cities, urban design theories are considered incapable of realizing the aspirations of the population and preserving the ecosystem if they do not use scientific technological tools. During this research, Software application was developed also the integration of GIS techniques to understand the reality of the complexities within the urban system and to give a clearer vision for decision-makers about the reality of cities and the ecosystem and the possibilities of providing safer, more comfortable, sustainable, and environmentally friendly cities with the peculiarities of these areas and the goals of sustainability. What Adrar lives in is an integral part of the problems faced by Algeria and the problems experienced by many cities in the desert of Africa and its South. However, other societies in the South of the world are often involved same issues in Southern Algerian cities and seek to get rid of them.

Chapter Three identifies the challenges faced by Algeria and the city of Adrar in managing the growth of population and rapid urbanization and maintaining sustainable growth stand facing to the economy of Hydrocarbons and Environmental Issues. Governments and decision makers have significant difficulties due to the economic and environmental problems, climate change and non-legitimate migration. Especially after Agenda 21 which formed an international consensus on "global thought, act locally" to protect shared land, state and local governments were urged to take tougher measures on environmental management by supranational organizations. Meanwhile, to continue economic growth, local and national governments also face the challenges of revitalizing fields and searching for new urban areas economic strategies, while managing urban / rural tensions.

In the Algerian context, ecological cities can be considered as a treatment for all to solve these challenges. Economically, ecological cities can generate demand for construction and the creation of new real estate markets to offset slow growth and low oil prices, especially after the recession of 2020 and the Corona epidemic. This is done by designing projects to accommodate the expanding rural and middle-class migrants, and to facilitate the transition to a consumer-based economy. About population management, the suburb must choose the locations of new eco-cities according to environmental, social, and economic data. In environmental terms, green features such as urban agriculture and restoration of drylands promised food security, peaceful coexistence between urban development and land conservation, reactivation of brown fields and greywater reuse in underperforming urban sites. By following this logic, the Eco-Cities model is presented as an ideal development model for places that share the main challenges Algeria faces for decades.

In addition to the possibility of solving common challenges, the idea of promoted eco-cities in Southern Algeria is also linked to cities in sub-Saharan. In the second part of research, this thesis studied models of eco-cities in the world. in addition to the fact that most emerging economies in the South of the world see the ecological city as the ideal model that can be emulated.

After several years of fever in building eco-cities in the world, there is an emerging question that needs attention and more research: What are the effects for the development of eco-cities?

This question involves a close examination of the social, environmental, and economic impacts of eco-cities on urban life. To date, clear and good studies have been absent from the effects of ecological urbanism. I would like to think about its effects, and I conclude my research by extracting insights from other urban development experiences (developing new cities, designing urban sustainability and mega-urban projects). Many studies argue that sustainable urban projects create new urban areas. While green urban designs in theory make places better for everyone. All examples in my research have been criticized for building residential pockets with greener streets, fresh air, and a bluish sky, is only available to the middle and global elites. but in general, the indigenous people were ignored, the creation of exclusive societies and the path towards ecological urbanism and a green economy. But it is unreasonable to ignore the human being because he is a part of the environment, the study tries purposefully to analyse the realities of the social ecological memory because it is the key to the success of any ecological design.

It is difficult to make a full assessment of whether it visualizes the future of the ecological city in a generation, but it is certain that the initial conception to preserve the social life of indigenous people and the capabilities of the environment will guarantee us at least guarantee the future of future generations.

In all the experiences of the world, the idea of eco-cities is built on corporate levy and tax consolidation, but the idea of the ecological city of Adrar stems from developing local sustainability ,and caring for green infrastructure , that aims to improve economic situation of local population , also to return the city to the regional role she was been playing in the past before the colonization of the region .Which transformed the life of the farmers' residents into relying on administrative works and services Where paid their wages from exploiting the gas and oil in produced in same the area. In general, eco city dwellings will be directed to the indigenous population to create family production enterprises, which is what is aimed at preserving the family ties and maintaining the private eco-system of the Oasis. This also provides a space for the well-being of investors and residents displaced from near or far areas the state has worked for years. On the division of free agricultural lands on the youth, but this politics never succeeded in reaching the desired goals, but on the contrary, she worked to demolish water layers, introduce hybrid plants, and use carcinogenic fertilizers, and negatively affected society's health, and known to produce a critical proportion of cancer compared to on the average.

Consequently, the concept of the ecological city aims to combine the economic need for agriculture, the protection of the ecological social memory and the preservation of the interconnectedness of society.

New Urban Agenda and SDGs

The implementation of the New Urban Agenda contributes to the localization of the 2030 Agenda for Sustainable Development in an integrated manner, and to the achievement of the Sustainable Development Goals and targets, including Goal 11 of making cities and human settlements inclusive, safe, resilient, and sustainable. Algeria intends to build on the achievements of the MDGs to achieve the sustainable development goals by 2030. It will certainly need more sustained efforts, a faster pace of achievements and more inclusive implementation mechanisms to achieve the goals. SDGs which cover a wider field of intervention. Indeed, more than the MDGs, the 2030 Agenda tackles the systemic obstacles that constrain sustainable development, including inequalities (SDG 10), the quality of education (SDG 4), the degradation of ecosystems (SDG 14). and 15), the sustainability of production and consumption patterns (SDG 12), human rights and the quality of governance (SDG 16). These are all relatively new fields compared to the MDGs which condition sustainable development, and which are at the crossroads of economic, social, and environmental dimensions. The Sustainable Development Goals Index and Dashboard Report for the Arab Region for the year 2019 showed that five countries emerged as regional leaders, with a total of 65 scores on the index or higher. These countries are

Algeria, the United Arab Emirates, Morocco, Tunisia, and Jordan, in descending order. Overall, the Arab region does not score high in achieving the sustainable development goals, with an average score of 58 out of 100. There is only one decade left to achieve the 2030 Agenda, and the region needs to accelerate its efforts in all areas of sustainable development. Even though the encouraging indications, but the reality does not reflect these indicators, given the situation in which cities are living. The study has taken the sustainable development goals SDGs seriously among the basic goals of the African ecological urban model by setting the goals of sustainable development 2030 and the new urban agenda among the main goals that must be improved, and through the application that aims in its first part to give the status of sustainable development indicators in the city and work to improve it, according to the development mechanisms achieved in any urban settlement, which is a mechanism that enables decision-makers, planners and residents to know the status of sustainable development indicators, in cities and contribute to making the right decisions in order to improve them.

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APPENDIX A

Maps

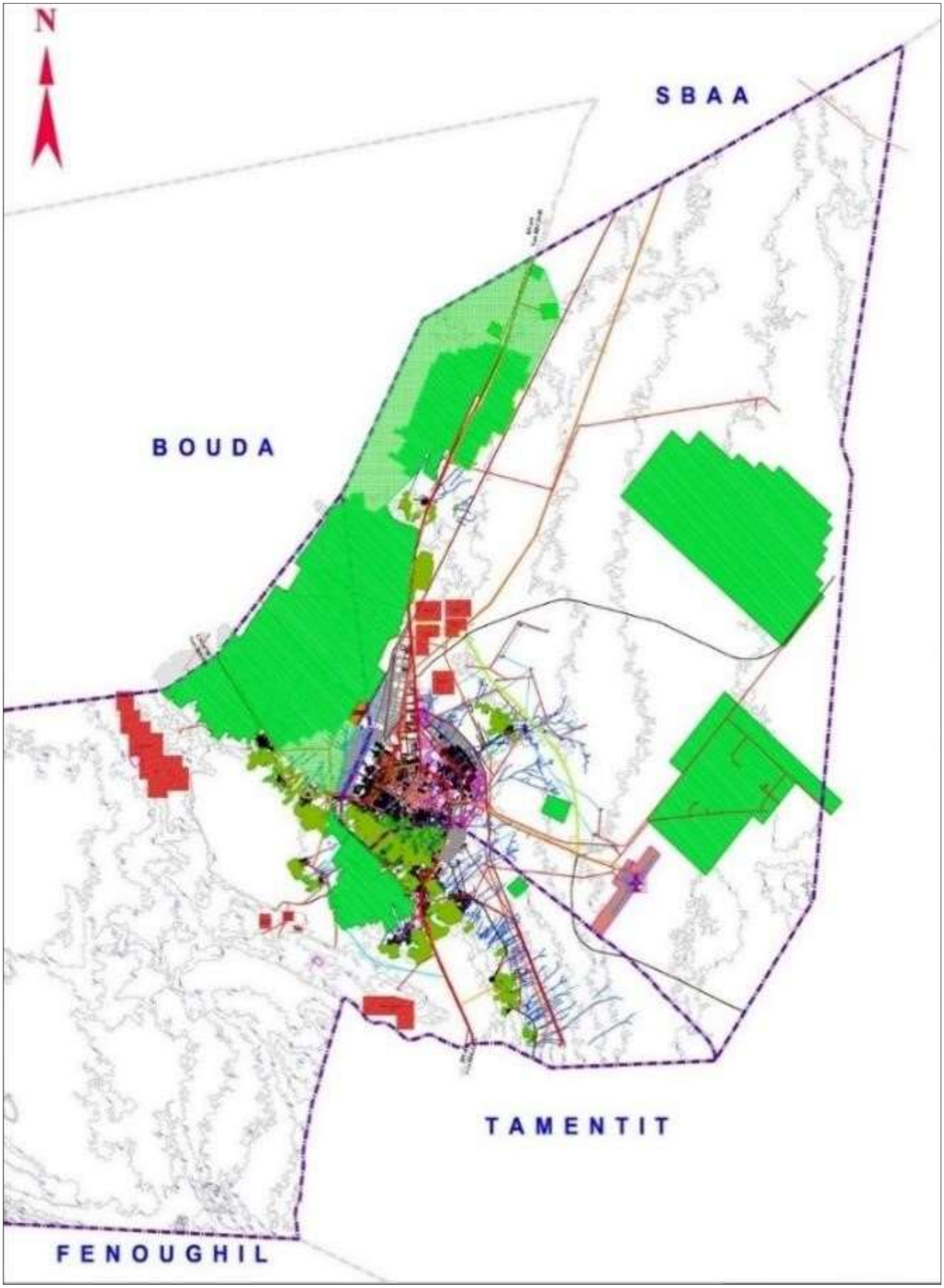


Figure 0-1 Agricultural activity space Adrar city source author (A-1)

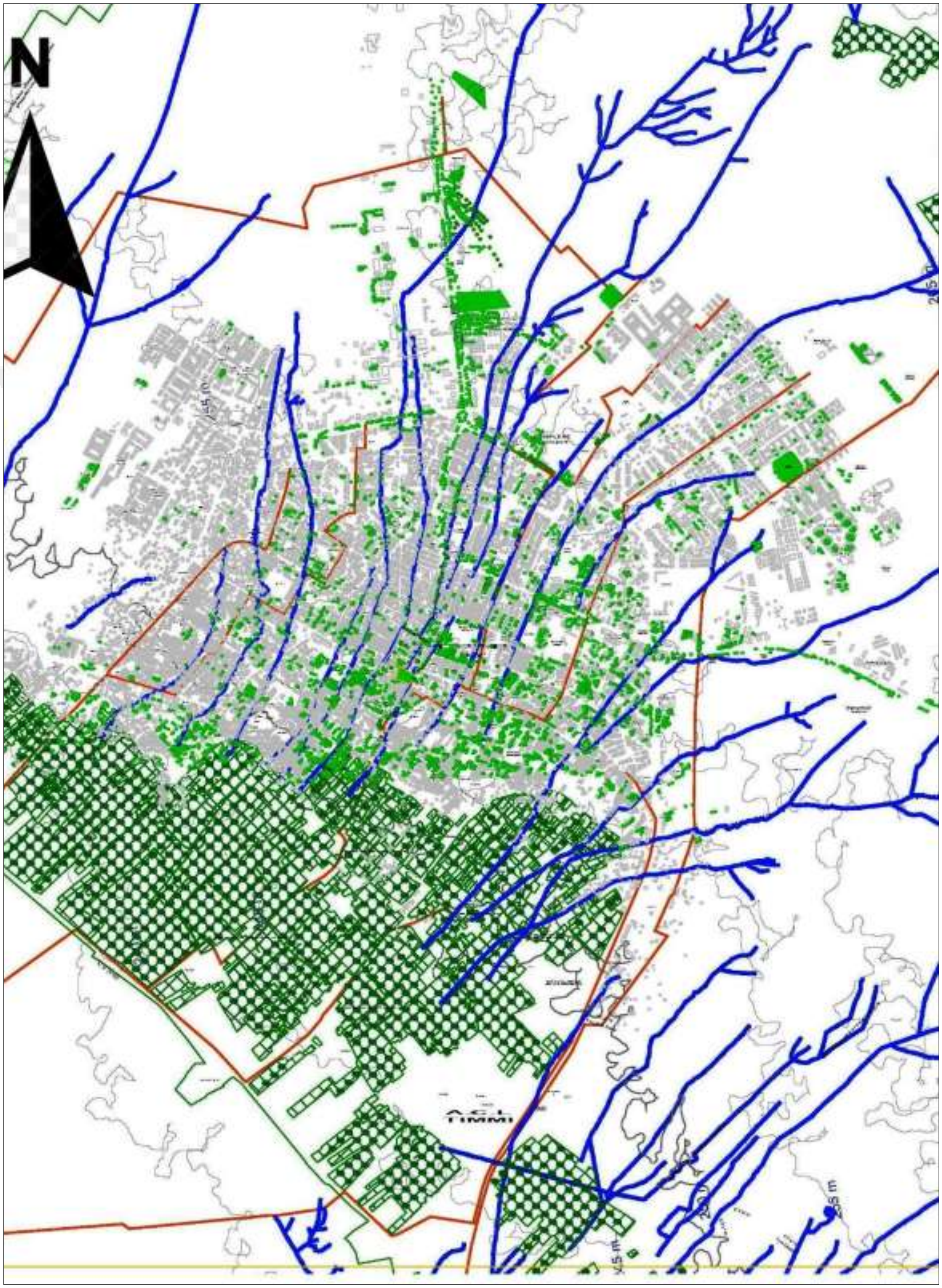
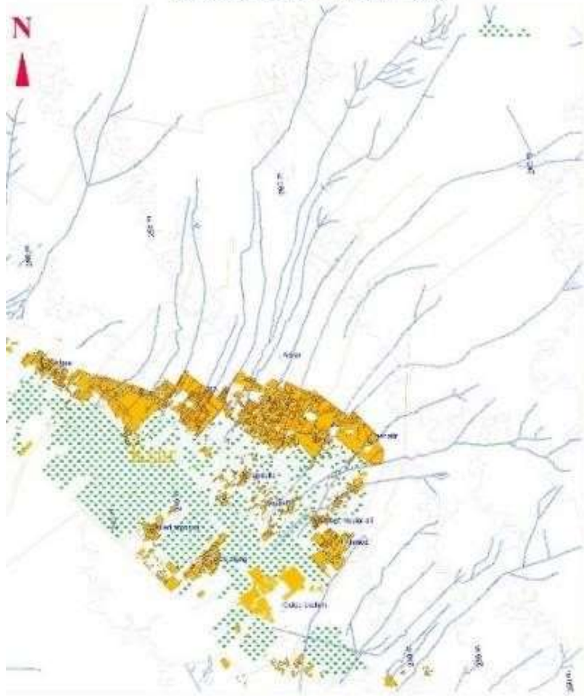
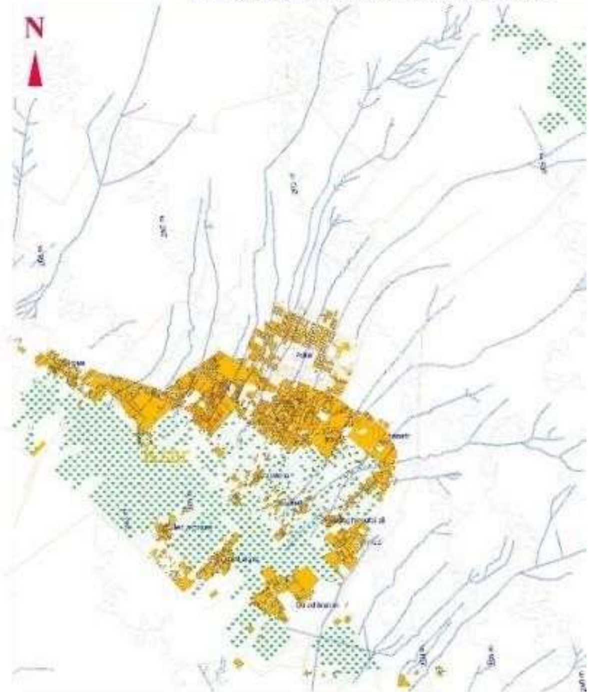


Figure0-2 green spaces in Adrar city (A-2)

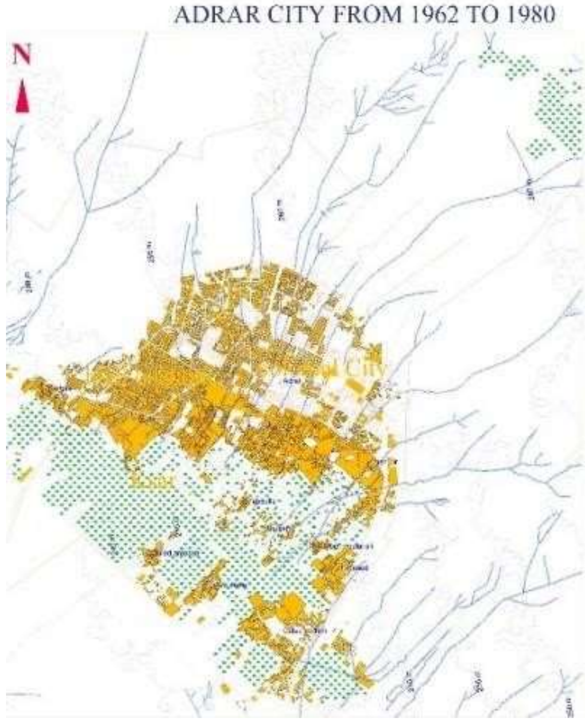
ADRAR CITY Befor 1900



ADRAR CITY From 1900 TO 1962



ADRAR CITY FROM 1962 TO 1980



ADRAR CITY AFTER 1980

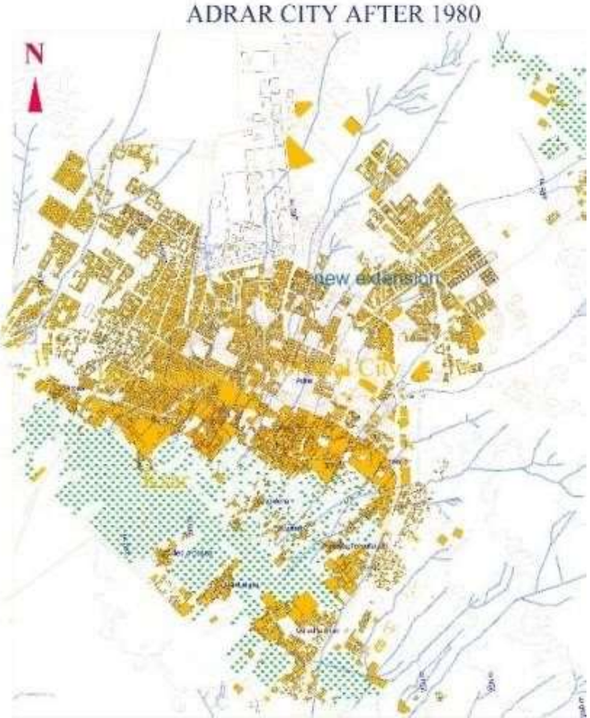


Figure 0-3 Evolution of Adrar city source author (A-3)

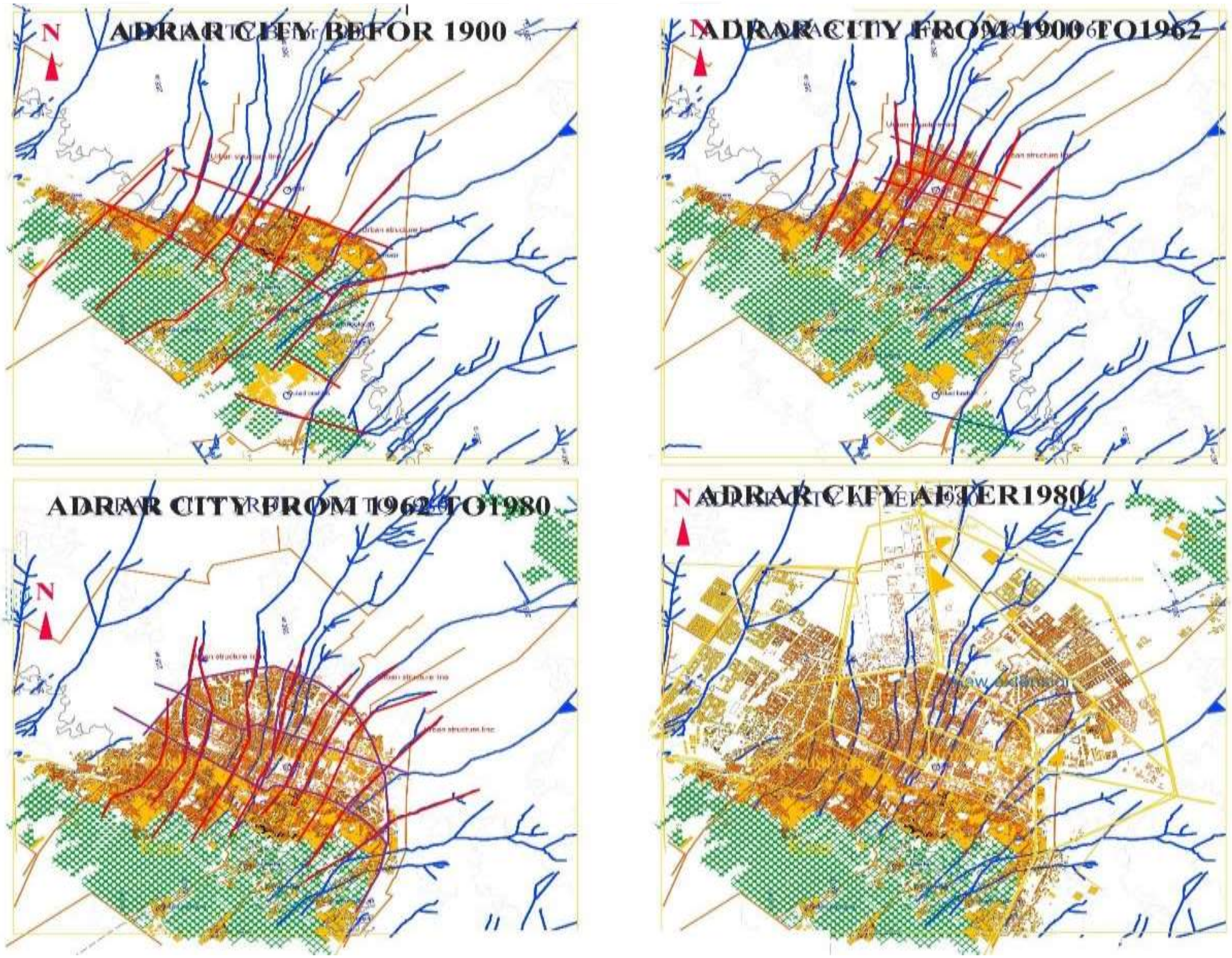

ADRAR CITY BEFOR 1900
ADRAR CITY FROM 1900 TO1962
ADRAR CITY FROM 1962 TO1980
ADRAR CITY AFTER1980
N

Figure 0-4 Historical urban morphological evolution of Adrar city. (A-4)

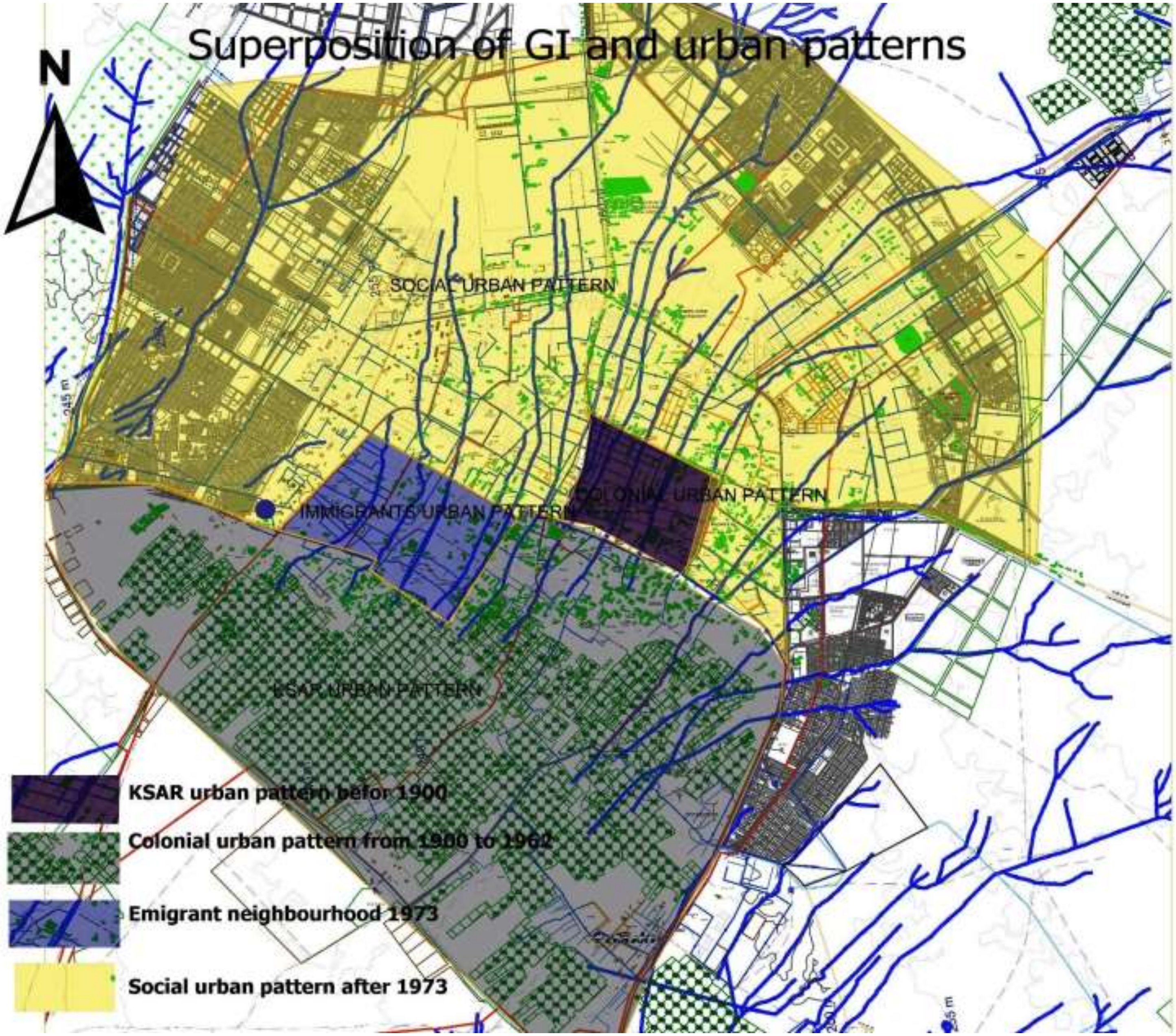


Figure 0-5Superposition of GI and urban (A-5)

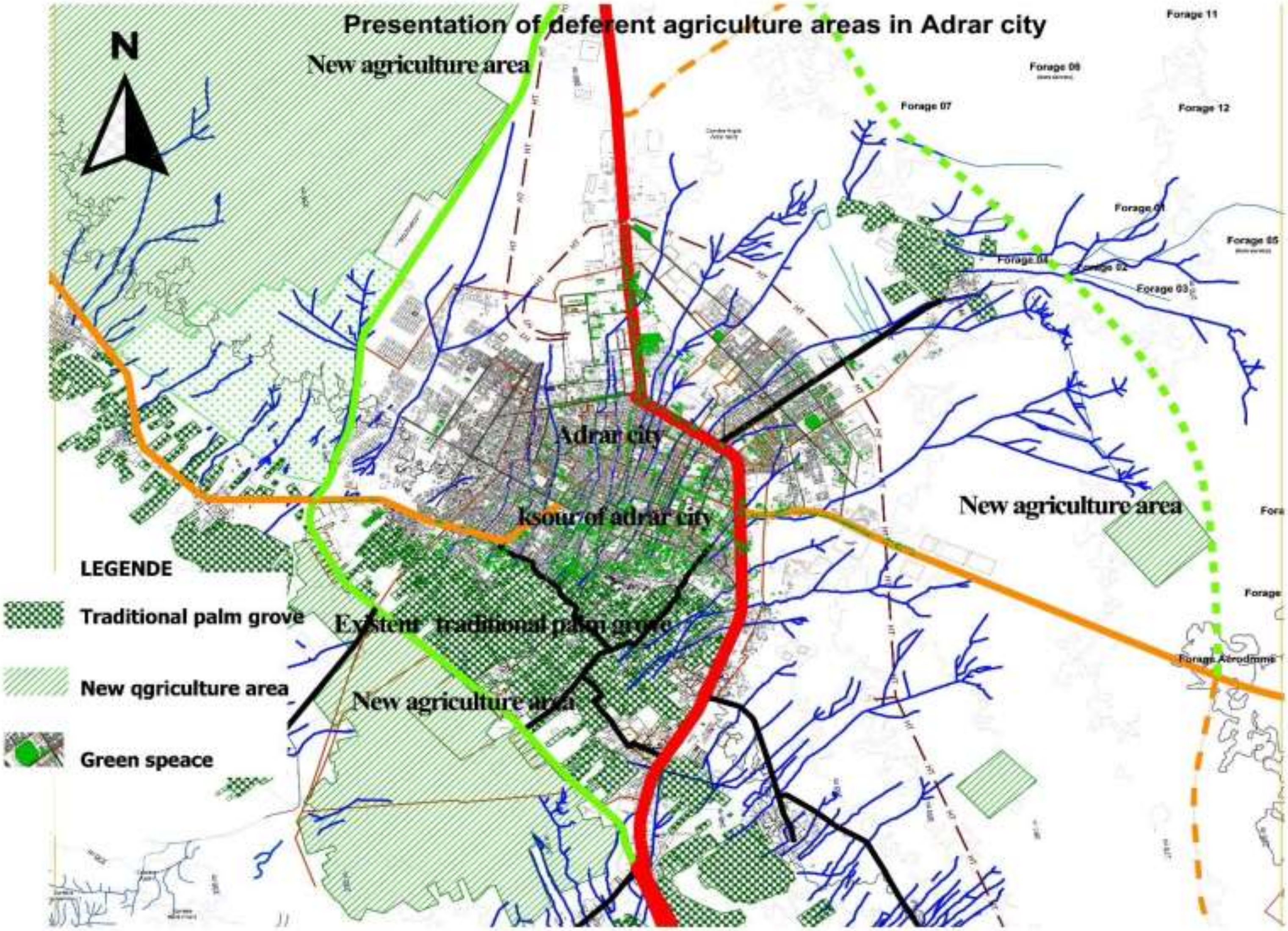


Figure 0-6 The conventional (new) and traditional agricultural land uses in Adrar. (A-6)

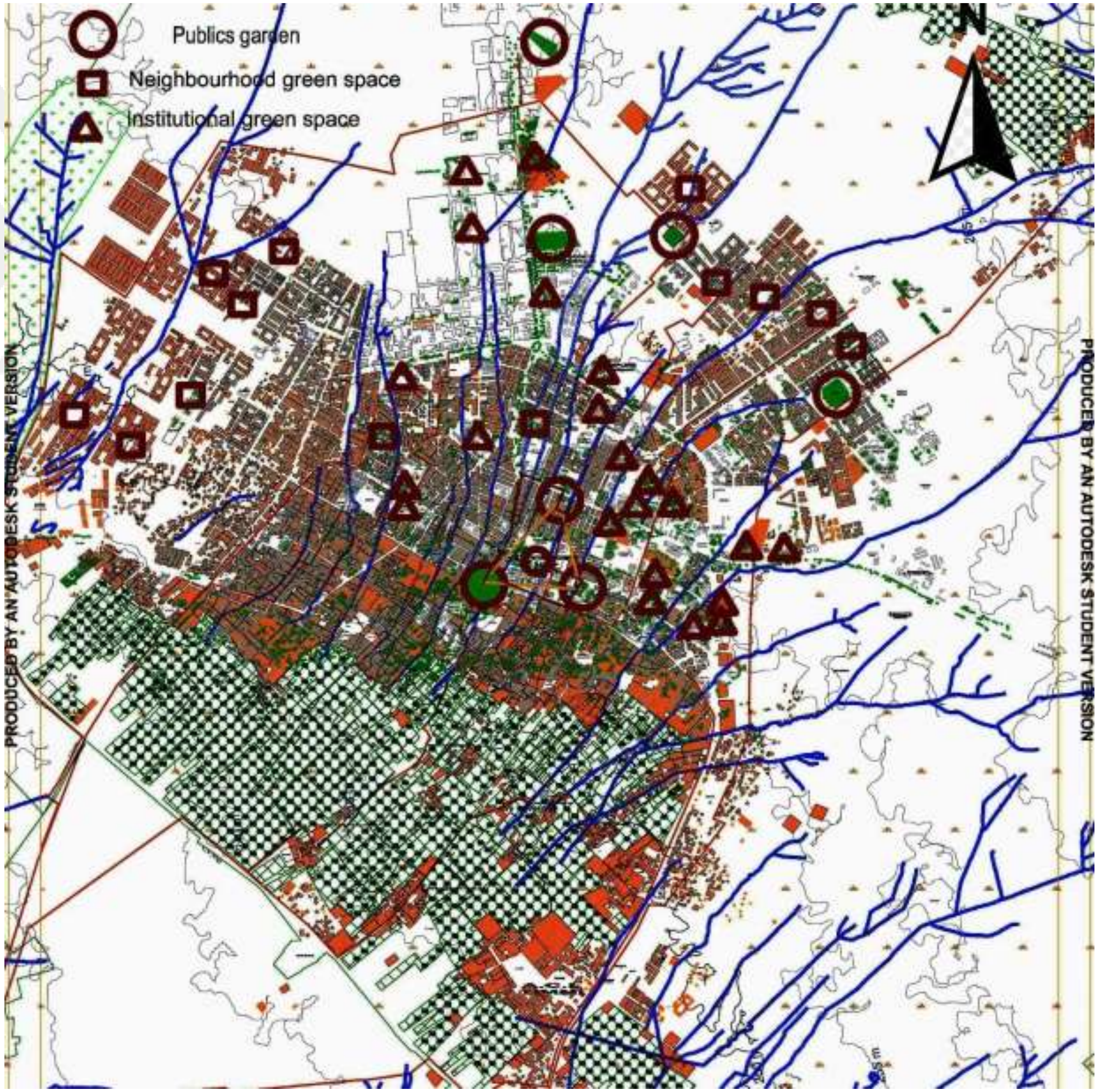


Figure 0-7 Public parks and recreational spaces in Adrar city. (A-7)

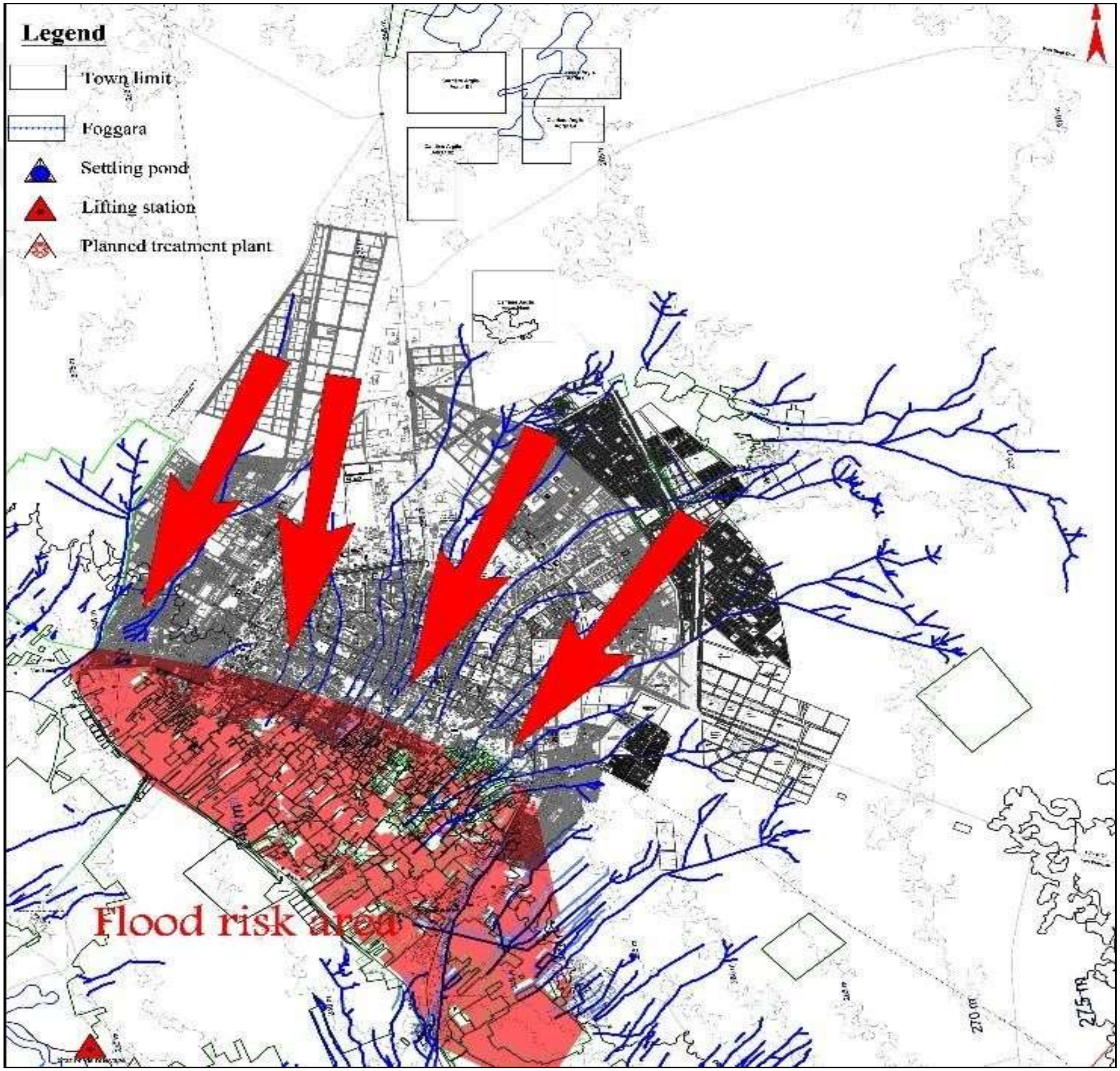


Figure 0-8 Map of Flood Risk in Adrar (A-8)

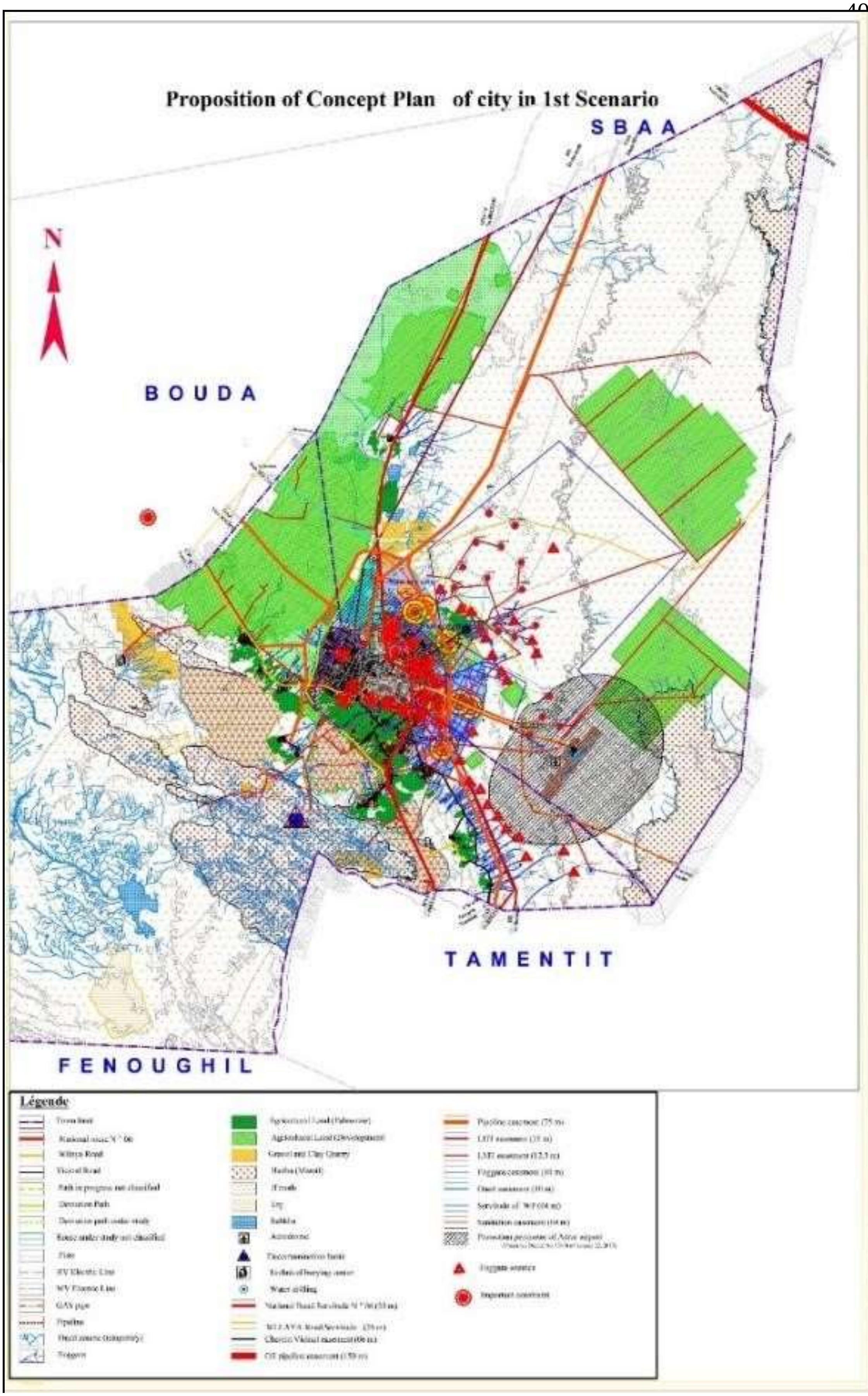


Figure 0-9 Proposition of concept plan 1st scenario (A-9)

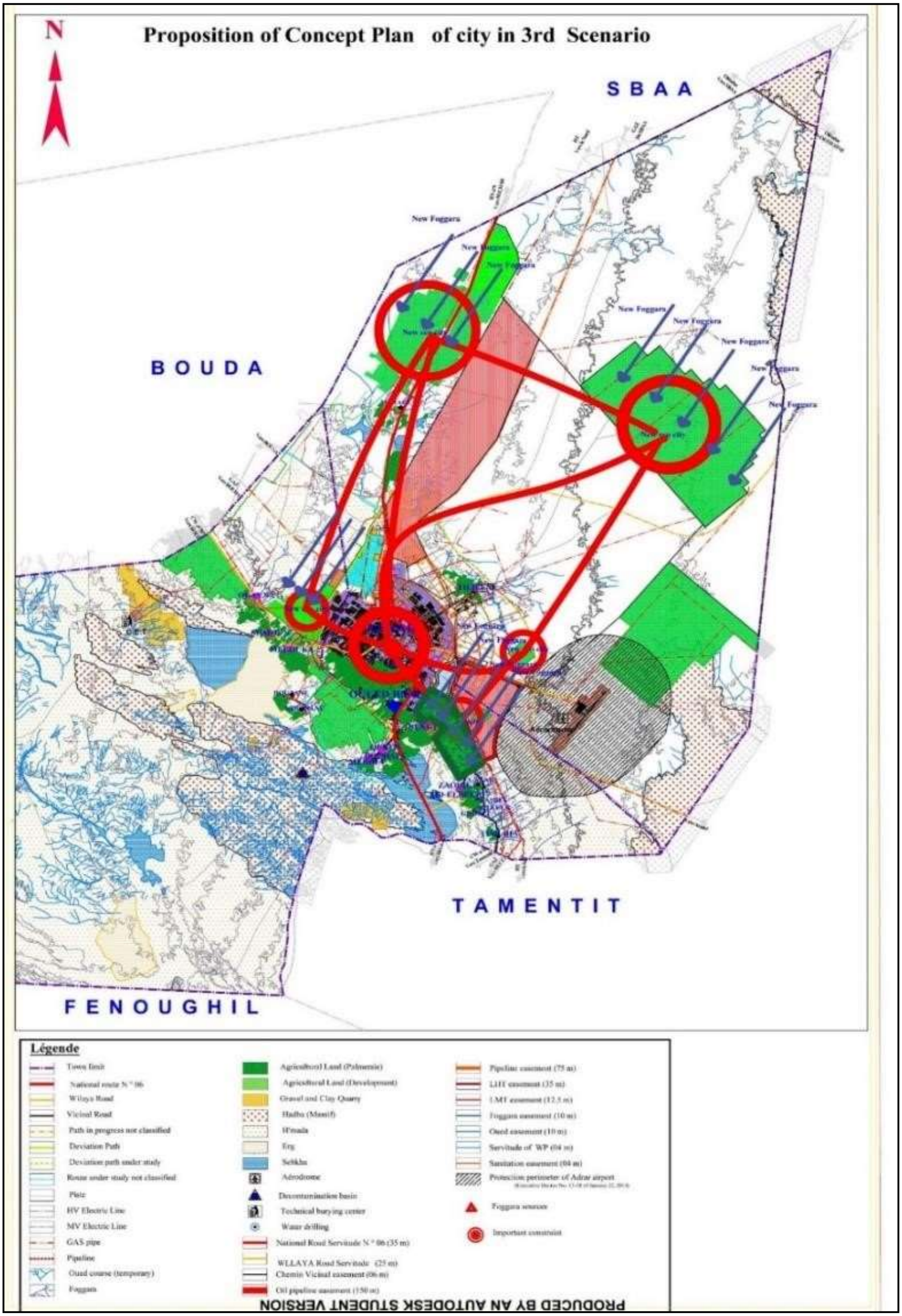


Figure 0-10Principal of concept plan 3 ed scenario (A-10)

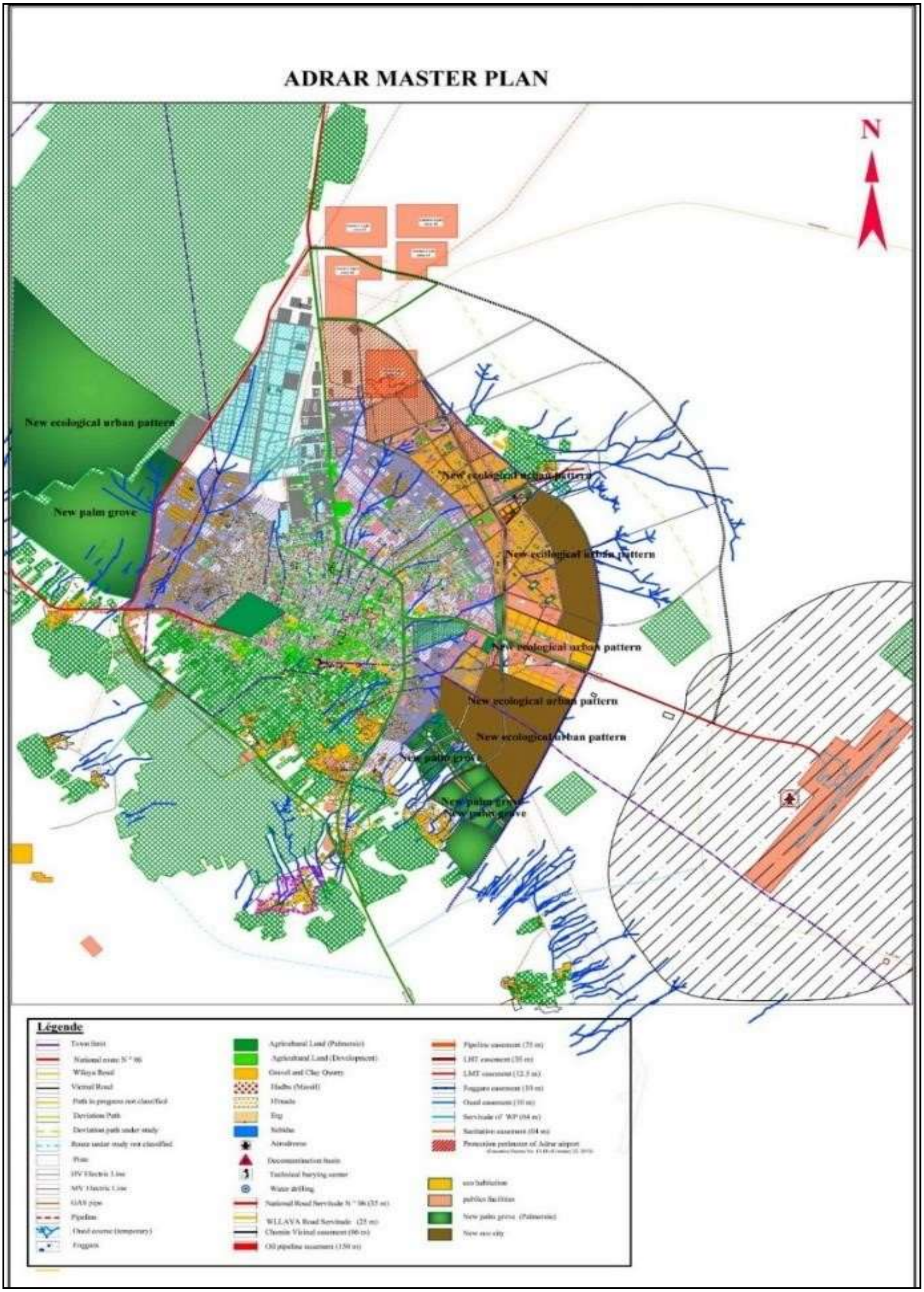


Figure 0-11Adrar master plan (A-11)

APPENDIX B

Tables

SOWT analysis of KSAR

Table 0-1 SOWT Analysis of ksar (B-1)

Strengths	Opportunities	Weaknesses	Threats

ential advantages of the area are in tual condition. Urban food Green space Existing of ecological memory 1. Connectivity and social relationship 2. Using of local materials in 3. itecture 4. 5. **differentiates it from its dings?** What distinguishes it from its surroundings? **What surrou** Microclimate ksar makes it medium 1. less affected by the external climate. Strong social bonding A 2. more sustainable urban environment 3. Partial self-sufficiency in food 4. Less energy consumption Preserving the urban 5. ecological memory **is** 6. **well organized?** 7. **What**	**What are the interesting trends and favourable possibilities?** 1. Re-consideration of the oasis, modernization and development of the traditional irrigation system, and generalization of the system to the areas of expansion of the oasis 2. Re-consideration of the residences in ksar 3. Preserving the ecological memory by preserving the areas that protect this memory, which we learned about in the previous chapter. 4. Reinforcement of the green infrastructure through its modernization and modernization of residences in the palace **What are the changes in urban or regional government policy related to the study area or to the greater area?** 1. Instead of building social housing for the residents of these areas away from the palm groves in which they work and provide jobs and positive impact on society and the environment, it is supposed to modernize the housing and green infrastructure to preserve the ecological memory.	**What can be improved?** 1. Housing improvement 2. Building framework improvement 3. Irrigation system overhaul 4. Green infrastructure improvement 5. Waste treatment of all kinds 6. Improve the economic level. 7. Create service activities such as tourism. 8. Development of the transportation system **What is done poorly or inconsistently?** 1. Lack of hygiene 2. Building materials pathology 3. Lack of spaces 4. Land properties 5. The degradation of the urban agricultural system 6. The deterioration of the economic level of the population	**What are the obstacles the area faces?** **The most significant problems of the site and the surrounding area are related to.** • **environment:** **Pollution**: this area of the city is the city's lung, as it contains the largest green area. The phenomenon of the passage of the water network used in this region and the availability of the source near the oasis palm and the negative impact on the environment was from the valley station mode filter in the city can be oases take advantage of them **Water quality:** set this area of the city crisis real water due to several problems including the use of drinking water for irrigation due to the deterioration of the case system of irrigation traditional and find the aborigines that use moral being wells of potable water is the cause to destroy the system of traditional irrigation. **Green spaces:** except for palm grove, there is a complete absence of green spaces.

1. Using the agricultural areas as an urban ecological area and ensuring the urban food
2. The use of underground water and its genius division and maintain the irrigating system. Social
3. organization
4. Collective work and cooperation between members of society

What is doing well?

1. 2. 3. Energy efficiency
4. 5. Microclimate
Social organisation
6. 7. Sustainable irrigation systems
8. Spatial organisation of habitat and palm grove

What
Protection from various winds
1. 2. 3. Green infrastructure efficiency
4. 5. Ecological memory preserving
6.

What ar are the good characteristics?

Provisi regul
Environmental ecosystem
Green space
Green infrastructure
Ecological memory
Social organization
Urban food self sufficiency

are the ecosystem services provided?

- timber, food, clean air
- climate, flooding cultural - health, creation and tourism supporting - soil

2. Using sustainable building materials that provide energy and safety in their uses.
3. Prevent construction with cement, especially in palm groves.
4. Reuse of household waste in agriculture, encourage animal husbandry, use of seeds and local agriculture to preserve the ecological memory.

What are the changes in cultural social and trends?

1. Cultural changes started since the beginning of the last century and colonialism entered the city of Adrar, despite that, the ksar preserved social ties and local culture even though it is not at best.

What are the changes in markets local and events?

2. The oasis provides as a biological centre with a high population density can also be a shopping centre, a centre of economic and cultural activities.
3. Local peasant production can be an economic income for the local population.

How might the health and ecology be restored?

1. In this part of town, there is no alternative to fixing palm trees.
2. The rebuilding of dwellings suited to a decent life for the citizens considers the requirements of a decent life.
3. Preservation of ecological memory

7. Neglect of the traditional built framework and the loss of knowledge in the field of construction

What should be avoided?

1. Use of unsustainable building materials.
2. Construction in agricultural lands

What intrinsic ecosystem services have been compromised by current or past uses?

1. Unplanned urbanism
2. Unsustainable water consumption
3. Energy consumption
4. Oasis deterioration
5. Wastewater and discarding it without treatment.

Household waste and its impact on the environment

Urban heating: this is the best area in the city, and the same traditional techniques must be maintained.

Criminality :this area is considered the least criminal due to conservative social relationships.

Social perception: the social relationship in the studied area is very good.

Urban landscapes: lack of urban development methodology in this area, lack of parks and green spaces

Land-or building-use conflicts:
The presence of agricultural areas and green areas within or near the urban milieu and in the absence of legal plans and directives for expansion makes this system in danger due to the need for expansion also appears with time illegal exploitation of land and is something that happened in the western side and the exploitation of these areas by immigrants.

What indications of the city plan or what urban policies that are going to be implemented will negatively affect the study area?

1. The urban master scheme p.d.a.u is the primary means that directs urban expansion. After analysis through the previous chapters, the expansion of this city with this methodology poses a clear danger to the continuation of the oasis and its system in general.

			2. The drinking water wells are clearly weakened due to the proximity of the groundwater to the groundwater.

formation, water cycling social and economic prosperity.	4. Green infrastructure developm be waste recycling 5. The preservation of groundwa foundation of life. **What ecosystem services can created?** (Provisioning services) food, Fibre and fuel Genetic resources Biochemicals fresh water **Regulating services** Invasion resistance herbivory Pollination seed dispersal Climate regulation Pest regulation Disease regulation Natural hazard protection Erosion regulation Water purification **Cultural services** Spiritual and religious values Knowledge system Education and inspiration Recreation and aesthetic values **Supporting services** Provision of habitat Nutrient cycling Soil formation and retention Production of atmospheric oxygen w		**3.** Wastewater poses a clear environmental threat to the oasis. **4.** The population expansion outside the oasis region has broken the social structure and affected the ecological memory of the oasis in a negative way. **transport and communication infrastructure:** connection of the area with other parts of the city; parking places, sidewalks, bicycle lanes, public transportation is in bad situation and no existence. **•public spaces and infrastructure:** social and cultural facilities, places to walk or stand safely, lighting in bad situation **•management issues:** lack of image or negative perception, prescriptive regulations **•demographic issues:** population income is so bad, it needs to develop economic incomes, the age profile, with young people migrating from oasis, the region still has the largest number of elders. The oasis is the most popular place of business, and there is a lot of unemployment. **What are natural phenomena?** Seasonal rains are a clear threat to the population. In addition to the problem of the environment through the waste-water estuary and the summer heat,

A. SWOT Analysis of colonial urban pattern

Table 0-2 A. SWOT Analysis of colonial urban pattern (B-2)

Strengths	Opportunities	Weaknesses	Threats
The essential advantages of the areits are in their actual condition. Economic importance /Geographic situation /Green space / Open space Large road Urban structure **What differentiates it from surroundings?** What distinguishes it from its surroundings? Leak of green space Social cohesion Number of open spaces Population density Economic activity **What is well organized?** Urban space Economic activity **What is doing well?** Social organisation Spatial organisation of habitat Ecological memory preserving **What are the good characteristics?** Urban structure Economic interest Social organization	**What are the interesting trends and favourable possibilities?** Re-consideration of the green space and urban alignment tree, Re-consideration of the residences Preserving the ecological memory by preserving the areas that protect this memory, which we learned about in the previous chapter. Reinforcement of the green infrastructure through its modernization and modernization of residences in the Ksar **What are the changes in urban or regional government policy related to the study area or to the greater area?** 1. Instead of building social housing to residents of these areas away from the centre of the city in which they operate and provide jobs, it is assumed that the update of the housing in a manner that respects the environment and more efficient environmental and green infrastructure to preserve the ecological memory. Using sustainable building materials that provide energy and safety in their uses. Prevent construction with cement, especially in palm groves. **What are the changes in cultural and social trends?**	**What can be improved?** Housing improvement Building framework improvement Irrigation system overhaul Green infrastructure improvement Waste treatment of all kinds Improve the economic level. Create service activities such as tourism. Development of the transportation system **What is done poorly or inconsistently?** Lack of hygiene Building materials pathology Lack of spaces Land properties The deterioration of the economic level of the population Neglect of the traditional built framework and the loss of knowledge in the field of construction **What should be avoided?** Use of unsustainable building materials. Construction in agricultural lands **What intrinsic ecosystem services have been**	**What are the obstacles the area faces?** **The most significant problems of the site and the surrounding area are related to.** • **environment:** **Pollution**: this area of the city considered the most polluted and the most influence in increasing the heat island, because it is the most population and the density and activity and the availability for construction and roads. The canals of irrigating system pose a clear threat to buildings and roads. **Water quality:** set this area of the city crisis real water due to several problems including the use of drinking water for irrigation due to the Deterioration of the case system of irrigation Traditional and find the aborigines that use moral being wells of potable water is the cause to destroy the system of traditional irrigation. **Green spaces:** Except for same abandoned, there is a complete absence of green spaces. **Urban heating:** This is the worst area in the city's heat island. **Criminality :**This area is considered the least criminal due to conservative social relationships.

What are the ecosystem services already provided? Flooding cultural - economic prosperity	Cultural changes had begun since the beginning of the last century and colonialism had entered the city of Adrar, yet that part of the city maintained local social ties and culture, even if they were not at best. **What are the changes in markets and local events?**	**compromised by current or past uses?** Unplanned urbanism Unsustainable water consumption Energy consumption	**Social perception:** The social relationship in the studied area is very good. **Urban landscapes:** Lack of urban development methodology in this area, lack of parks and green spaces **Land-or building-use conflicts:**

	Considered the city's colonial centre to display products come to all the inhabitants of the fire and neighbouring cities, a centre of economic activities, and cultural event. **How might the health and ecology be restored?** Health can only be reformed by restoring green spaces and thinking about more effective green spaces. Replant the road trees. To bring down the thermal island, The reconstruction of housing suitable for a decent life for citizens considers the requirements of a decent life. Preservation of ecological memory The age of building ecological housing units that reduce transport pressure also includes most activities. Green infrastructure development and waste recycling The preservation of groundwater is the foundation of life. **What ecosystem services can be created?** (Provisioning services) food, Fibre and fuel Genetic resources Biochemicals fresh water **Regulating services** Invasion resistance herbivory Pollination seed dispersal Climate regulation Pest regulation Disease regulation Natural hazard protection Erosion regulation	Wastewater and discarding it without treatment. Household waste and its impact on the environment	Many of the conflicts between individuals, especially in the case of renovation of buildings and the appearance of the building, high new do not respect the peculiarities of the old buildings adding to the problems of orientation between buildings. **What indications of the city plan or what urban policies that are going to be implemented will negatively affect the study area?** The urban master scheme p.d.a.u is the primary means that directs urban expansion. After analysis through the previous chapters, the expansion of this city with this methodology poses a clear danger to the continuation of the Oasis and its system in general. All the expansions have a negative effect on the traffic downtown due to the absence of public facilities and shops. The out-of-area population expansion has broken the social structure and adversely affected ecological memory and social cohesion. • **Transport and communication infrastructure:** connection of the area with other parts of the city; parking places, sidewalks, bicycle lanes, public transportation is in bad situation and no existence • **Public spaces and infrastructure: social and cultural facilities, places**

	Water purification **Cultural services** Spiritual and religious values Knowledge system Education and inspiration Recreation and aesthetic values **Supporting services** Provision of habitat Nutrient cycling Soil formation and retention Production of atmospheric oxygen water cycling		**to walk or stand safely, lighting in bad situation** • **Management issues: lack of image or negative perception, prescriptive regulations** • **Demographic issues:** population income is so bad, it needs to develop economic incomes, the age profile, with young people migrating, the region still has the largest number of elders.

SWOT Analysis of (Beni ousket) immigrants' neighborhood urban pattern

Table 0-3 SWOT Analysis of (Beni ousket) immigrants' neighborhood urban pattern (B-3)

Strengths	**Weaknesses**	**Opportunities**	**Threats**

The essential advantages of the areits their actual condition. 1. Connectivity and social relationship **What differentiates it from surroundings?** 1. Leak of green space 2. Social cohesion 3. Population density **What is well organized?** Total no organisation. **What is doing well?**	**What can be improved?** 1. Housing improvement 2. Building framework improvement 3. Irrigation system overhaul 4. Green infrastructure improvement 5. Waste treatment of all kinds 6. Improve the economic level. 7. Create service activities such as tourism. 8. Development of the transportation system	**What are the interesting trends and favourable possibilities?** 1. Creation of the green space and urban alignment tree, 2. Re-consideration of the residences 3. Preserving the ecological memory by preserving the original lifestyle 4. Reinforcement of the green infrastructure through its modernization and modernization of residences in the Ksar **What are the changes in urban or regional government policy related to the study area or to the greater area?** 1. Instead of building social housing for the residents of these areas away from the city centre in which they work and provide jobs, it is assumed that the modernization of housing	**What are the obstacles the area faces?** **The most significant problems of the site and the surrounding area are related to.** • **environment:** **Pollution** :this area of the city is considered the most polluted with dirt and disease due to the lack of infrastructure. The irrigation system channels pose a clear threat to buildings and roads.
1. Preserving of nomad life **What are the good characteristics?** **2.** Economic interest **3.** Social organization **What are the ecosystem services already provided?** Flooding cultural - economic prosperity - breeding sheep for milk and meat for eating	**What is done poorly or inconsistently?** 1. Lack of hygiene 2. Building materials pathology 3. Lack of spaces 4. Land properties 5. The deterioration of the economic level of the population **What should be avoided?** 3. Use of unsustainable building materials.	4. in a manner that respects the environment and environmental and green infrastructure is more efficient to preserve the ecological memory and enable the Bedouin population to 5. exercise their lives freely while preserving the character urban of the city. 2. Use sustainable building materials that provide energy and safety in their uses. 3. Prevent construction with cement. Enabling residents of green spaces and spaces that allow them to animal husbandry. Their animals, whether at the level of homes or public spaces	Most buildings are poorly constructed and are most affected by monsoon rains. **Water quality:** set this area of the city crisis real water due to several problems including the use of drinking water for irrigation due to the deterioration of the case system of irrigation traditional and find the aborigines that use moral being wells of potable water is the cause to destroy the system of traditional irrigation. **Green spaces:** there is a complete absence of green spaces.

	4. Construction of green infrastructure **What intrinsic ecosystem services have been compromised by current or past uses?** 1. Unplanned urbanism 2. Unsustainable water consumption 3. Energy consumption 4. Wastewater and discarding it without treatment. Household waste and its impact on the environment	**What are the changes in cultural and social trends?** The residents of this area of the city transferred their culture from the sub-Saharan countries and the customs of the Bedouins, which stopped for several decades without developing this area, yet this part of the city maintained social ties. **What are the changes in markets and local events?** Although this part of the city is considered very poor, but there are significant economic activities in addition to traders accustomed to foreign trade with the countries of the South, where they export dates and import animals, coal, and African clothing, as they are transported outside this region to other regions of the city. **How might the health and ecology be restored?** 1. This area lacks all that is ecological and healthy, and this region is the most affected by the chaotic reconstruction. 2. No green area or road trees 3. Building housing suitable for a decent life for citizens considers the requirements of a decent life. 4. Preservation of ecological memory 5. The age of building ecological housing units that reduce transport pressure also includes most activities. 6. Green infrastructure development and waste recycling 7. The preservation of groundwater is the foundation of life. **What ecosystem services can be created?** (Provisioning services) food, Fibre, and fuel; Genetic resources	**Urban heating:** this is the worst area in the city's heat island. **Criminality :**this region is considered the most criminal because of poverty, social affliction, drugs, and human trafficking, and it may reach organized crime. **Social perception:** mostly, the social relationship in the study area is very bad, and conflicts between tribes are often witnessed, and in most cases the perception of the city is absent, and the concept of the tribe becomes the one who controls and uses this logic even politically. **Urban landscapes:** lack of urban development methodology in this area, lack of parks and green spaces **Land-or building-use conflicts:** Many of the conflicts between individuals, especially in the case of renovation of buildings and the appearance of the building, high new do not respect the peculiarities of the old buildings adding to the problems of orientation between buildings.

		Regulating services Pollination seed dispersal Climate regulation Pest regulation Disease regulation Natural hazard protection Erosion regulation Water purification **Cultural services** Spiritual and religious values Knowledge system Education and inspiration **Supporting services** Provision of habitat Nutrient cycling Soil formation and retention Production of atmospheric oxygen water cycling	**What indications of the city plan or what urban policies that are going to be implemented will negatively affect the study area?** Despite many development programs that the city has known, this Neighborhood remains neglected and suffers from marginalization, poverty, disease and all the requirements of life. • **transport and communication infrastructure:** connection of the area with other parts of the city; parking places, sidewalks, bicycle lanes, public transportation is in bad situation and no existence • **public spaces and infrastructure: social and cultural facilities, places to walk or stand safely, lighting in bad situation** • **management issues: lack of image or negative perception, prescriptive regulations** • **demographic issues:** the income of the population is very bad, as it needs to develop economic income, and the age profile, with continuous emigration from neighboring countries is considered the most growing region and there are many young people.

SWOT Analysis of new extension

Table 0-4 SWOT Analysis of new extension (B-4)

Strengths	Weaknesses	Opportunities	threats

The essential advantages of the area are in their actual condition. 1. Urban structure 2. Reservation of green space **What differentiates it from its surroundings?** 1. New construction 2. No existence of green space 3. Big energy consumption 4. No existence urban ecological memory **What is well organized?** 1. Urban network 2. New large road 3. Existing of new construction **What is doing well?** 1. Spatial organisation of habitat 2. Protection from various winds 3. Infrastructure efficiency **What are the good characteristics?** No think **What are the ecosystem services already provided?** The new expansions lack of the ecosystem services, except for some individuals who try to plant some trees,	**What can be improved?** 1. Housing improvement 2. Building framework improvement 3. Green infrastructure improvement 4. Waste treatment of all kinds 5. Improve the economic level. 6. Development of the transportation system **What is done poorly or inconsistently?** 1. Lack of hygiene 2. Building materials pathology 3. Lack of green spaces 4. Land properties 5. The degradation of the urban agricultural system 6. The deterioration of the economic level of the population 7. Great energy consumption 8. Social problems **What should be avoided?**	**What are the interesting trends and favourable possibilities?** 1. Reconsidering the green areas, modernizing, and developing the traditional irrigation system, and generalizing the system to the city's expansion areas. 2. think about allocating private and public places for home cultivation. 3. preserving ecological memory by creating areas that protect this memory, 4. enhancing green infrastructure by providing the greenest areas and eco-technologies to reduce energy consumption and the impact of the thermal island. 5. Proposing architectural techniques to help residents in houses that do not match the climate, to make the houses more liveable. 6. Maintaining in expansionist social housing the privacy of each population **What are the changes in urban or regional government policy related to the study area or to the greater area?** 5. Instead of building social housing for the residents of these areas away from the palm groves in which they work and provide jobs and positive impact on society and the environment, it is supposed to modernize the housing and green infrastructure to preserve the ecological memory. 6. Using sustainable building materials that provide energy and safety in their uses.	**What are the obstacles the area faces?** **the most significant problems of the site and the surrounding area are related to.** • **environment:** **Pollution**: this area of the city is considered the weakest area in terms of green areas. Through planning techniques, they are the most energyconsuming, which causes the most pollution and increases the island's heat to the city. The construction process with cement materials is very polluting to its production or use. The large use of transportation is very polluted as well. **Water quality:** this area constitutes a wide consumption, but the water is available through a modern water network, but it creates clear pressure on other areas of the city. **Green spaces:** there is a complete absence of green spaces. **Urban heating:** this region forms a clear pressure due to the heat generated by the buildings. Also, the asphalted roads and transportation, and the lack of green areas, clearly increases the heat island. **Criminality :** these regions suffer from major social problems, such as drug proliferation and deviation of youth, in addition to high crime and insecurity. **Social perception:** the social relationship in the studied area is very bad.

affected by the ecological memory that they carried with them from other areas of the city.	1. Use of unsustainable building materials. 2. Construction in agricultural lands	7. Prevent construction with cement, especially in palm groves.	**Urban landscapes:** lack of urban development methodology in this area, lack of parks and green spaces **land-or building-use conflicts:**

3. Loss of ecological memory

What intrinsic ecosystem services have been compromised by current or past uses?

1. Unplanned urbanism
2. Unsustainable water consumption
3. Energy consumption
4. Oasis deterioration
5. Wastewater and discarding it without treatment.

Household waste and its impact on the environment

8. Reuse of household waste in agriculture, encourage animal husbandry, use of seeds and local agriculture to preserve the ecological memory.
9. Reconsidering the urban plans and architectural design of housing according to preserving the environment and energy and ensuring comfort for the residents

what are the changes in cultural and social trends?

1. The new housing is considered anonymous, which has lost the ecological memory of the indigenous people or immigrants who came years ago or new arrivals, which poses a threat to the balance in the ecosystem in the desert cities.

are the changes in markets and local events?

1. The absence of adequate shopping centres in these expansions, and the need to acquire the needs, making it economically and economically costly, which is considered an environmentally bad factor.

How might the health and ecology be restored?

1. In this part of the city, there is no alternative but to encourage afforestation by planting palm trees and creating indoor and outdoor green spaces.
2. developing new technologies for the rehabilitation of housing and neighborhoods.
3. Preserving the ecological memory of the other areas of the city
4. developing green infrastructure and recycling waste and water

5. Conserving ground water is the foundation of life.

What ecosystem services can be created?

The absence of a clear awareness of the needs of the residents made the phenomenon of trespassing on the land's opposite to the houses by the residents a very widespread phenomenon and is used either as parking lots, gardens, or expansion of houses.

What indications of the city plan or what urban policies that are going to be implemented will negatively affect the study area?

5. The urban master scheme p.d.a.u is the primary means that directs urban expansion. After analysis through the previous chapters, the expansion of this city with this methodology poses a clear danger to the continuation of the Oasis and its system in eral gen .
6. The drinking water wells are clearly weakened due to the proximity of the groundwater to the groundwater .
7. Wastewater poses a clear environmental threat to the Oasis.
8. The population expansion outside the Oasis region has broken the social structure and affected the ecological memory of the Oasis in a negative way.

Transport and communication infrastructure: connection of the area with other parts of the city; parking places, sidewalks, bicycle lanes, public transportation is in bad situation and no existence public spaces and infrastructure: social

		(Provisioning services) food, Fibre and fuel Genetic resources Biochemicals fresh water **Regulating services** Invasion resistance herbivory pollination seed dispersal climate regulation Pest regulation Disease regulation Natural hazard protection Erosion regulation water purification **Cultural** **services** Spiritual and religious values Knowledge system education and inspiration Recreation and aesthetic values **Supporting services** provision of habitat nutrient cycling soil formation and retention production of atmospheric oxygen water cycling	and cultural facilities, places to walk or stand safely, lighting in bad situation. **Management issues: lack of image or negative perception, prescriptive regulations Demographic issues:** population income is so bad, it needs to develop economic incomes, the age profile, with young people migrating from Oasis, What are natural phenomena? Are a clear threat to the population. Heat is a clear form in these areas through poor performance in resisting the external temperature, which requires the use of air conditioners, but most of the time there are blackouts due to excessive use of energy. Another phenomenon is that most of the population in these areas are displaced in this chapter to the north of the country to avoid this heat, which is what constitutes pressure even on other regions and may lead to economic damage in the field of national tourism. Also, the residents of these areas were forced to purchase housing in northern cities to be used in the summer, which negatively affected the housing crisis in other cities in the north of the country.