

Reintegration of Nature in the City of Algeria: Model Case of “Oued Kouba” District in Annaba (North-East of Algeria)

Kamila DJEBAR¹, Akrem BOUTCHICHA¹ and Rachid Rouabhi^{2*}

^{1,2}Department of Architecture, Faculty of Engineering Sciences, Annaba University, BP. 12, 23000, Annaba, Algeria

³Exact and Life Sciences Faculty, Tebessa University, Tebessa, Algeria

Corresponding author: [r_rouabhi\[at\]yahoo.fr](mailto:r_rouabhi@yahoo.fr)

Abstract: *Today, in many countries around the world, urban planning research gives very little importance to the nature aspect. Thus, a reshaping of sustainable communities development strategy is being restructured to counteract the dangers of global changes related to globalization and technological and industrial development. In Algeria, successive phases of rural exodus that the country has lived have caused an overpopulation of cities generating excessive and rapid consumption of land with the gradual disappearance of green spaces. So, the city can constitute an ecosystem linked to many components including the district which represents a real model of sustainable discovery and invention. Annaba, 4th important city in Algeria and a large regional entity with a very significant human, natural and economic potential, is now currently exposed to the ecological problems due to various types of pollution. This observation has prompted us to undertake this project: it concerns the study of district named "Oued Kouba" which with these particular natural elements (sea, green spaces, wadis), represents one of the most appreciated districts of Annaba. However, despite its advantages, this district has many problems (pollution, poorly exploited green spaces, fragmentation of the green chain and that of the blue chain), which shows a real perturbation in the relationship of built environment to nature, and which requires a targeted and structured intervention. Our project consists in the restoration of nature in this part of Annaba, it is composed of two important steps; a brief analysis of the concept "nature in the city", its evolution and its main characteristics followed by the main concepts that refer to it. A second "diagnostic" approach is composed of two parts, the Analysis / Diagnosis part which concerns the analysis of the architectural, sociological, economic and natural aspects, etc.) whose results are grouped in a AWOT table (Advantages, Weaknesses, Opportunities and Threats). These results allow the definition of the issues of the study area that will make possible to define aims. The second part Scenarios / Intervention, will focus on the implementation of a scenario in the form of a management plan.*

Keywords: Nature, District, Green Areas, Oued Kouba, Annaba city, Algeria

1. Introduction

The awareness of the destruction of natural areas because of the mass actions of man, the over-exploitation of resources has existed for many years. In 1992, the Rio Summit pioneered the "Sustainable Development" trend, which aspires to concrete actions. Among these actions, the reintegration of nature in the city contributes to preserve the environment and biodiversity (Emelianoff, 2004 and 2005). In this way, the ecosystem approach offers an unparalleled opportunity to promote human health through enlightened management of the ecosystem (Forget and Lebel, 2003, Rey and Lufkin, 2015). When many countries are beginning to give considerable place to the natural dimension in the design and vision of their future cities, a negative observation is noted on the importance that urban research attaches to the relationship between nature and the city in Algeria. Annaba (Fig. 1), Algeria's fourth important city (economically), is no exception to this problem, indeed, the double rural exodus linked to certain economic factors (presence of industrial complexes created in 1970) led accelerated and uncontrolled urbanization without taking into account the biodiversity of the territories. This was the origin of invasion forests and agricultural land by concrete, undeveloped and unguarded green spaces, the creation of dormitory towns and an increase in the rate of pollution-related diseases, etc., (Lamri, 2012). It is for this purpose that our work is undertaken, we have chosen to carry our study on the urban environment composed of an important district

of the city of Annaba: Oued Kouba (Fig. 2). En effet, Oued Kouba has all the characteristics of an urban environment exposed to multiple urban pollution, with poorly exploited green spaces or even nonexistent, in other words an urban space with no connection with its natural environment (Fig. 3). The advantages of reinvesting the urban perimeter by natural elements and the invention of an EcoQuartier according to the characteristics of its own are considerable and much work remain to be done.

2. Methodology

We chose the northern part of the city of Annaba as a study area. In this work we used a method based on observation (collection of data), comparison, and assessment of the state of play ((river, green spaces, sea (Fig. 4)). This research will concern the definition of the particular and specific characteristics of the selected area "Oued Kouba", it will then be deepened by an analysis of the particularities of the selected area. It will then be necessary to define the actions to be undertaken with regard to the reintegration of nature into this urban site and to make it a real EcoQuartier.

3. Summary of Findings and Discussion

EcoQuartiers are designed as showcases to enhance the cities and countries hosting international events (Olympic Games, World Exhibitions). They aim to reduce the energy

consumption of buildings, to reduce the car's utilization, to favor the selective repartition of waste and recycling and to enhance the natural environment, favoring new governance practices. Ecological urbanism is practically absent today in Algeria. In a dispersed way, specialists learn the basics of an architecture and an ecological urbanism, without finding real answer on the side of the companies of the buildings and the public works, the craftsmen and the distributors of building materials. The transformation of our cities and the ecological transition are the main ambition of EcoQuartiers or EcoDistricts. In this aim, an important district of the city of Annaba is studied: it is the district of Oued Kouba (Fig. 5).

3.1 Location of the district

The district of Oued Kouba is located north of the town of Annaba, it includes the area of the Chapuis walk path and the area of Oued Kouba POS (Land Cover Plan, 2011), (Fig. 4). It is bordered to the east by the sea (Rizzi Amor beach), to the north by the subdivision and beaches of Caroube, to the west by the district of Valmascort and south by the boulevard Patrice Lumumba Beni Mhaffeur.

3.2 District history

The beginning of the urbanization of the study site was rapid and continuous from the 1950s. Previously, this territory existed in the forme of farmland with two farms named "Valmascort" and "Oued Kouba" in addition to a few individual houses (5 between 1932 and 1955). A first planning district on what constitutes today the totally principal axis of Oued Kouba was realized in 1960. A massive urbanization of the site followed between 1960 and 1962, it is characterized by:

- The creation of colonial collective housing (social type with 500 housings comprising 7 buildings and a 1 tower) as part of Constantine's plans. These buildings are intended for the French military and will later be occupied by the staff of the National Company of Iron and Steel.
- The creation of "Plaisance" sub district (635 parts of land) for individual housing.

These two projects were made in very short times, which shows their dilapidation compared to the buildings of the other districts of Annaba. At independence, a new sub district called "Gassiot" considered as the lung of the district began its urbanization in 1970. This urbanization will be continued until 1998 with a second sub district, one residence, school and some detached individuals houses located at North "Plaisance".

The river named "Kouba" passing behind the high school "Mohammed Aouachria" has been converted into an underground tunnel to recover this land. Between 1990 and 2000, two sub districts named "Sonatiba" are born. It is also during this same period that the first real estate promotions named (Genie Sider) of the site appear at the district site. The urbanization of the study area intensified during the 2000s with the creation of a residence called "Falek" at Oued Kouba and the appearance of many towers intended for collective housing in the "Chapuis" area. The urban evolution of the study area was rather anarchic and random and many anomalies appeared (anarchic urbanization, non

respect of specifications, and degradation of the urban due to the degradation of the natural setting of the site).

3.3 Urban texture of the district

The "viaire" system of the study area consists of two different ways:

- A road obeying the contours of the site (high topography: "Plaisance" sub district and district around the "Benboulaïd" street and January 28, 1957 street).
- A road network located at flat areas. By its form, the road system consists of the juxtaposition and the interweaving of different systems, all constituting streets, alleys and dead ends whose importance is variable (main road, secondary road, tertiary road).

The study area has a parcel layout adapted to the shape of the road and the topography of the land.

- A linear plots aligned around streets and other major structural axis of the site. These plots range in size from (200-600m²) and are mostly for individual housing.
- The largest parcels of the site (2000-5000m²) are located on the flat part of the site (central point of the district and its surroundings) because they are reserved for collective housing (buildings and towers), residences but also equipment and open spaces. There are two types of residences in our study area, semi-collective residences where a parcel contains a group of multi-family housings and semi-detached residences that are closed zones containing several small parcels containing individuals houses.

3.4 The built-up / non-built area at the district

The study area of Oued Kouba presents a great diversity in terms of building and is related to three parameters which are the type (form), the living mode and the construction period. In terms of occupancy the area includes a Colonial Collective Home, a Modern Collective Home, a Colonial Individual Home, a Modern Individual Home and a Modern Semi-Collective Home (residences). The period of construction of these different housings corresponds to three periods, the Colonial Period, the Post Colonial Period and the Contemporary Period (present). The district also has several types of undeveloped spaces (car parks, sidewalks, squares). Nature occupies most of these spaces, in different forms (weeds, alignment trees along the way and decorative bushes in public green spaces or private gardens).

3.5 Socio-economic aspect of the district

The study area presents certain diversity in terms of equipment. Shops represent the most important activity of the site and are therefore the main source of its attractiveness. The latter are located mainly at the central point of the district of Oued Kouba in Ground floor of the collective and individual housing. The district of Oued Kouba also has a weekly street market.

3.6 Climatological data of the district

Annaba is located in a humid zone, its Mediterranean climate makes it a region richly watered (650 to 1000 mm /

year), its average temperature is 18 ° C. The direction of the prevailing winds is Southwest and the average wind speeds range from 2.9 to 21.4 m / s. The location of the district (near the sea) influences the characteristics of the winds, including the south-west easterly breeze and the north-easterly sea breeze. The district enjoys intense sunshine in summer. The recorded humidity levels are quite high throughout the year and vary between 66 and 77%. The study area is characterized by a high rate of humidity mainly due to the presence of the sea and a river, (Terfaya, 2013). The rainfall ranges from November to January, it is ranged between 109 and 124 mm. The temperature variations are between 15 ° C (average in winter) and 26 ° C (average in summer). The district is characterized by four types of pollution all of which are caused mainly by man's human: it is the air pollution mainly due to car exhaust and the discharges of factories located on the outskirts of the city; soil pollution caused by the discharge of household waste; pollution of water, sea by waste from summer visitors and those rejected by boats. On the other hand, the fresh waters of river are also contaminated by wastewater discharges. The fourth type of pollution concerns noise pollution, which is often absent during urban planning studies, but it is just as harmful as the previous ones (car noise, construction sites, schools, high schools, shops, etc.).

3.7 Main natural elements of the district

The fauna and flora of the study area are quite diversified (Fauna in the form of aquatic and marine species such as fish and waterfowl, and terrestrial species spread throughout the territory such as certain Mediterranean birds, Canids and Felids), (Fig. 6). Our results show that the main natural elements of the site are not highlighted (lack of enhancement of inter-district links, significant natural potential devalued, flat trend district with presence of underground river and presence of green spaces not maintained (wild nature)).

3.8 AWOT of the district

The AWOT of the district has three dimensions, the architectural urban dimension (Table 1a), the socio-economic dimension (Table 1b) and the nature dimension (Table 1c). It consists of illustrations to explain the Advantages, Weaknesses, Opportunities and threats of the site.

3.8 Issues, objectives and actions envisaged at the district

The synthesis of the data collected and analyzed during the diagnosis phase allowed us to highlight 4 main issues for Oued Kouba district, namely Landscaping Issues (Fig. 7a), Environmental Issues (Fig. 7b and 7b') and Social Issues (Fig. 7c). Each stake includes objectives that are realized in the form of actions on the ground.

3.9 Scenario programmed for the district

This scenario aims to reintegrate nature to make it more present at the level of the study area while revaluing the existing natural elements to make the district of Oued Kouba a green Ecodistrict of the city of Annaba (Fig. 8.). This scenario includes:

- **The reintroduction of nature by various processes** (Vegetation of the facades of collective buildings, Development of terraces gardens on the towers, Preservation of the wooded area by an ecological delimitation and Natural treatment of the soil (cobblestones).
- **Improvement of the image of the district** (Flowering of green spaces, Redevelopment of the wooded area, Creation of pedestrian paths, Installation of water points, Creation of adapted urban furniture and respectful of nature and Deviation of the drainage pipe at the beach.
- **The development of connectivity of the district** (Creation of an extension of the Rizzi Amor street on the sea (creation of a wharf), Creation of a continuity between the of January 28, 1957 street and the Rizzi Amor street by adequate facilities, Uniform furniture, An enhancement of the junction between the two streets and the rehabilitation of soft traffic.
- **Boost the conviviality of the study area** (creation of vegetable gardens at the bottom of buildings and creation of equipment for environmental education (big aquarium)).

3.9 Techniques and intervention

Methods Among these techniques are green roofs; this is a process that consists of covering a flat or low slope roof with a vegetated substrate, Bouattour and Fuchs (2009), and is referred to as an eco-roof or vegetated roof. The advantage of this type of process lies in the ecological and health interest that it presents through an improvement of the quality of the air, a mitigation of the urban heat islands, a filtration and a biological purification of the waters of rains and regulation of water flow. On the technical side, the water tightness of green roofs is greater than that of ordinary flat roofs. In terms of landscaping, this process gives cities, especially industrial cities, an undeniable aesthetic value and enhances the habitat by supporting the integration of the building into its environment. Socially, this process contributes to make the city more "calm", more welcoming and improve the conviviality by the terraces gardens. In parallel to this process are the green walls that are "living" walls, or "gardens or vertical ecosystems", more or less artificial, conceived sometimes as aesthetic elements in the context of urban gardening, sometimes as works of art using the plant, or as elements of urban ecology, (Bouattour and Fuchs, 2009). By projecting redevelopment of the sea, the district of Oued Kouba has set itself the aim of improving the reception of the public and restore a "nature" identity to the site. Indeed, the heterogeneity of the facilities, the lack of fluidity in the links between the various poles of interest, the concept of any car of the past years and the natural wear of the materials give the site an unwelcoming aspect for the visitors. The proposed reorganization of spaces responds to specific functions, such as a new playground, a pedestrian zone near buildings; convivial terraces, rest areas and wildlife viewing; or a renewal of the path around the sea. The judicious staging of these spaces (choice of plantations, furniture, coverings, effective and didactic signage, etc.) gives the site a character and a landscape quality. which contributes greatly to improving the reception of the public. Particular emphasis will be placed on the accessibility of infrastructure for all. This will be followed by renaturation

and development of new development environments, the project will contribute to fight against erosion fauna and flora of the site. The current surroundings, in poor condition, will be replaced by others, by the development of aquatic flora.

4. Conclusion and Recommendation

Most cities in the world have a conflict with nature, Annaba, coastal city of eastern Algeria is one of them. It is through the study of Oued Kouba that we were able to discover the many damages and other dysfunctions caused by the urban invasion of nature. However, it is not impossible to reintegrate nature into an already dense urban perimeter, using processes designed to adapt nature to the city. During the study of the Oued Kouba area by adapting the approach of the urban project, the diagnosis revealed the numerous positive and negative attractions of the site. Indeed, this site has a very rich natural potential between blue and green parties.

The location of these elements allowed us to target our intervention on four important parts of the site. The actions undertaken to reconcile the study area with nature, aim to highlight the existing natural elements by preserving them and ending their degradation and reintroducing nature into the elements of the urban. The impact of this intervention is not only environmental, it is also landscape, social, economic and cultural. The Oued Kouba eco district project also raises the question of density. We are on the border of the Mediterranean, with a rather strong Arab-European tradition in terms of urban projection. Annaba is a very closed and dense radioconcentric city. We must find a third way between this form of city and the Arab-European city, mixing collective and individual housing to fit into this landscape. The site is also fully autonomous for rainwater. We worked on the planting of an organic horticultural and market garden on the perimeter of the water catchment point as well as on the catchment basins, to recover the water and to infiltrate it on site. Our work allowed us to intervene by injecting nature into urban elements such as buildings (green facades, garden terraces), the redevelopment of certain green spaces by adapting them to the activities practiced by citizens, introducing other natural elements (water, animals) and the photo-purification and the development of the approaches to the sea. Regarding this last point, we proceeded with the development of the littoral by the creation of a wharf on the sea to prolong the walk as well as the rehabilitation of the equipment "Bel azur" in big aquarium. At the end of this study, it appears that the eco-district of Oued Kouba has a great ambition, that of constituting a new piece of the city of Annaba and rehabilitate the urban housing (collective or individual), making it naturally attractive economically profitable and socially accessible.

5. Acknowledgements

All my gratitude and thanks are addressed to DGRSDT for their support and encouragements.

6. Data Availability Statement

The authors confirm that the data supporting the findings of this study are available within the article and its supplementary materials.

References

- [1] M. Bouattour et A. Fuchs "La végétation des bâtiments". Ed. Paris, 2009, 45 pages.
- [2] L. Cormier "Les urbanistes et l'approche écologique de la nature en ville : Une conciliation possible ?" *Innovations Agronomiques* 45, 2015, pp. 83-93.
- [3] K. Djebar et A. Boutchicha "Pour une réconciliation de la ville avec la nature : Cas de la zone de l'Oued Kouba, Annaba". Mémoire de Master II en Architecture, Université de Annaba, Algérie, 2017, 130 pages.
- [4] C. Emelianoff "Urbanisme durable ?", *Ecologie et Politique* 29, Ed. Syllepse, Paris, 2004, 244 pages.
- [5] C. Emelianoff "La ville durable en quête de transversalité". In N. Mathieu, Y. Germond (Dir.), "L'ville durable, du politique au scientifique". Ed Cemagref, INRA, 2005, pp. 129-142.
- [6] G. Forget et J. Lebel "The ecosystem approach to population health: the case of mercury exposure in local communities in Amazonia and in northern Quebec", 2003, pp.45-50.
- [7] S. Lamri "Espace vert urbain et périurbain de Sétif : état des lieux et place dans la gestion municipale". Mémoire de Magistère, Université de Sétif, 2012, 161 pages.
- [8] Direction de l'Urbanisme de l'Architecture et de la Construction (DUAC), Annaba. "Plan d'Occupation des Sols", 2011, pp. 12-22.
- [9] E. Rey and S. Lufkin "Des friches urbaines aux quartiers durables". Ed. Société, 2015, 142 pages.
- [10] Sommet de Rio, "le troisième à Rio de Janeiro (Brésil) en 1992.
- [11] R. Sidi Boumediène "L'urbanisme en Algérie, échec des instruments ou instruments de l'échec? "Ed. Alternatives urbaines, 2013, 228 pages.
- [12] M. Terfaya, M. R. Djebar and H. Berrabah "Influence of climatic parameters on the distribution of air pollutants and public health in Annaba (East of Algeria)". *International Journal of Medical Research & Health Sciences*, 2013, pp. 118-124.

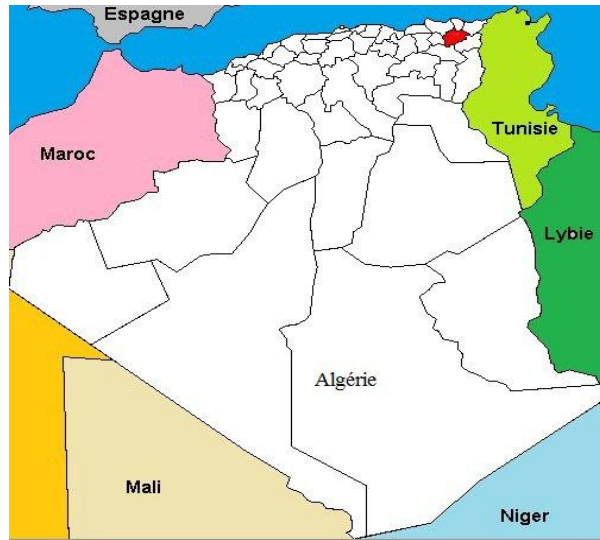


Figure 1: Location of Annaba city



Figure 2: Location of Oued Kouba district



Table 1 (a): AWOT (Advantages, Weaknesses, Opportunities and Threats) of Oued Kouba district: Urban and Architectural Dimensions

Principal point of district	Urban and architectural dimension	
	Situation	Urban part
Advantages	<ul style="list-style-type: none"> - Good situation. -- Transition site. - Joining element between the two main axes surrounding the site. - Standardized channels. 	<ul style="list-style-type: none"> - Urban mix (modern and colonial housing with equipment).
Weaknesses	<ul style="list-style-type: none"> - Located on a part of the river. 	<ul style="list-style-type: none"> - Disordered development of the habitat (lack of respect of the specifications). - Lack of maintenance of some colonial homes. - Sobriety of facades. - Presence of illegal housing - Degradation of coatings.
Opportunities	<ul style="list-style-type: none"> - Connecting element between different sectors. 	<ul style="list-style-type: none"> - Constructions able to be vegetated.
Threats	<ul style="list-style-type: none"> - Overexploitation in high season (tourists, visitors ... etc.). 	<ul style="list-style-type: none"> - Degradation and / or collapse of some houses due to lack of maintenance. - Uncontrolled and uncontrolled evolution of the site - Deformation of the initial morphological aspect of the site

Table 1 (b): AWOT (Advantages, Weaknesses, Opportunities and Threats) of Oued Kouba district: Socio Economic Dimensions.

Principal point of district	socio-economic Dimensions		
	- Transport and Access.	- Use and appropriation of spaces	- Others
Advantages	<ul style="list-style-type: none"> - Several accesses. - 2 types of public transport (bus, taxi) 	<ul style="list-style-type: none"> • Presence of relaxation areas, games, meetings. • Various trades. • Nature research by the citizen (creation of spontaneous green spaces by plantations or flower pots). • Ownership of homes by certain animal and plant species (facades, interstices etc.). 	<ul style="list-style-type: none"> • Presence of equipment and various businesses. • Presence of educational, sports equipment and religious, plus a safe service.
Weaknesses	<ul style="list-style-type: none"> - Non diversified transport - Lack of plates of signaling 	<ul style="list-style-type: none"> • Some uses are not suitable for free spaces and cause their deterioration. • Uncontrolled appropriation of free spaces (weekly market ...) • Presence of urban wasteland. 	<ul style="list-style-type: none"> • Waste rejection in the tree boxes. • Lack of street furniture adapted for people with reduced mobility. • Lack of leisure facilities.
Opportunities	<ul style="list-style-type: none"> - Easy pedestrian circulation (flat land) 	<ul style="list-style-type: none"> • Creating a friendly atmosphere by the appropriation of public spaces by the inhabitants. 	<ul style="list-style-type: none"> • Active social life through the exchange between businesses and open spaces.
Threats	<ul style="list-style-type: none"> - High traffic in summer (traffic jams, lack of parking spaces). - Problem of pollution and noise nuisance. 	<ul style="list-style-type: none"> • Nothing to report 	<ul style="list-style-type: none"> • Nothing to report

Table 1 (c): AWOT (Advantages, Weaknesses, Opportunities and Threats) of Oued Kouba district: Nature .Dimension

Principal point of district	Nature
Advantages	<ul style="list-style-type: none"> - Presence of sparse vegetation - Good quality soil - Mediterranean climate - Local fauna and flora still extant - Land with flat tendency
Weaknesses	<ul style="list-style-type: none"> - poorly maintained green spaces - Scattered vegetation - Lack of development of local fauna and flora. - Pollution - Crossing of underground rivers.
Opportunities	<ul style="list-style-type: none"> - Local flora and fauna offering a typical character to the site.
Threats	<ul style="list-style-type: none"> - Degradation of green spaces - Disappearance of some local plant species - Dull and mineralized landscape.

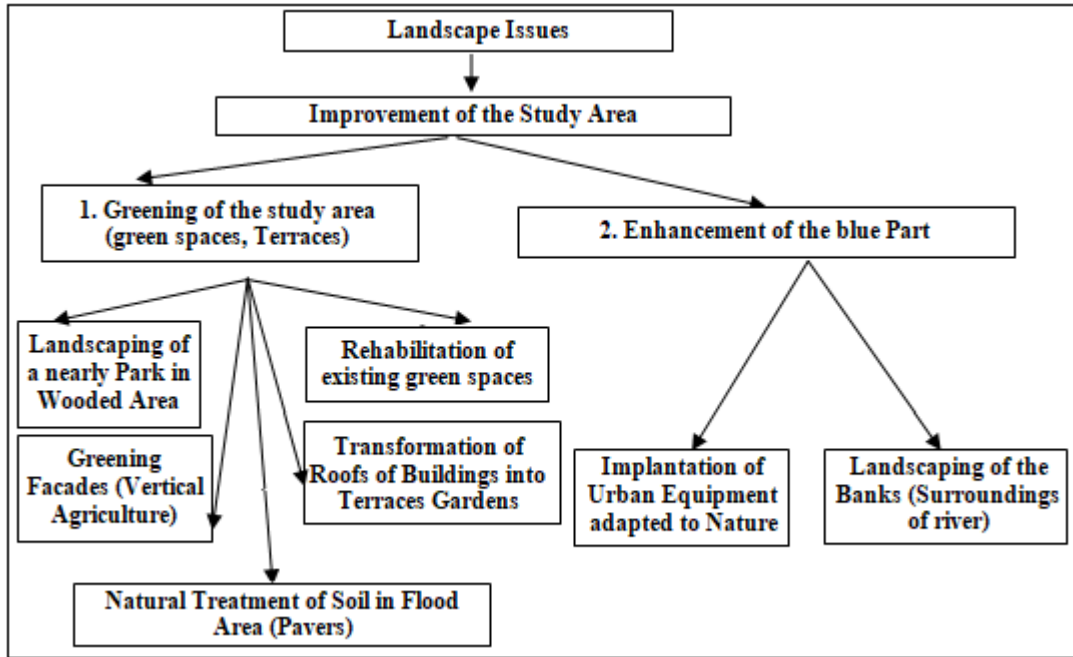


Figure 7 (a): Representative Diagram of the Landscape Issues of the District of Oued Kouba

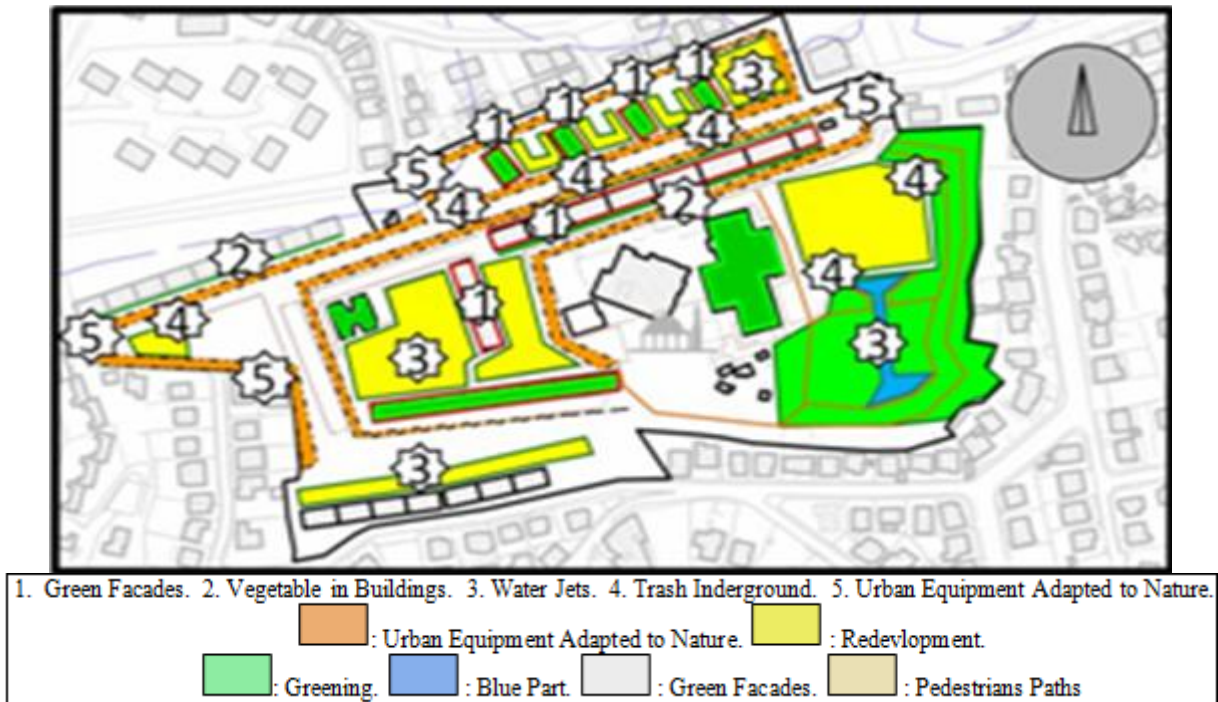


Figure 8: Representative Diagram of the Proposed Action Plan for the District of Oued Kouba