

The Ecological and Urban Threats with Regard to the Environmental Dimension in Saharan Urbanism (Case of the City of El Oued)

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Abstract

Urbanization in arid areas faces specific problems. The most important and most visible of these are environmental problems. In a territory where summer temperatures reach 50°C in the shade, where less than 100mm/year of rainfall falls, and where sandy winds are frequent and suffocating, seeing urban concentrations of more than 100,000 inhabitants is surprising. Seeing a city like El Oued, its northern limit position of the hyperarid domain, its particular topography of the land the presence of three entities: sand dunes, flat lands, and ghouts, its hydraulic potentiality (groundwater) leads to a different specificity in space management. In recent years, the city knows strong urbanization that leads to exposure to two constraints: water and wind that makes the city vulnerable, the consequences of urban activities. The public policies of Saharan urbanism are driven by a logic of overall resorting to urban management tools (PDAU-POS). The lack of understanding, the absence of local studies and research, the disregard of past experiences, the import of foreign theories and practices, have led to the conception of inhabited space, the city, and the urban environment, ignoring the particularities of the site (climate and soil nature ...).

Keywords: environmental problems, the city of El Oued, Saharan urbanization, urban management tools (PDAU-POS).

INTRODUCTION

The city of El Oued was, for a long time, less urban than the cities of Guemar or Zgoum. It is, in the 19th century, that it imposed itself as the capital of Souf, but it equals or exceeds its rivals in beauty, natural setting, and architecture. El Oued is characterized, of the other Saharan cities, by its immense expanses of dunes in which it is inserted, which earned it the name of "the city of golden sand" or "the sea of dunes" or "the city of a thousand domes" by its architecture of vaults and domes that the writer Isabelle Eberhardt (1877-1904), who was fascinated by it, did not cease to praise, of which she described it: "(...) the city (El Oued) gray lost in the gray desert, participating entirely in its blazes and its pallor, like him in him, pink and golden in the enchanted mornings, white and blinding in the inflamed midday, purple and violet in the irradiated evenings... And gray like the sand from which it was born, under the pale skies of the winter!" (Djilali. S, 2004).

In January 1984, with the national administrative division, El Oued was promoted to wilaya, with 30 communes and 12dairas, including the commune of El Oued, also the chief town of daïra and wilaya, occupying practically the center. After belonging to Ouargla in 1969 and Biskra in 1974 (PAW El Oued, 2012). Today the wilaya contains 22 communes and 10 daïras with the new administrative division according to the law n° 19-12 on December 11, 2019 (Algerian official newspaper n°078-2019).

This administrative promotion drained the city of a mass types of equipment and important investments on behalf of the State, which provoked the natural growth of its population, the return to the country of a certain number of Sufis of the emigration, and the stability of the nomads who saw the possibility of making fructify their capital here.

The population of the city of El Oued has quadrupled in the space of thirty-two years, more precisely between 1966 and 1998, from 24,747 inhabitants to 105,257 inhabitants. This represents an average contribution of 2,516 inhabitants/year (D.P.S.B W of El Oued, 2022).

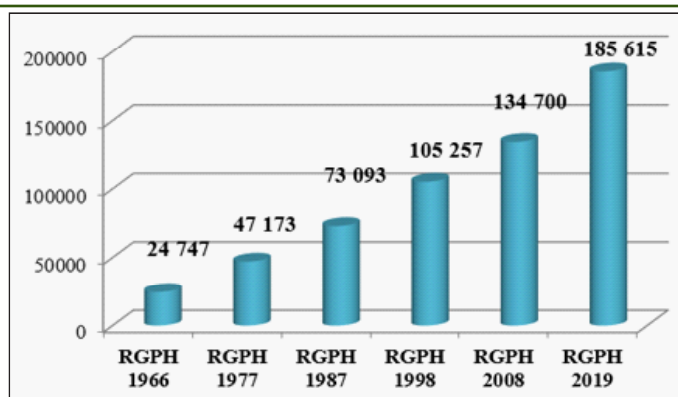


Figure 1. Evolution of the resident population of the city of El Oued (Source: D.P.S.B W of El Oued, 2022) (RGPH: general census of the population)

This rapid population growth followed by an exacerbation of environmental problems in the city, including the phenomenon of rising groundwater, constitutes a real threat to the region, its phoeniculture, the flooding of Ghouts, leading to an asphyxiation of palm trees, inefficient waste management, cumulative effects of all these factors on the environment and health of populations.

This leads us to wonder why and how the Saharan city of El Oued has reached this situation, where are the controllers of urban planning and how are they reacting at the level of development and housing in front of this poor state?

METHODS

To answer the questions posed, it is necessary to:

- first specify the specific environmental properties of the city of El Oued through the collection and analysis of environmental data (geophysical characteristics, climatic conditions, natural resources, etc. ...)
- to highlight the realities of the field, by questioning the relationships between the urban spaces produced and the environmental characteristics of the environment.
- It is necessary to adopt an approach strategy based on the environmental vision to better understand and analyze the city from its ecological situation.

The environmental approach is structuring and constitutes a guiding principle for the development for the elaboration of urban planning instruments and allows to feed their different stages. We have noted the narrow use of the word "environment": the urban planning instruments speak of respect for the environment, but without defining it in concrete terms. However, the environmental analysis proposed by ADEME (Environmental and Urban Planning Approach, Methodological Guide) for local authorities and urban planning actors (AEU) makes it possible to identify the city's environmental priorities. The whole process then consists of using the results of this analysis to define objectives, priorities for action and possible options in order to finally arrive at concrete decisions. These decisions can be taken at different stages of the urban project. They must thus contribute to orienting the project in the direction of a dynamic of environmental performance and sustainable development.

Location and Presentation of the City of El Oued

The city of El Oued is the most agglomerated commune being the chief town of the wilaya, it is one of the main oases of the Algerian Northern Sahara in the Eastern Erg. It is located in the South-East of Algeria, about 700 km South-East of Algiers and 350 km West of Gabes (Tunisia). The city covers a total area of 1869.4 ha. (ONS, 2017).

The commune of El Oued occupies practically the center of the wilaya, around which gravitates the whole of the cities and villages. It is limited :

- To the West by the commune Oued Alenda.
- To the North by the communes Kouinine and Hassani Abdelkrim.
- In the East by the town Trifaoui.
- And finally, in the South by the municipality of Bayadha (map 1).

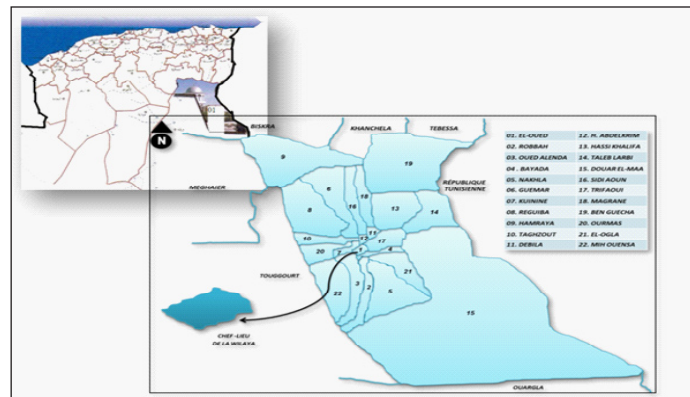


Figure 2. Geographical limits and administrative division of the wilaya of El Oued(Source: DPSB and the author, 2022)

This city has marked in its history an integration with its natural site, a true harmony between the palm grove and the habitat, the right choice of building material and roofing treatment. El Oued is characterized from other Saharan cities, by its immense expanses of dunes in which it is inserted, which is worth the name of “the city of golden sand” or “the sea of dunes” or “the city of a thousand domes” by its architecture of vaults and domes (Djilali, 2004)

Note that the city of el-oued met the factors of architectural quality, especially the historical factor, economic factor, factor of integration with the site, environmental factor, and the factor of identity and character (Hanafi, 2018).

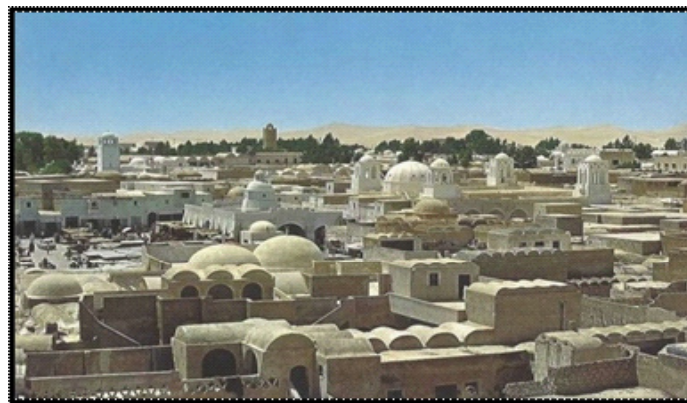


Figure 3. view of the city of El-oued, where the habitat encircles the palm grove Ghouts and the use of the coupoles for roof treatment (APC of El Oued, 2021).

The other characteristic of El-Oued is its palm groves (“Ghaouatine”, singular “Ghout” or “Ghitane”) where the palm trees, dug in depressions in the shape of valleys or funnels having the roots directly plunged in the water table, unfortunately, these traditional palm groves are currently disappearing because of the rise of water. Everything in El-Oued, shows the brutal passage of the isolation to the opening on the outside while knowing “to recover” the brand image of the old urban core.

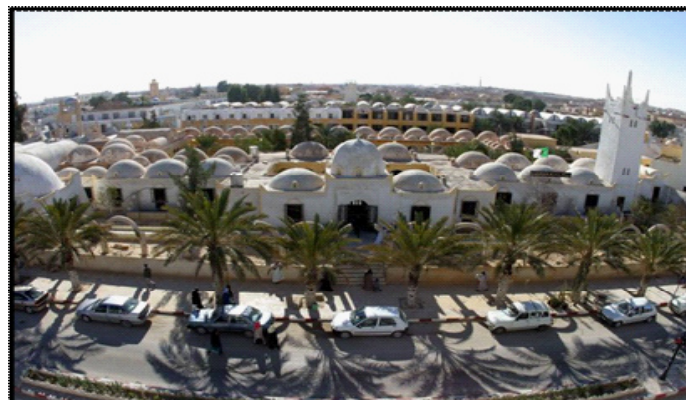


Figure 4. view of the city of El-Oued.

RESULTS AND DISCUSSIONS

Analysis of Environmental Aspects

This environmental analysis makes it possible to introduce several environmental aspects into the elaboration of urban planning instruments as a preliminary approach, which can also reform their content. We have retained the following points in our analysis:

- Climate (to better understand the characteristics of this region, we based on the climatic synthesis established over 35 years (1975-2010) according to the data of the National Office of Meteorology (O.N.M.) of El Oued)
- The topography.
- The hydrography.
- The green space.
- Waste management

The Climate: a Harsh, Hyper-Arid Climate

Due to its continental position and proximity to the equator, the city of El Oued is characterized by a Saharan climate and an arid environment.

- It records an average temperature ranging from 05°C in winter to 48°C in summer, with low rainfall, not exceeding an average of 80mm to 100mm per year. The average annual rainfall in El Oued is 80mm. Rain falls only a few days per year, so the study area is characterized by a dry period that extends throughout the year, as shown in the umbrothermal diagram (graph 2).

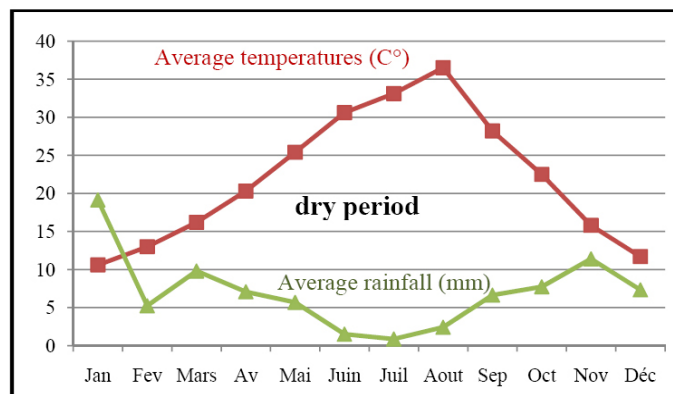


Figure 5. Umbrothermal diagram of the El Oued region (1975 - 2010). (Source: ONM. El Oued, 2011)

The east wind is the dominant wind of the warm season, it is appreciated in spring because it brings freshness, but it is dreaded in any other season because it is violent, it is the one that “brings” sand. The Sirocco, which is south and southeast wind, blows in the summer and causes the dehydration of the entire natural and human environment, hence the need to protect crops and people.

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The long period of insolation, which is spread over almost the whole year, reaching its maximum of 352 hours in July, and the strong evaporation testify to the aridity of the climate of the region.

Topography: The Risk of Silting

The site where the city of El Oued is located is characterized topographically by a low slope. Therefore, we face problems with water drainage (Boubir. H, 2018). The city of El Oued was born on a natural site, on which we find two landscapes that contrast with each other. On the one hand, there are large sand dunes, and on the other hand, there are palm groves, an important agricultural landscape.

The palm groves dictate a highly linear growth pattern along a north-south depression. This urban expansion cannot be carried out towards the east because it requires the destruction of the palm groves. In fact, this situation seems to be the result of the combined effects of sand and craters, which give rise to the aridity of the environment. Because of their funnel shape and because they surround the city, the craters have always represented growth barriers guiding the city's development (Voisin, 2004). (Figure 6)

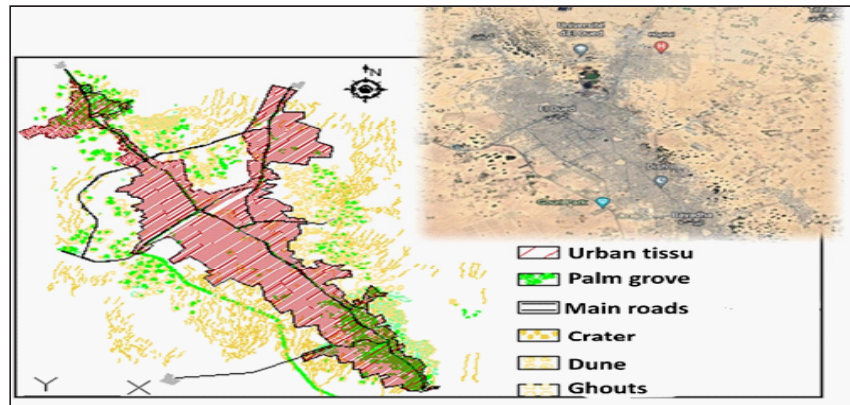


Figure 6. The city of El-oued alignment of north-south dunes, beehive cells are as many ghout palm plants.
(Source: PDAU, 2013 + Author)

The mobilization by the wind of this large stock of sand is a serious threat to the entire infrastructure development of the city. The impact of this major risk in this region is reflected in the rapid progression of two phenomena: desertification and silting, which compromises all economic development in the city. Several road infrastructures, hydro-agricultural, ghouts, and agglomeration are perpetually threatened by the mobile dunes in the region.

In recent years, the city has experienced a great expansion of potato cultivation under pivot distributed around its urban perimeter. This type of crop needs flat land, therefore terracing the dunes, which has led to an increase in wind speed and temperature in the city. (Directorate of Environment of the wilaya of El Oued, 2021).

Hydrography

The city of El Oued is known for its richness in fossil waters. Its hydrological aspect reveals the existence of superimposed aquifers at very variable depths at the bottom of the sand and the subsoil. The hydrogeological study in this region has shown the existence of two types of aquifers, a free water table corresponding to the water table and

two captive aquifers, corresponding to the Continental Intercalary and the Terminal Complex (Benhamida and Benzeguir, 1993).

The hydraulic system of the city is based on groundwater for drinking water and agricultural needs, but from the sixties, the water level of the groundwater has gradually increased creating with time a city sick of too much water. The causes of this phenomenon determined by the report of the ONA (National Sanitation Board) are:

- Intensive exploitation of deep groundwater resources (CI-CT) by deep drilling and discharge into the water table of the flows taken from the terminal complex and the continental intercalary (Albian) water tables.
- Leakage of water and sewerage networks.
- Insufficient sewage disposal networks (only 32% of the population was connected to the sewage network in 1993).
- Insufficient drainage of irrigation water
- Lack of outlets
- Since the eighties, the city had suffered from the phenomenon of rising water table causing damaging and irreversible consequences on the urban environment, which are :
- The flooding of almost all the ghouts of the city of El Oued (more than 65ghouts urban).
- The weakening of the houses in some neighborhoods clearly threatened with collapse, especially in the City of Sidi Mestour, and the neighborhoods of Laâchache and Lamsaâba.

- The aggravation of sanitary conditions linked to the permanence of stagnant water, and the appearance of parasitic diseases, skin diseases, leishmaniasis, malaria, typhoid....
- Some flooded ghouts become dumping grounds or places where informal settlements flourish on their edges.
- These unexpected and uncontrolled bodies of water in the city have been used by children as playgrounds, without taking into account the danger of death by drowning.

Finally, this development is detrimental to the tourist attraction of El Oued and its region, the original green setting surrounding the city of a thousand domes, described by Isabelle Eberhardt, has disappeared. It is better today to hide from the potential tourists these trash- ghouts which encircle the city....

Green space

The vegetation cover of the city of El Oued is of open type with low density and diversity. The green spaces occupy 218,020 m², or 1. 16% of the total area of the municipality, they are presented by Eucalyptus trees planted during the project of the green belt in order to observe the rising water table, and spontaneous plants that are characterized by a rapid growth, small size and adaptation to the edaphic and climatic conditions of the region as: *Stipagrostis Pungens*, *Calligonum Polygonoides Subsp*, *Comosom*, *Calobota Saharae*, *Calligonum Azel*. (D.P.S.B W.of El-Oued, 2019).

This vegetation cover is composed as follows:

- 08 public gardens with a total area of 100,220 m².
- 13 collective and residential gardens with a surface of 41,800 m².
- 03 urban forests with a surface of 76,000 m².
- Alignments in the urban fabric 10.78 km.



Figure 7. public botanical garden.



Figure 8. Alignments in the urban fabric.

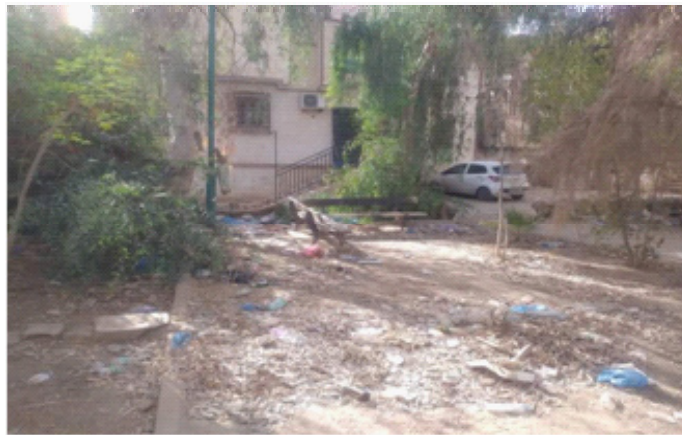


Figure 9. collective and residential garden, 400 housing estate.(Author, 2021)

- But we notice that these spaces have been neglected by the lack of maintenance (watering hygiene..), and the fallen trees mark the proliferation of waste within the green spaces. The inhabitants, who pour the waste illegally, do not have sufficient culture and knowledge.

Waste Management

El Oued has experienced a significant proliferation of urban waste in the various neighborhoods of the city. 56 268.13 tons of urban waste/year according to data from the Directorate of the Environment of the wilaya of El Oued in 2021, averaging 468901 t/month and 0.84 kg/inhabitant/day. The quantity of waste treated at the technical landfill center (CET) in Oum Sahaouine- Oued el Alenda- El Oued is 40,438.36 tons (71.86% of the total quantity of the city). (Directorate of Environment of the wilaya of El Oued, 2021)

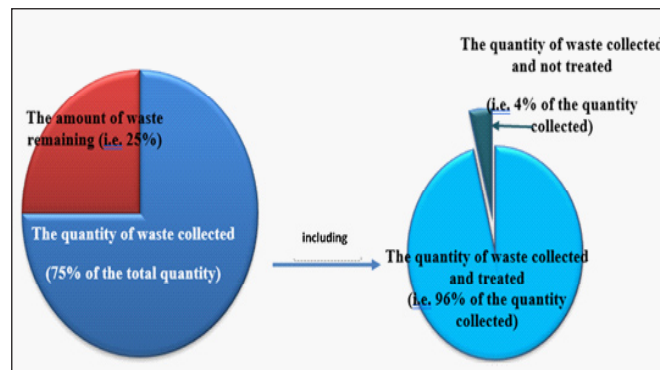


Figure 10. Diagram explaining the management of waste in the city of El Oued.

In the city of El Oued, the household waste collected is buried in the Ghouts located on the outskirts of the urban fabric. Most of the inhabitants dump household waste in the 18 Ghouts located in the urban area. This results in a threatening landscape for the houses and the playgrounds for the children of the neighborhood.



Figure 11. the serious situation of the daily Souk of Libya in the middle of the city.

We must insist on the issue of waste: The collection of household and hospital waste is very imperfect, and sorting is non-existent or very partial (waste oils). The dumps are most often open-air, even if technical landfill centers are beginning to appear. There are more uncontrolled or unregulated landfills than controlled landfills. This field suffers from a lack of organization and a lack of means.

Quality of Protection Against Natural Risks on the Ground

Through the above, we have found three main natural hazards in the city, the extreme conditions of the desert climate, the silting, and clearly the phenomenon of rising sewage:

The Extreme Conditions of the Desert Climate

We found that the city of El Oued shows radically new urbanization, and surprising in many ways. And especially by its forms, drawing its models in those of the north of the country, repeating the same techniques, the same materials, and the same mass plans seeming to turn their backs on forms of bioclimatic adaptation and cultural heritage.

Distended prospective urban fabrics, disparate roughness, dominant mineralization that does not favor shade in summer, and on the contrary lead to local overheating by absorption of solar radiation, not to mention the disturbance in the airflow, on windy days.

At the level of the building, the size of its plot, the elevation in height, and the creation of personal greenery oblige the head of the family to think today about the adaptation of its housing to the climate. The complementary element considered mandatory is the air conditioner.

In addition, the Laachache-Messaba district, which is considered an artifact well inserted in its environment, constitutes only a very small part of the built-up areas. This district is undergoing a radical transformation in its morphological, social, and functional aspects. The commercial dynamics and the relative high cost of land in this district seem to have preserved it from bulldozing operations. Most of the reconstructions are initiated with a commercial purpose and whether this activity is the leitmotiv, the way in which the operation was carried out augurs a better future for this neighborhood. The trend towards alignment and respect for a certain architectural and urban character is very strong. Several studies have been conducted to preserve and reclaim this district, the last of which "Permanent Plan for the safeguarding and enhancement restoration of the safeguarded area of the former district of Laachache-Messaba PPSMVSS" is a study conducted by the Directorate of Culture in 2019. But without the application on the ground.

Silting

The threat of silting has always been one of the main concerns of the city of El Oued, which since the colonial period has not ceased to seek a resolution to this problem. Several methods have been adapted to mitigate the displacement of sands among which:

- Method of cones "EL METHANA" to evacuate the sand thanks to the wind energy (case of the big dunes): A very effective method applied on the national road RN16 (Tougourt- Oued Souf)



Figure 12. the immediate approach of the road is completely desilted and the effectiveness of the cone method on the national road RN 16 (Tougourt to El Oued) (Source: C.R.S.T.R.A, 2015)

- System of protection of the road axes implanted in full Erg :



Figure 13. Successive palisades laid perpendicular to the direction of the prevailing wind (Robbah-Oued) (Source: author, 2022), the photo on the right represents palisades based on palms laid obliquely to the road to be protected (El Oued-Robbah) (Source: C.R.S.T.R.A, 2015).

- System of protection against the silting of Ghitânes “named Bernoussa”

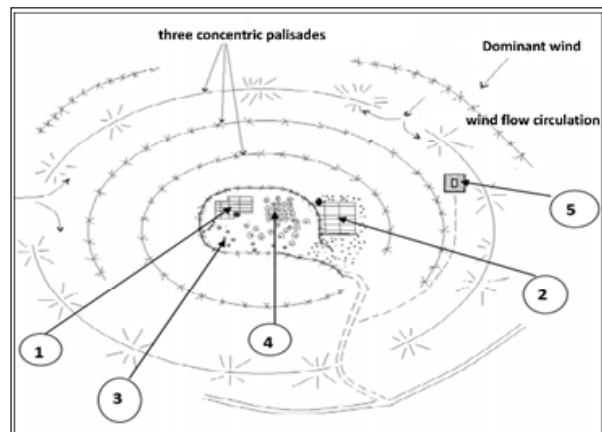


Figure 14. Flared craters in the wind zone, which requires the construction of several concentric palisades to deflect the wind flows (Bernoussa system).

- Deep Ghout in sandy soil:

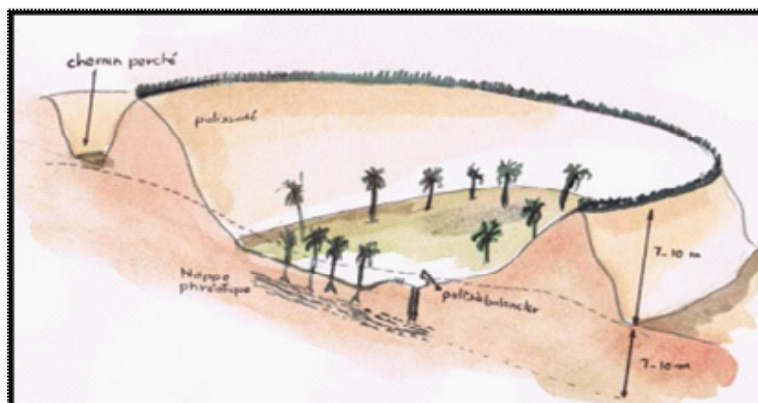


Figure 15. Deep craters in sandy grounds. In this free sand, 7 to 8 meters of difference in level are excavated and accumulated on the perimeter, in a ridge surmounted by a fence of palms. The counterpart is the depth of the water table: it is there at 10 m, even 14 m deep. These Ghouts have 100, sometimes 200 palm trees. The development unit 2 to 3 ha (Source: C.R.S.T.R.A, 2015)

- The new innovation of Souf, the cultivation of potatoes under pivot (of local conception)

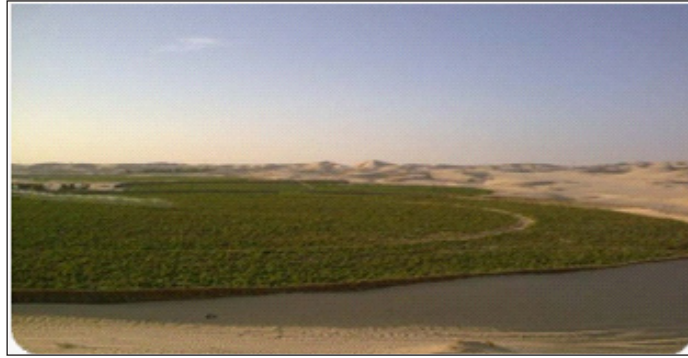


Figure 16. Palisade based on concentric palms to protect the potato crop under pivot from wind flows.

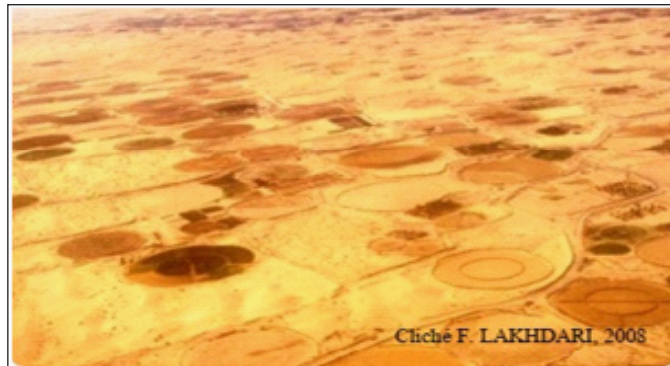


Figure 17. Aerial view of crops under pivot in dune environment, this production system has modified the agrarian landscape of the Souf region.

However, all these protection techniques only become really effective when they are integrated into very complex forms of social organization, based on a collective discipline necessary for survival in an environment normally hostile to human life.

Thus, the interventions of desilting and restoration, which are very frequent and sometimes even urgent, require important material and human means. On the other hand, at the level of the urban fabric of the city neglects the movements of sand that can, however, denude the foundations, without forgetting the disappearance of plant cover, which plays a role of air filter and windbreak while lowering temperatures and humidifying the air. As provided for in the PDAU, the urban space is progressing, especially in the new western districts, by destroying the dunes, which are transformed into plateaus with bulldozers. This results in local reorganization that threatens the buildings. Elsewhere, in the northeast, the dunes are often used as gigantic sandpits.



Figure 18. the silting up of Ennouret 8 Mai and the total absence of vegetation

The Risk of the Rise of the Water Table

In 2002, the study relating to this phenomenon of rising groundwater was entrusted to the National Sanitation Board (ONA) to the Swiss consulting firm Bonnard and Gardel Consulting Engineers. More than 22 billion dinars, or 323

million U.S. dollars, have been entirely devoted to a mega-project entrusted to the national company COSIDER TP and the Chinese company Sinohydro. Another company (Portuguese) plans to clean up the water table and fight against its rise (Boubir. H, Medareg. N, 2018). According to the report of ONA, this project includes the implementation of:

- 04 wastewater treatment plants (including STEP1 for the communes of Robbah, Bayadha, El Oued Kouinine)
- A vertical drainage network that includes 58 boreholes. (More than one vertical drainage network El Oued is the only commune that has a horizontal drainage network. This drainage network is intended mainly for the areas affected by flooding (Chott city, El-Coutar, Nazla and Sidi Mastour)).
- A sewerage network and a North-South transfer collector, including 16 lifting stations.

The launch of the work ending in June 2005 at the latest, was spread over five years (Zine. B, 2021).

At the same time, a reforestation operation has also been initiated. Thus, about 33,000 eucalyptus were planted. Irrigated at the beginning of their planting by a drip irrigation network (Boubir. H, Medareg. N, 2018).



Figure 19. Alignments in the road El Oued- Biskra (Source: DENV W of El Oued, 2021), the photo on the right represents a forest near the university of El Oued (Source: DENV W of El Oued, 2021)

Despite all these solutions, the situation of the city remains dramatic and the consequences of the redentée of water are serious and dangerous knowing that according to the studies made by the direction of the environment of the wilaya of El Oued in 2022, the city of El Oued contains 17 polluted lakes scattered throughout the city. They are considered to be permanent black spots. In addition, a new, unexpected biotope has appeared, with reeds, mosquitoes, egrets, moorhens, wild boars, etc., for which the inhabitants pay dearly.

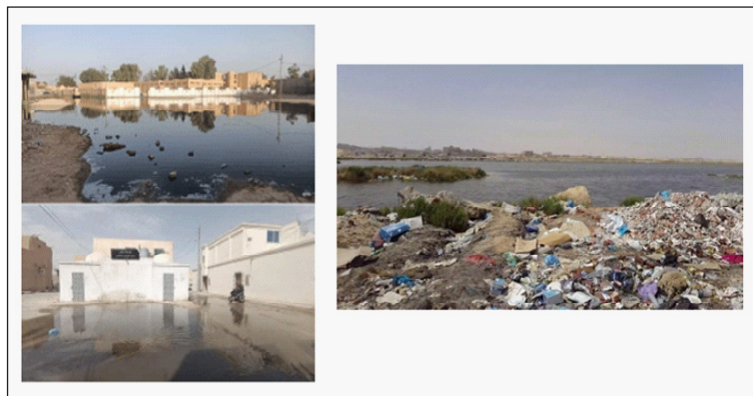


Figure 20. Flooding in the low district of Sidi Mastour (Source: Ennasr newspaper, 2021), the photo on the right shows the waters of the groundwater level at the surface in the area of the chott (Source: author, 2021)

The problem of the rising water table is far from being mastered and no solution is yet planned. Whether it is a question of partial or total backfilling for reasons of hygiene, this remains a difficult operation and the results are not conclusive, as the humidity has reappeared in many of the superficially backfilled ghouts. These are surfaces of contact with pollution, since they serve as routes used by the population, or used as living space (ghout became stadium). Moreover, in filled ghouts, construction is difficult, costly, and not without risks, not to mention the disappearance of vegetation cover, thus causing an ecological imbalance.

The Environment What Part in the Pdau of the City of El Oued

The ecological situation of the city of El Oued undergoes a negative change because of the anarchic urban sprawl, poorly thought is hardly controlled" which goes against the interests and tourist and environmental assets of the city. The latter asphyxiates more and more because of its extension and economic development and the proliferation of waste (solid or liquid). Our observation confirms this impression.

Consideration of the Environmental Issues by Urban Instruments

The PDAU has cited these problems in the form of points without determining solutions or deep proposals, it presents only a brief analysis of environmental quality (the revision of PDAU of the city of El Oued, 2013).

The PDAU and the POS associated with it are only management instruments, filling areas with fictitious housing, without concern for the real capacities of sites in a desert environment. Where The lack of understanding, the absence of studies and local research, the disregard of past experiences, the import of foreign theories and practices, have made the design of inhabited space, that of the city and the urban environment, have ignored the climate and its consequences.

Synthesis of Environmental Issues in the City of El Oued

The notion of "environmental protection" is perceived at different scales and dimensions and is associated with variable and heterogeneous environmental issues.

After several analyses and reflections made on this subject, we found that the dangers and risks related to the environment remain badly perceived in the city of El Oued. This last step allows us to define and identify several environmental issues for the city that present a source of pressures and threats for the inhabitants that the local authorities must understand, analyze and anticipate.

Among the main issues that are already having real impacts and that could increase over time, the first issue is the prevention of natural hazards, including sunshine and sand and desertification by adapting to the harsh climatic conditions of this Saharan city. It is therefore imperative to reconnect with the oasis, with the way of conceiving, perceiving, and consuming the Saharan space. As made the ancient Sufi and built neighborhood Laachache-Messaba. We are not allowed to lose this ancestral heritage that is the oasis, evidence of a continuous struggle against the desert and its harsh conditions as a witness of a civilization to be transmitted to future generations. It is not enough to preserve its historical monuments in order to make a museum for the joy of tourists, but on the contrary, to modernize it for its reuse. By retaining from the architecture of this old district certain principles that have proved their worth, at the level of the cell, the block and the city. Reconciling the bioclimatic adaptation of yesteryear with the consideration of modern elements.

The second issue is the prevention and treatment of wastewater uptake. It is to adopt the methodology of environmental improvement, which is to find solutions to negative environmental phenomena from the environment itself. For example, purify wastewater by the pilot system of phyto purification, and reuse as irrigation water, and also treat the water of wetlands by introducing fish and use it as a tourist site. The process is quite ecological, odorless and can be very aesthetic.

As we insist on the creation of many green spaces at the level of the city, choosing the species best adapted to the climate and edaphic conditions, in particular the one that requires the most important quantities of water, extracted from the water table. These plants should also have a role in protecting roads and infrastructure from sand, creating a humid climate that will provide wood for the population. It will undoubtedly be a way to remove and reduce silting especially when we know that the surroundings of the city are mostly areas with positive sediment balance and the creation of environmental and recreational space.

In such problems, it is more than imperative to give life and body to the role of the State, for the preservation and sustainability of natural resources, because the continuation of the current situation is fraught with consequences risk to permanently mortgaging any attempt at development. The instruments of urban planning must, today, consider the environmental Saharan issues, respect and enhance the landscapes of the city of El Oued.

CONCLUSION

On the environmental level, the problems of pollution, rising water, and the loss of part of the palm grove accentuate the degradation of the oasis and threaten the future of the city, in its connection with its natural environment. In fact,

the fragile balances established by traditional society have not withstood the disturbances in land status, demographic pressure, uncontrolled urbanization and anarchic and speculative development. Also, the advance of the sand worries and risks to make disappear, in a short time the essential of the orchards surrounding the city.

Algerian developers (PDAU) must now consider the environmental issues of this Saharan city, respect and enhance the city landscapes. The climatic integration of cities is a promising alternative to sustainable urban development. Given the great energy savings it can provide and the urban quality and thermal comfort it can offer to city dwellers, through appropriate urban design. Adaptation to the climate must integrate all the natural environmental elements and constraints specific to the urban desert environment, the achievements of various fields, including urban climatology and bioclimatic architecture that must be the major references of Saharan urban planning.

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