

THE HUMAN CAPITAL AND HIS IMPACT ON THE OASIS ECOSYSTEM CASE OF THE ZIBAN MICRO REGION, BISKRA, ALGERIA

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Abstract

The oasis society is continuously seeking out for coherence with the natural environment adapting with the rules of a social-economic organization where the resources ensure the equilibrium by indicating the relationship between the symbioses built / palm grove. The oasis makes an impression of the traditional man in his Saharan context. It represented the witness of a sustainable adaptation to a hostile environment with a simple inventive organization. The Ziban micro-region reflected a specific oasis identity by its local architecture and its urban organization basing on the respect of the environment, the taking into account of its constraints and the rational consumption of the potentialities in natural resources, water and palm grove. Nevertheless, this ecosystem is now going through a fundamental mutations participating intensely in the loss of the identity of a local architecture, and the death of a culture illustrated by the degraded situation of the traditional cities and the rate of their abandonment in this micro region.

This paper focuses on the analyze of the traditional oasis space in order to explain the impact of the oasis population on the oasis ecosystem destruction and the emergence of the urban ecosystem in the Ziban micro region.

Keywords: *Oasis agro-system, Urban ecosystem, Ecological equilibrium, Oasis Identity, Human capital, Ziban*

1. Introduction

The oasis functions as an ecosystem based on the water, habitat and palm grove trilogy and the interpretation of human capital. In the middle Ages, it constituted relays and points of support on the major caravan courses within the framework of trans-Saharan exchanges. The requirements of these exchanges participated in the creation of the simply localized oasis where water potential existed while connecting the two shores of the Sahara. [1]

The micro region of Ziban described as "the desert's gate", is a portion of the buffer zones between the north and the south of Algeria, located at the bottom of the Saharan Atlas. It represents a primordial function of exchange and transition between the Tell and the immense

Sahara.

It was subdivided into various Zab including a number of oases distributed along the valleys "wadis" which are characterized by political and economic independence. All of these ensure the irrigation of the Ziban by a hydrographic network: wadi El Hai and wadi Abdi gives birth to their assembly wadi Biskra, wadi El Arab and wadi El Guetan which cross at Zribet-el Oued resulting in wadi Zriba. It's crossed by wadi Jdaïa which constitutes the water receptor of the Saharan Atlas. These resources are occasional but with an underground importance. [2]

The Ziban illustrated an oasis agro-system composing an ecological equilibrium. It's characterized by a very harmonious relationship between buildings, water and palm groves, specified the architectural, natural and human components. These elements identify an oasis network.

It was the site of a linear implantation of the houses that it contained, compact and distributed along the banks of the watercourses "seguia" that ensures the survival of the oases through the availability of water resources where the integration with the palm grove guarantees a balanced territory. [3]

Currently, this micro region has lost its oasis characteristics due to a number of mutations of socio-economic, spatial and environmental order. This leads to a distinguished dissociation between buildings and palm groves and the change of the lifestyle of the citizens.

A population movement towards other destinations has also its impact on the neglect of the oasis city. This last is gradually transformed into an urban ecosystem where the natural is marginalized within the confront of the force of an accelerated urbanization while the close relationship between the pillars of the Zibanese oasis network has disappeared in the face of an uncontrolled population growth creating the current situation of the micro region where the human being is the main factor.

2. Materials and methodology

The aim of this paper is to demonstrate the main factors involved the mutation of the oasis ecosystem of the Ziban micro-region, particularly in the municipality of Biskra, the different types of this mutation and its consequences on this area.

The most specific mutations of Biskra oasis are analyzed for evaluating the socio-economic and spatial organizations in the ancient and modern city. Demonstrate how the occurrence of the urban ecosystem to the detriment of the palm grove resulted.

This research based on the spatiotemporal, the socioeconomic and urban analysis with different parameters basing on monographs statistics, cartographic, graphic documents and plans. In addition a climatic statistics translated with Microsoft Excel and numerical simulation with ENVI-met 4 Beta II is adopted.

3. The oasis agro system: a lost identity

An oasis territory is specified by a natural heritage illustrated by the presence of vegetation includes the palm grove and another animal, and the physical environment occupied, by providing water, air and the necessary needs for living as well as the habitat built by humans with adapting to their constraints. [4, 5, 6]

The Ziban micro-region represented a mode of sustainable adaptation to a qualified delicate environment taking into account the climatic constraints in the urban organization of the city and the use of local materials respectful of the environment (clay brick *-toub-*, trunk of palm tree...) in the construction of dwellings. This last symbolize an aspect of coherence between buildings and palm groves, the structural element of the oasis, an inseparable component from the constituents of the urban structure. [7]

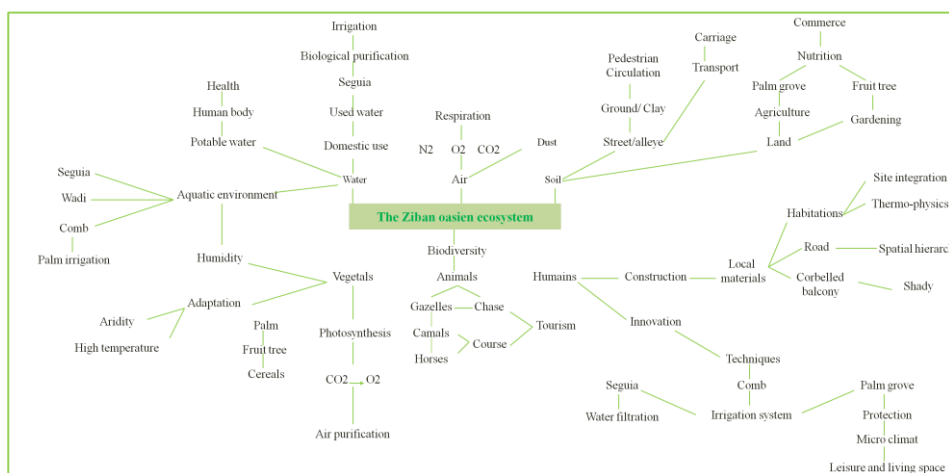


Fig .1. The oasis ecosystem an its features in the Ziban micro region

Source: Author

The peculiarity of the oasis ecosystem in this micro region represented the adaptation method of man to the constraints of his hostile environment by the exploitation of local materials in the construction and development both architectural and urban guaranteeing integration into the site.

This capital has innovated hydraulic techniques through a multifunctional cyclic system: the waste water resulting from domestic use circulates in the seguias - biological treatment plant - where the filtration operation takes place for the irrigation of the palm grove and the gardens. The palm grove itself has a positive impact in climate protection through its adaptation to high temperature and the harmful effects of aggressive wind, as well as in the apogee of the local and national economy as a source of commerce and nutrition at a time. Also, the richness in animal biodiversity contributed to the development of tourism by differentiating between racing and hunting.

Nowadays, the oasis identity of the Ziban has lost its weight, due to the changes made to the original context of the oasis, from which man rejects the old within the confront of new technology and recent construction materials developed ensuring the speed of realization. The habitations that were perfectly integrated interior the palm grove, gave way to the construction of new concrete dwellings without integration with its environment.

The close relationship between the pillars of the ecosystem of Ziban has vanished because of modifications related to the development of the secondary and tertiary sectors. [8]

As a result, the specificity of the habitat’s typology and the urban morphology of the city have disappeared in the face of uncontrolled demographic growth creating the current situation of the micro region.

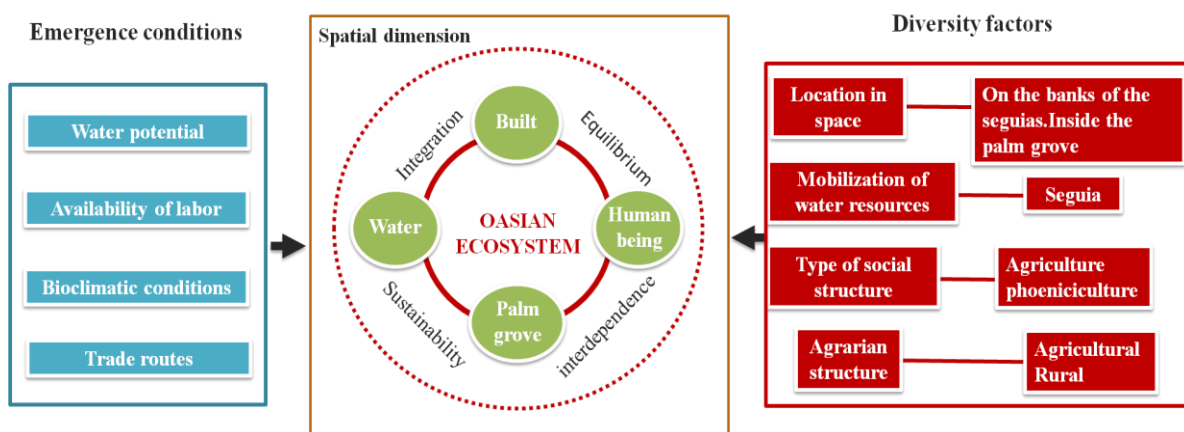


Fig.2. Structure of the Ziban oasis ecosystem Source: Author based on the structure of oasis ecosystem by Kouzmine Y, 2007 [9]

4. The oasis mutation to an urban being into an urban ecosystem

The quality of the Ziban oasis agro system is threatened by the influence of several human and climatic factors on economic, social and environmental levels. The Ziban has known transformations on different stages by multifactors that change it to an urban being interrupted with its oasis identity. This undesirable status that the city is currently experiencing is due to urbanization accompanied by a series of various changes.

4.1 Social Mutations

On the social level, the mutations have specified the evolution of the social composition of Zibanese society. Transformations’ series in the manner of life and practices from the oasis to the urban has occurred.

In fact in 1954 Biskra had more than 250,000 palm trees for a population not exceeding 50,000 inhabitants, a ratio of 05 palm trees per inhabitant. Using data from 1904, we compared the growth in population and in palm trees for some of the Ziban capitals. A data

base created by Colonel Delartigue. [10]

Table1. The distribution of the population and of the palm tree in certain Ziban capitals Source: Author according to Colonel Delartigue, 1904

Capital	Number of palm trees	Population	Ratio palm tree/population
Biskra	180000	7500	24
Sidi Okba	66000	4400	15
Zribet Eloued	1200	1100	1.09
Khanguet Sidi Nadji	28000	1100	25.45
El-Kantara	90000	3000	30

According to the data in table 1 and graph curves in figure 3, we observe that the number of palm trees is superior to the number of inhabitants. The Zab of Biskra alone had 180,000 palm trees with a ratio of 24 palm trees per person more than twice that of El Kantara and almost three times that of Sidi Okba with 15 palm trees per person, while Zribet Eloued saved the lowest data with 1200 palm trees, a ratio of just 1 palm tree per person.

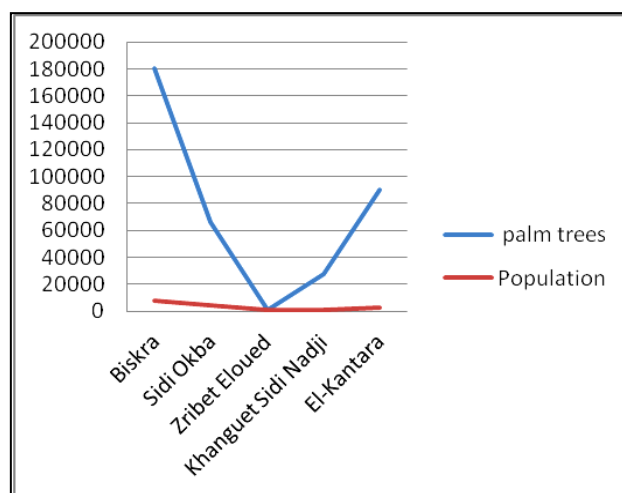


Fig.3. Graph of the ratio between population and number of palm trees of some Ziban capitals. Source : Author

It would be interesting to observe what becomes of this report in the current situation. We based ourselves on the data of the monograph of Biskra state of 2018, to produce the following table and graph.

Table 2 .The distribution of the population and of the palm tree in certain Ziban capitals Source: Author according to monograph 2018 of Biskra

Capital	Number of palm trees	Population	Ratio palm tree/population
Biskra	184.580	262054	0.7
Sidi Okba	380.986	42708	8.9
Zribet Eloued	62.740	27987	2.24
Khanguet Sidi Nadji	22.720	3875	5.86
El-Kantara	27.630	14549	1.89

It is clear that urban sprawl and the growth of the population have had negative consequences on the palm grove. We can notice that the only municipality which has been able to keep relatively its natural heritage is Sidi Okba with more than 8 palm tree per person. On the other hand, Biskra lost it completely with less than 1 palm tree per person. In order to arrive at the following graph that clearly expresses the proportional imbalance between population and number of palms.

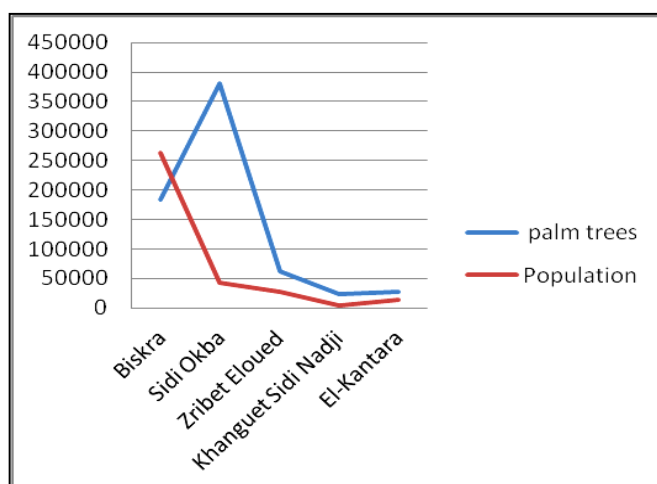


Fig. 4. Graph of the ratio between population and number of palm trees of some Ziban capitals. Source: Author

The character of the Ziban is based primarily on agriculture and basically on the palm grove. The curves in Figure 4 and Table 2 data obviously express the loss of this character. When population growth gallops the palm grove decreases.

Comparing the two graphs of the ratio between population and number of palm trees of some Ziban capitals in the years of 1904 and 2018 previously presented, we distinguish that Biskra, El-Kantara and Khanguet-Sidi-Nagji have almost completely lost their palm grove surface due to the population growth with 97.08%, 93.70% and 76.97% respectively. Sidi Okba has been able to keep relatively its palm grove surface with 40.66%. While Zribet Eloued with a percentage of 105.50% doubled its ratio of palm tree/inhabitant and increase the palm grove

surface twice than before.

4.2 Economic mutations

The transition from an agricultural society to one with an increasingly industrial vocation has upset the established economic order for a long time.

Considering the cultivation of dates unprofitable, some owners simply prefer to get rid of these palms. The land cleared of these palm trees brings in more money than the production of dates. By this act, we are witnessing a great imbalance of the local microclimate and the ecosystem of the micro region. [10]

This explains the change in professions that were essentially based on phoeniculture to other activities under the requirement of new needs.

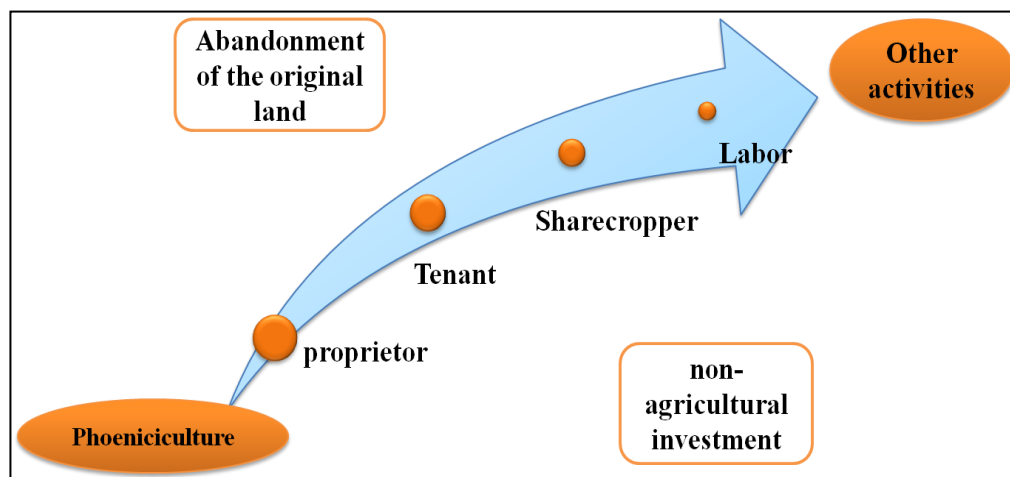


Fig.5. The evolution of the professional transfer of the oasis farmer

Source: Author

4.2.1 From phoeniculture to plasticulture: [11]

The micro region of Ziban, where oasis agriculture existed in difficulty, is currently considered the prospect of Algerian agriculture.

The nature of its oases is modified, from traditional oasis agriculture in stages, to irrigated crops by pivot [1] or to agriculture combining palm trees and large-scale tunnel greenhouses, in some regions.

Agriculture in the Ziban is experiencing a recorded development, due to greenhouse vegetable crops –plasticulture- located in certain parts of the state, in parallel with phoeniculture, on rangelands or in the desert.

Plasticulture in the Ziban has given new life to Saharan agriculture through allowing the diversification of agricultural production systems, by promoting the extension of the palm grove and by boosting commercial activities.

Possession of property is not an obligation to practice plasticulture; the rental market makes it easier for landless agriculturists to access it without the cost of a dissuasive agreement. This can be an offer invites non-native agriculturists by sharing the new know-how brought to the micro region with the natives who have mastered plasticulture since the 1980s.

Table 3 : Agricultural data of Biskra Source : Author according to DSA of Biskra,2018
[12]

Agricultural indicators	Biskra State
2013	
Useful agricultural area (ha)	185000
Irrigated area (ha)	104000
Area of greenhouse crops	4100
Number of date palms	4286000
2018	
Useful agricultural area (ha)	185473
Irrigated area (ha)	117958
Area of greenhouse crops	7238
Number of date palms	4723500

4.2.2 The major causes of abandonment of young people from agriculture: [13]

Young people are turning away from agriculture due to causes which can be summed up in:

- Inaccessibility to productive resources, and land in particular.
- The reduction of state interest in agriculture and the modernization of social and productive infrastructure in agrarian environment.
- The neglect of agricultural skills due to the under qualification of agrarian youth by the education system.
- Disregarding agriculture as a Professional path.

4.2.3 Public programs for youth employment in agriculture:

In order to promote society and cure unemployment and involve young and marginalized populations, state aid was developed and aid programs were launched.

Two public programs have directly contributed to the dissemination of plasticulture by subsidizing the purchase of greenhouses.

- *National agricultural development plan (2000-2007)*: encouraged the planting of date palm, as well as boreholes and drip irrigation equipment.
- *Youth employment support system (2004-2014)*: with the sale of 6 Canarian greenhouses of 3 hectares each and 2000 tunnel greenhouses on average per year. [8]

Supporting the price of energy (fuel and electricity), is another public policy helping to expand agriculture in the micro region where agriculturalist pay only 50% of their electricity bill.

From the graph in Figure 6 which concerns the distribution of activities and employments generated by this aid, we note that only 4% of this aid goes to agriculture; 41% to other services; on the other hand, 43% of this aid goes for the promotion of craft activities.

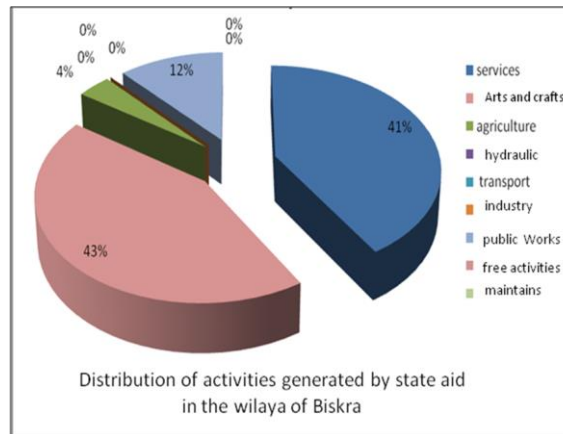


Fig .6. Distribution of activities generated by state aid in Biskra state Source: Monograph of Biskra, 2018

4.2.4 From plasticulture to phoeniculture: a return to the land of origin

The socio-professional progression of young people is linked by the evolution of plasticulture, where the young agriculturalist goes through a pyramid progression ladder: The worker can become a sharecropper after learning certain knowledge and skills. The sharecropper can save capital to get greenhouses and become a tenant. This last will be an owner after investing in the land by its earned profits. As a result, he switched to phoeniculture, a profitable activity that requires less cultivation operations. [14] The return to phoeniculture through the possession of agrarian land is the rooting of agriculturalist in their region reflected in the return to the land of origin and the planting of palm trees.

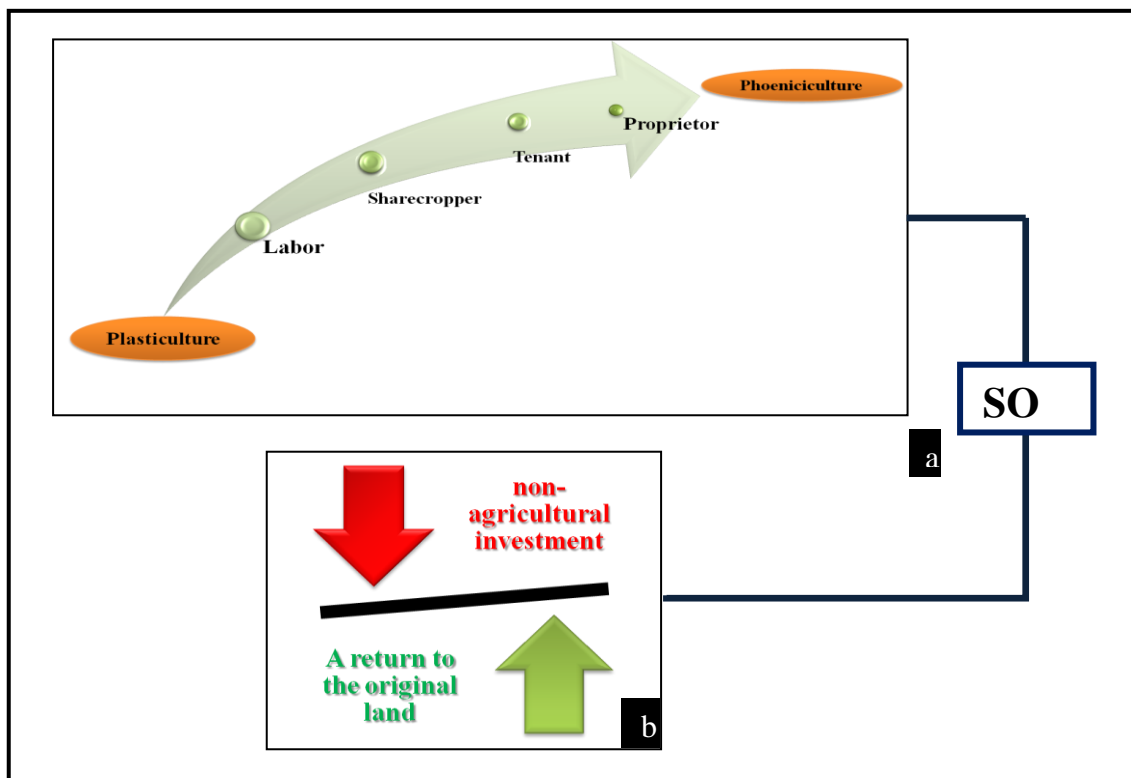


Fig.7. From plasticulture to phoeniculture: a return to the land of origin
(a) Progress diagram of a young worker and the agriculture land investment in the Ziban micro region (b)The balance between the agricultural and non-agricultural investment Source : Author

Through the comparison of the results in figure 8 concerns the employment distribution by sector with which in figure 7 above, we observe that the agriculture sector alone represents 50%, or about half of the total employers in the state, and this reflected the positive impact of the National Fund for Agricultural Development, followed by the administration, services, commerce and transport sectors with 22% and 12%, respectively, then industry, construction and public works with rates estimated at 10% and 6%, respectively.

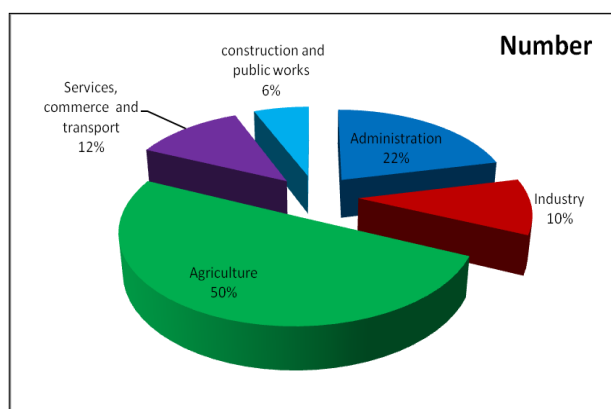


Fig.8. Employment distribution by sectors Source: Monograph of Biskra, 2018

4.3 Morphological mutations

The physical and morphological aspect of the urban organization of the region suffers from disfigurement and degradation resulting from the changes introduced to the original composition of the entire micro region.

These changes are the result of the implementation of various urban planning instruments inappropriate to the spatial and social context of the micro region, which causes problems of functional integration and urban fragmentation.

This spatial mutation is spread over the built environment, introducing radical transformations concerning its architectural forms, its volumes, its heights, the organization of the elements of its facades, as well as the construction materials used. [15]

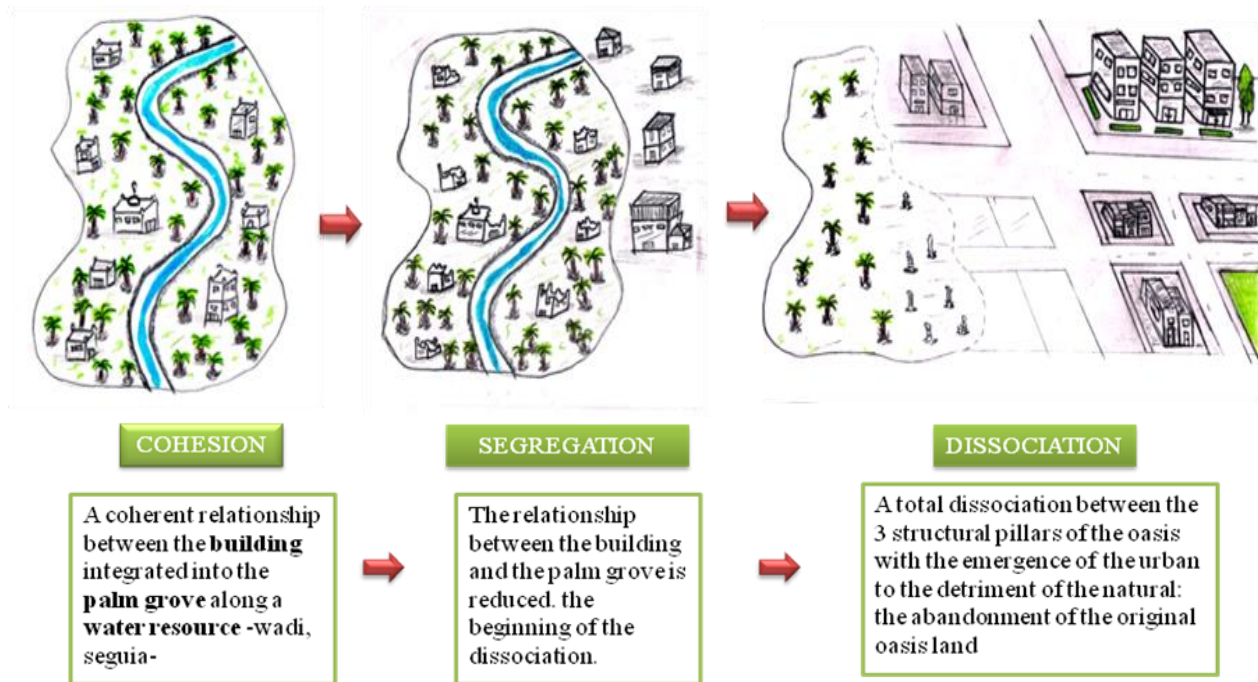


Fig.9. Dissociation of the structuring elements of the oasis Source: Author based on C.Kalfali et al [16]

4.4 Spatial mutations

Man is the main actor in the creation of spatial mutation. It largely depends on its exotic behavior in the oasis space by urban sprawl to the detriment of the palm grove due to the increase in population. This growth has produced new needs that the city can no longer meet.

The particularity of the Ziban micro-region is distorted by: the variance between the environmental data specific to arid zones, the urbanization models specific to the northern regions which have been used and the new urban interventions in order to adapt to contemporary life. [8]

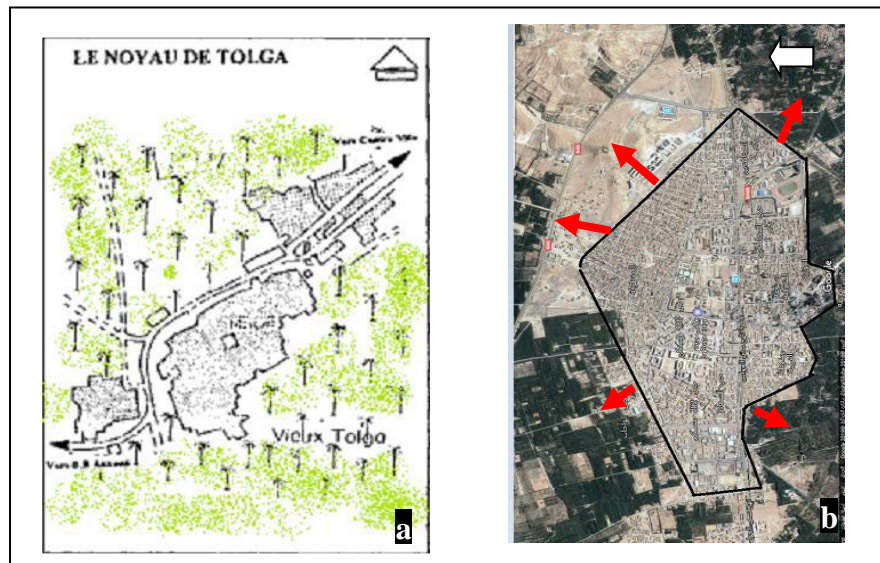


Fig.10. The spatial mutation of Tolga a- The old nucleus of Tolga surrounded by its palm grove. b- The spread of Tolga to the detriment of the palm grove.

Source : Author

4.5 Consequences of the mutation of the Zibanese oasis ecosystem

All of these transformations have consequences that reflect negatively on the identity image of the city from a various points of view:

- **Socio-economic:** waste of agricultural land, inadequate infrastructure and equipment, and the removal of palm trees as a producer of money more than dates.
- **Environmental:** a poor water management represents the loss of the vocation of the watercourse "*segua*" which was transformed from a regulatory course from the ancient town to a sewage channel today. This is reflected in the appearance of ecological imbalances.

The disappearance of the coherence of the oasis trilogy: *water, palm grove* and *habitat*, is the result of a cycle of mutations in the Ziban micro region. From the oasis ecosystem into an urban being towards an urban ecosystem which "is based on the interaction between the three constituent environments of the urban: *social, economic* and *environmental*, which participate in its survival, depend as much on the capacities of the environment to meet demand, the state of social well-being, satisfaction of its needs and the economic efficiency of its production". [17]

These three complex axes have replaced the simplicity of the oasis potentialities of which man who was the structuring capital of the oasis has become a constraint.

The urban ecosystem concerns all the areas where human constructions are greater than that of the natural areas present in the perimeter. [18] This materializes the situation of the micro region of Ziban where the area occupied by the population greatly exceeds the area occupied by palm trees and agrarian lands.

5. The affect of human behavior on the Ziban climate

5.1 Temperature

The Ziban micro region occupies a strategic area between north and south with latitude of 34.8 °, longitude 5.73 °East. It is classified in the winter climatic zone H3a and the summer climatic zone E3, with an arid climate: hot and dry in summer, cold in winter, where the temperature difference between day and night is significant.

A minimum of 6.4 ° C recorded in January and a maximum of 41.8 ° C in July. The thermal amplitude between the hottest month and the coldest month is 35.4 ° C

Table 4. Monthly temperature forecasts for Biskra (2017) Source : infoclimat.fr

Month	Jan	Feb	March	April	May	Juin	July	Aug	Sept	Oct	Nov	Dec
T _{min}	6.4	9.9	12.8	15.6	22	25.7	28.2	27.7	22.3	16.7	10.7	7.2
T _{max}	16.2	21.6	25.4	27.8	34.7	38.5	41.8	40.9	34.3	28.9	21..8	17.5

Table 5. Biskra temperature record from 1887 to 1891 Source : Hubert Cataldo, 1988

Month	T° max	T° min
October	28,1	15,2
November	31,1	9,2
December	16,3	5,7
January	15,2	4,4
February	17,2	5,8
March	26	9,4
April	26,1	12,7

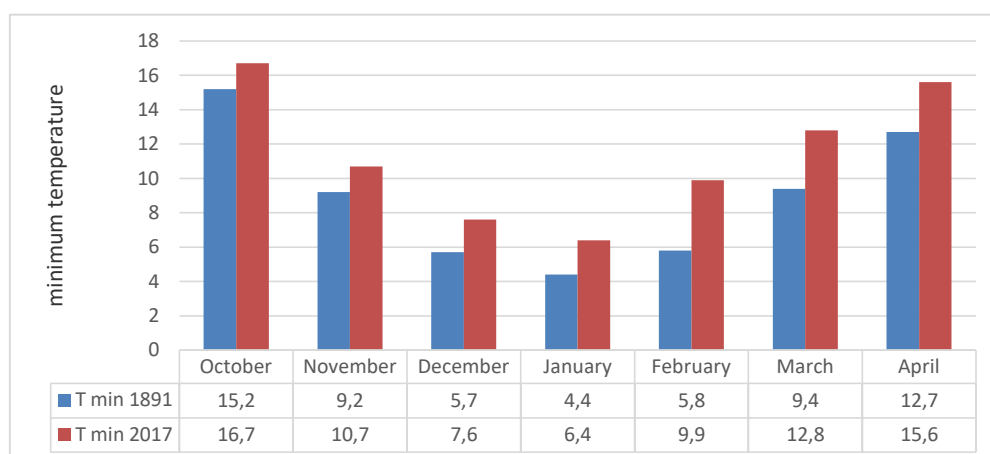


Fig.11. Ratio between the minimum temperatures of Biskra for the years 1887 to 1891 and 2017 Source: Author

According to the graphs of figures 11 and 12 which concern the ratio between the minimum temperatures of the city of Biskra from the years 1887 to 1891 and 2017, and those of the maximum temperature of the same period, we observe that the temperature of the year 2017 is high compared to the years 1887 to 1891.

As a result, we are today witnessing a great imbalance in the local microclimate of the ecosystem of the city of Biskra. While previously, the oases covered the entire micro region guaranteed better thermal insulation from the high heat of the desert's solar rays whereas reducing the internal temperature of the houses, which creates a very favorable micro climate during the summer period. These climatic characteristics made the micro region a very popular wintering station erected as a health resort. The oasis man had always taken them into account by adapting to its difficulties of aridity and fragility. The harmonious exploitation of the resources of its oases following a creative and relational technique between water, buildings and palm groves was applied.

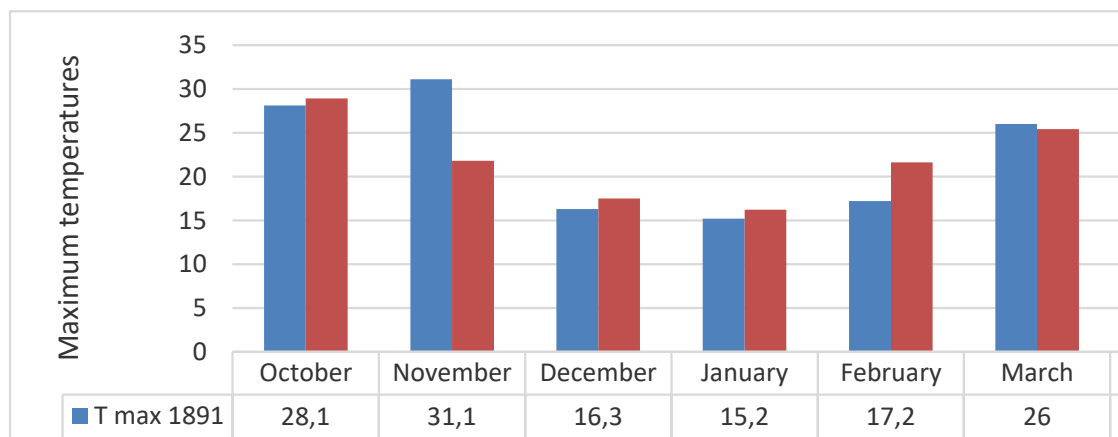


Fig.12. Ratio of the maximum temperatures of Biskra from the years 1887 to 1891 and 2017 Source: Author

5.2 Winds

The oasis is an optimal example of protection against the climatic hazards. It represents a barrier role against the winds efforts offering an inhabitants well-being. [19]

The prevailing winds in the city are north-westerly, south-easterly and blow at an average speed of 6 to 12 m / s. The maximum wind frequencies are recorded in the months of January, May and June. The hot winds accompanied by dust and sand those which blow from the South-West and South-East in the spring, reach 80 km / h. [20]

The Ziban oasis network represented a natural windbreak against the force of the wind by reducing its speed and providing dynamic comfort to oasis humans.

Currently, these climatic characteristics incorporated by the citizens during the urban and architectural organization in the Ziban micro region, are no longer taken into account, which has negatively reflected on climate change. The demographic growth of the population is modified from a rural society to a city dweller at the detriment of the palm grove. This involves the reduction of vegetation cover and increases in temperature which results a climate change that we noticed recently.

An analysis of the current situation helps to understand the impact of wind behavior on the

reduced palm grove area.

The simulation in the following figure is performed using ENVI-Met 4 Beta II software applied to an urban environment that was previously a part of the oasis. The birth of this open space in all its directions is devoid of vegetation in the absence of the palm grove. The destruction of this structure by man; the first influencing this climate change, makes the region exposed to high wind speeds creating an uncomfortable situation.

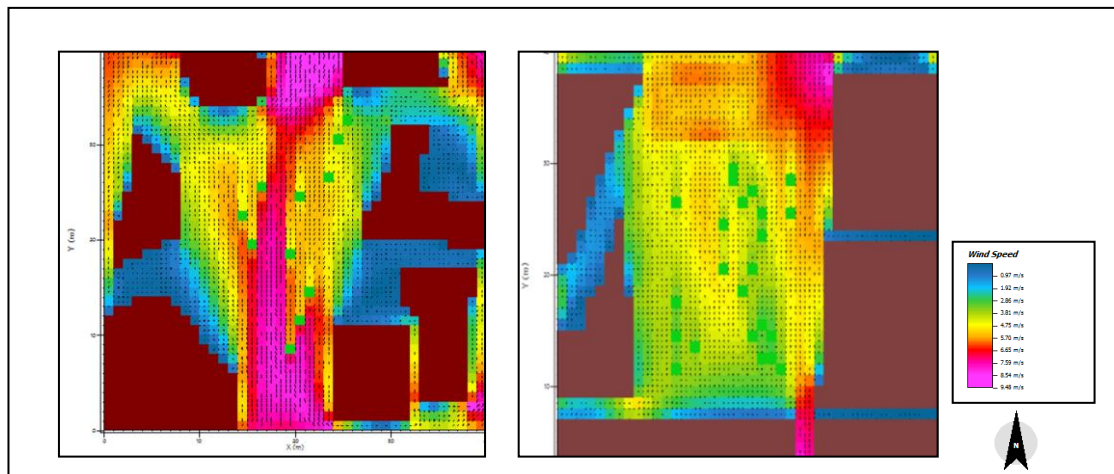


Fig.13. Wind flow scenarios in a public square in the city of Biskra

Source : Author

With the disappearance of the oasis, the urban environment is exposed to the unfavorable wind behavior and the heat of the high temperature without protection of its consequences. This reflects negatively and causes a discomfort to the inhabitants' well-being.

The image of the Zibanese paradise, clean and healthy no longer exists, the green micro region has become a pale desert under the influence of climatic constraints.

6. Conclusion

This paper focused on human capital and its impact on the oasis territory of the Ziban micro region. It has illustrated the symbol of sustainability in an arid environment to which oasis humans have adapted for a long time with their particularly climatic difficulties.

A study of the oasis ecosystem in traditional and modern city of Biskra in parallel is basing on 1904 and 2018 data. The mutation of the city with its different parameters and the study of the climate change are analyzed.

In the Ziban micro region, urbanization has experienced an accelerated growth in favor of agrarian land. It has produced ecological imbalances that have a negative reflection on the oasis image. The biskri man has moved from being a landowner to being a trader or practicing other activities. The professions that were essentially based on phoeniculture are neglected to other activities, industry and service under the requirement of new needs. This causes to participate strongly in the loss of the oasis identity and the appearance of ecological imbalances which results in the disappearance of the coherence of the oasis trilogy: water,

palm grove and habitat. The specificity of the typology of habitats and the urban morphology of the city in the face of uncontrolled demographic growth and the oasis heritage has disappeared. In the other hand, the reduction of the value of the oasis ecosystem to a simple historical cachet inducing discomfort and a lack of life hygiene which is noticed by the area occupied by the population that is greatly exceeds the area occupied by palm trees.

The spread of the urbanization phenomenon has also given rise to new urban forms exogenous to the structure of the region. The city encountered a sudden transition from traditional forms that were well integrated into their context, respecting environmental and social conditions.

In different places in Biskra, town planning is similar to that of the northern cities: wide avenues, vacant lots established by large complexes. In these new fabrics, the air conditioners suffer to cover the abundance of the principles of the traditional cities in the construction of the new equipment. The palm grove is no longer taken into consideration in the face of this uncontrolled extension, yet its importance in the old biskri who knows the value of a habitat benefiting from the shade of the palm trees that encourage the occurrence of an imbalance in the local microclimate.

From the oasis ecosystem into an urban being towards an urban ecosystem, that last is based on the interaction between the three constituent of the urban environment: social, economic and environmental. These three complex axes have replaced the simplicity of the oasis potentialities of which the man who was a structuring capital of the oasis has become a constraint.

Therefore, solutions will have to be found to these mutations which are contributing to the occurrence of several losses concerning the oasis space, the environment and its heritage. The design of a city respecting the environment that includes it serves to be an alternative to the conservation of this natural heritage and to the recovery of its oasis image.

This appeal for the sensitization of the human being on the different levels, economic, social, spatial and environmental by restoring the urban ecosystem of the Ziban micro region through the return to phoeniciculture to root the agriculturalist in their region reflected in the return to the land of origin. The recourse to history in order to recover the collective memory of the oasis inhabitants of Biskra, based on the secret of the close relationship of its structural trilogy: the building, the palm grove and the water. The return to phoeniciculture is the rooting of agriculturalist in their region reflected in the return to the land of origin.

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