

# Road networks in high sensitive areas

## A tool for sustainable development

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### Abstract

Egypt has unique ecosystem diversity. It has striking natural sites in addition to sunny beaches, including desert landscapes, oases, canyons and falls. Environmentally sensitive areas are considered as a major source of economic resources in Egypt, where a lot of the touristic activities and agricultural activities are achieved. These sensitive areas mostly are attached to urban or rural communities that results a mixture between urban and natural life at the same time.

Egypt includes 29 protectorates represent 15% of the total area of Egypt. These protectorates are considered as some of the most important ecological areas in the world. These regions face environmental and urban challenges affecting the future of their natural life and the urban life. One of the most important challenges is to develop road networks of these ecosystems, toward achieve the concept of sustainable development.

This paper highlights the importance of upgrading system of movement and intervention strategies on Lake Qarun in order to achieve sustainable development goals.

Key words: sustainable development, lake, conservation, system of movement, natural life

### Research framework:

The research focuses initially on understanding the concept of sustainability, and factors that affect sustainable development such as the relation between road networks ,environment and urban. This relation is one of the most important principals of sustainable development. Then the research deals with high sensitive areas and their essential need for sustainable development. Through analysis of International experiences of developing lakes areas as a kind of high sensitive areas the research concludes a methodology to develop road networks in high sensitive areas. This leads to applying this methodology on one of distinguished high sensitive areas in Egypt" lake Qarun" and to what extent can develop road network in this area towards sustainability achievement .

The research will be summarized as follow:

- Sustainable development
- Road networks and sustainable development
- Functions of road network
- High sensitive areas
- A need for sustainability
- international experiences
- Case study: Lake qarun

### 1.Sustainable development:

Over the course of the last fifteen years, the concept of sustainable development has become essential to the development of most countries. Sustainable development is defined as balancing the fulfillment of human needs with the protection of the natural environment. A common definition of sustainable development is "development that meets the needs of the present without compromising the ability of future generations to meet their own needs."<sup>i</sup> (United Nations,1987) The field of sustainable development can be conceptually broken into three constituent parts: environmental protection, economic sustainability, and social justice.

- Sustainable Development promotes and adopts close link between environment and economy, and the reason for this is the effects of urban activities and buildings on the environment which has economic dimensions.

## 2- Road networks and sustainable development:

The road network is a key component of the built environment that serves the land uses contained within the urban fabric, whether they be residential, commercial, educational or other. Despite of that road networks in communities, mobility, safety, accessibility, comfort, and convenience have been seriously neglected in most places. The relation between road networks and urban is one of the most important principals of sustainable development, as shown in Figure (1).

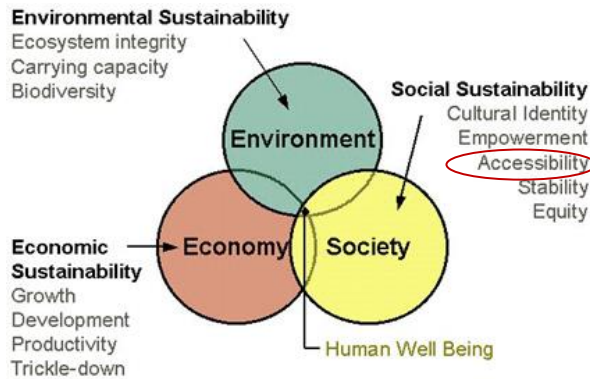


Figure (1), Road network as a tool of accessibility in societies is one of the most important principals of sustainable development

## 3- Functions of road network:

Road networks play vital role in urban communities. They have many functions:

- Provide accessibility to and within urban areas. They Permit people and goods to get from here to there.
- Linking different functions in the community.
- It has an environmental function with its greenery
- streets are important corridors for utilities such as electric power, communications such as telephone, cable television and fiber optic lines, storm and sanitary sewers, and natural gas lines.

## 4-High Environmental Sensitive Areas

Environmental Sensitive Areas (ESA) is defined both in terms of the expected mutual Impact and the nature of the area in question. (Ismail2004).most of (ESA)are protected areas or simi protected according there national - international importance .Protected areas are a fundamental tool used worldwide for protecting natural resources, creating a buffer and refuge against a rising tide of human impacts. Today, there are 114,000 protected areas around the world in almost every country, covering nearly 12% of the world's land surface. In addition to preserving outstanding examples of natural habitats and providing refuges for endangered species of plants and animals, they also play an increasingly important role in social and economic development (NCS2006)

Protected areas defined in Egyptian law as "a natural protectorate is defined as any area of Land, or coastal or inland water characterized by flora, fauna, and natural features having cultural, scientific, touristic or esthetic value."

Egypt has 27 Protected Areas, covering 15% of Egypt's area (EEAA2008) like most countries; Egypt has faced many challenges due to technological development and interlinked global ecosystems, as well as, revolutionary genetic engineering, free trade, growing world tourism, along with limited financial resources. Therefore,

Egypt has considered international cooperation in nature protection as a top priority, which played a pivotal role realizing intended goals.

## 5-Sustainable development for ESA

The concept of sustainable development for (ESA) depend on conservation of nature recourses with develop it to get socio- economic opportunities without compromising the ability of future generations to meet their own needs.

	Environmentally Sensitive Area at Risk	Since	Id. In	Declared Protected	Current Pressure	Source
1	Fertile Land	1953	1960	1983		U,I
2	River Nile	1962	1975	1982		A,F,I,T,U
3	Nile Islands	1989	1994	1998		U,T
4	Delta Wetlands	--	1998	1998		A
5	Lake Qarun	1975	1987	1989		A,I
6	Red Sea Coasts	1981	1994	2003		T
7	S. Sinai Coasts	1987	1989	1992		T
8	Siwa Oasis	1985	1998	2002		U, A
9	Lake Nasser	--	1987	--		A,F,I,T,U
10	Wadi Allaqi	--	1987	1989		M,I
11	Darb Arbein	--	--	--		A,U

A: Agriculture, F: Fishing, I: Industry, M: Mining, T: Tourism, U: Urban  
Source: Laws dates compiled from Bakr,2000. Other dates are approximate compiled from the Al-Ahram internet archives.

Figure (2) problems faced (ESA) in Egypt

**Materials and Methods:**

The United Nations Conference on Environment and Development in 1992 recognized the important role that indicators could play in helping countries make informed decisions concerning sustainable development. However, the sustainable development remains a renewed process and variable due to renewed humanitarian needs and changing economic and social. So the planners and designers should develop measurement and analysis tools to keep pace with these changes by using sustainable development indicators (CSD).

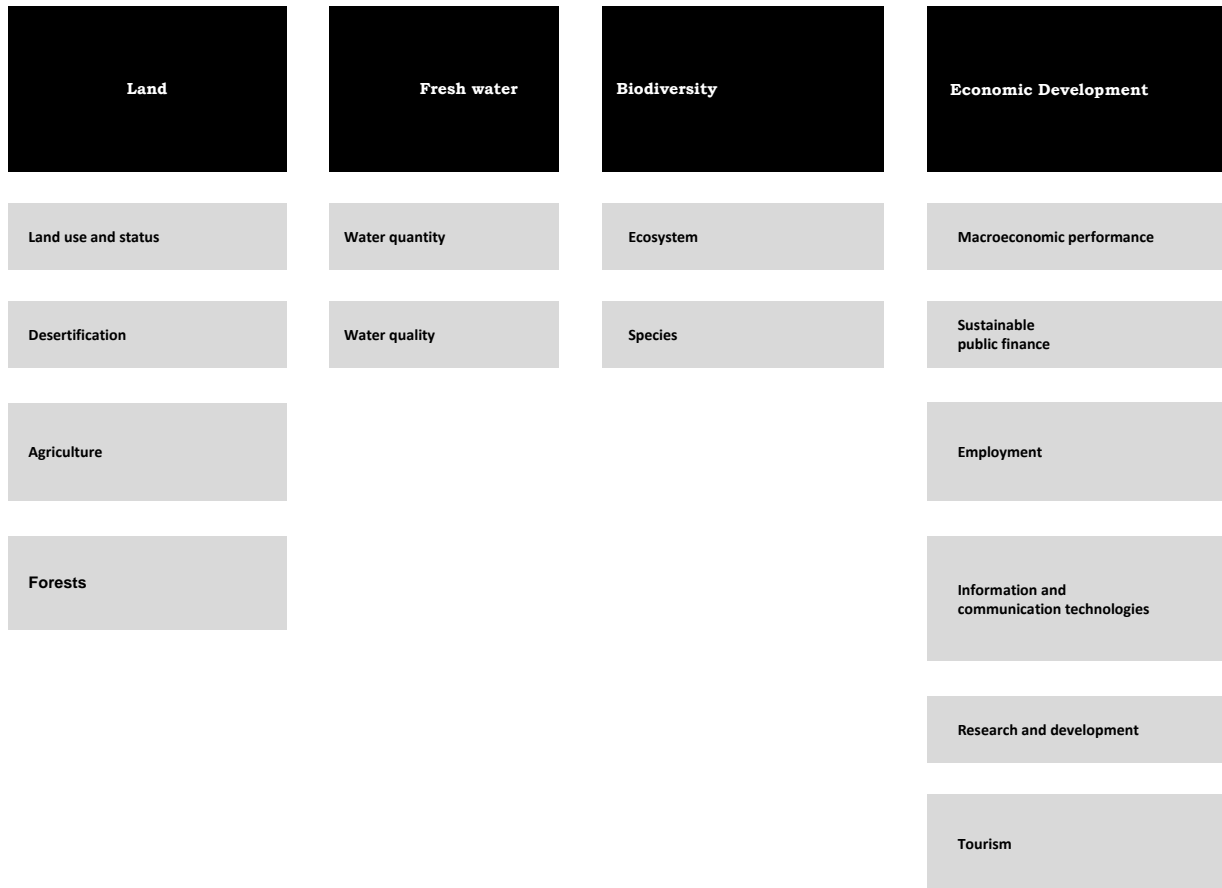


Figure (3) sustainable development indicators (CSD)

## International experiences:

### James Clarkson Environmental Discovery Center, White Lake Township, Michigan

**Project Statement:** The James Clarkson Environmental Discovery Center is dedicated to the exploration and celebration of the natural environment, educating users on the importance of biodiversity, native habitats, and environmental protection. Restored ecosystems and their associated wildlife inhabitants are within an arm's length, optimizing interaction with the natural world, while preserving and protecting its sensitive ecological areas and endangered species. Interpretation of the area's hydrology is articulated through the rehabilitation and creation of wetland, prairie, and forest ecosystems. And kids think it's really cool, too. (ASLA2008)

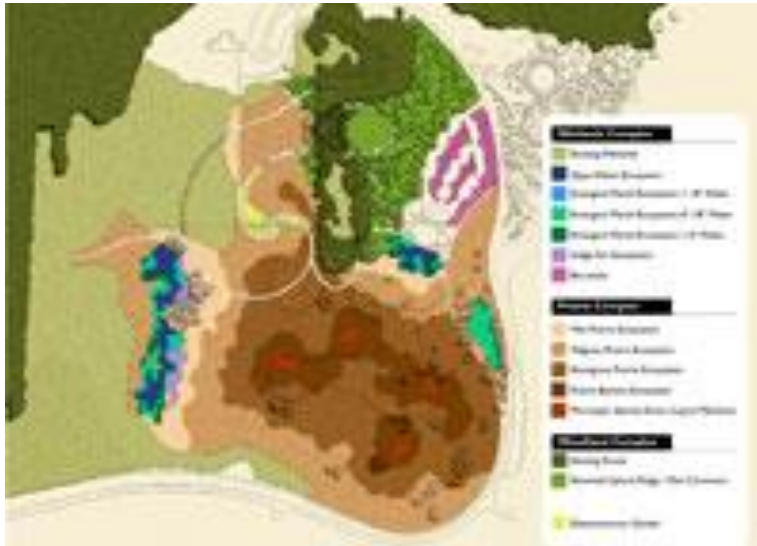


Figure (4) James Clarkson Environmental Discovery Center master plan (ASLA2010)

The James Clarkson Environmental Discovery Center is envisioned as a place of learning, play, and gathering that seeks to open a window on the beauty and diversity of the natural world that exists in Southeast Michigan. The 70-acre center, located within Huron-Clinton Metropolitan Authority's (HCMA)

These ecosystems establish an ecological vocabulary, revealing the influences and processes that shaped the Midwestern landscape. The center's infrastructure elements are sited to optimize the visitor's interaction with the natural world, while preserving and protecting its sensitive ecological areas and endangered species. The focus from the outset was to take advantage of the diversity of ecosystems present within the park, and to make it a unique and extraordinary educational platform

The goal is to use the site to teach about ecosystems and to give visitors an appreciation of the complexity of natural systems and the interrelationships between all aspects of nature, including the role of human beings.

The master plan Based on, the bio-diversity of the site was celebrated and augmented through the restorations of the following ecosystems: prairie barrens, short grass prairie, tall grass prairie, and a sedge-fen-lake complex. This large-scale ecosystem restoration required the landscape architect to coordinate the expertise of the entire team, understanding complex issues related to site hydrology, native plant species, and storm water control, and endangered species preservation. The landscape architect utilized the site's natural 40 feet of grade change in order to help reestablish the various eco-systems that would naturally assimilate to the different micro-climatic conditions. This allowed the reestablishment of more than 170 plant species. Using the high water table as a result of the headwaters, a sedge fen lake was dug to create additional educational opportunities and study of open water systems.

In this project many designing and function methods were used to achieve the educational purpose and maintain the unique environment at the same time.



Figure (5) Ecosystem Transitions - Pathways and council rings are utilized to delineate ecosystem transitions and



Figure (6) Wetlands Boardwalk - The wetlands boardwalk at the sedge fen lake is an ideal location for environmental

**Design Concept:** diversity in paths not only in function and materials but also curved paths were used to achieve a harmonic visual image.

**Materials:** Using stone and trees from the species surrounding the area to achieve sustainability concept and using wood for Seats.

In critical zones, network of trails were created to preserve the nature in these zones.

In this project paths varies from mechanical movement roads reaching to pedestrian paths and from functional perspective they varies from exploration paths, promenade paths and paths in critical areas for researchers and students.



## Remodeling Paradise — Landscape Renovation Round West Lake Region in Hangzhou



Figure (7) West Lake Region in Hangzhou Master plan



West Lake of Hangzhou is a natural lake of most cultural significance in China. For more than a thousand years, people have created beautiful scenery and plentiful historic sites in the lake area as well as a great deal of widely spreading legends, poetries and other cultural heritages. West Lake has been the ideal model of traditional Chinese landscape and even the model of other Asian countries. Owing to West Lake, Hangzhou is known as the "paradise on earth." By the end of the 20th century, with the speedy urban growth and the increasing number of visitors, many problems had become more and more acute in the West Lake region and Hangzhou was almost unable to be worthy of the name of "Paradise." In view of this situation, the project was proposed in 2001. The local government expected to create a better urban environment, promote the development of tourism, and provide high-quality urban open spaces for citizens by remodeling the West Lake region. The project covers an area of 12.8 square kilometers and almost comprises all significant landscape resources of the city. As it is an extremely complex large-scale systematic project, the landscape architects are confronted. (DYJG2010)

Road network in west lake region faced many problems .like width of streets is not enough to take in the movement activity.In southeastern part there were four lakeside parks between the city and West Lake, whose connection had been cut off by some other types of land. The northern part is an area with hills behind and the lake in front. Part of the narrow strip between the lake and city road functioned as a park and part of it as a walkway.



Figure (8) walkway in the project

This project presented many solutions to this problem in eastern part, changing the main street into an underground street. One of the proposed solutions is considering the southeastern part is to establish a continuous broad lakeside walkway establishing a continuous broad lakeside walkway. In northern part transform the lakeside area into a more comfortable urban open space, a number of renovation measures are proposed, including: rearranging vegetation, opening the view lines, building some waterfront platform, widening the walkways and pavement

The project also has created a large continuous beautiful urban open space with all necessary facilities, which serves both the residents and the visitors properly. According to the survey from 2005 to 2009, Hangzhou has kept the title of "The Best Well-being City in China" for five years.

Comprehensive Benefits: Through this project, the city has greatly enhanced its environment and consequently attracted large numbers of talented people, big companies and capital to arrive. Despite its huge investment, this project is cost-effective in view of the city's accelerated economic growth from its beginning to the present. With beautiful environment, harmonious society and dynamic economy, Hangzhou city once again become an ideal "paradise." This project has become a model of sustainable urban development.

### Lessons learned from international experiences:

The study analyze international experiences using selected indicators of sustainable development and tries to evaluate these experiences through achievement of road networks sustainability in high sensitive areas. The indicators are selected from CSD themes according to the aim of the study and the nature of case studies. These selected themes are land, fresh water, biodiversity and economic development

Theme	CSD Indicators	projects	
		White Lake	West Lake
land	Land use and status	*	**
	Desertification	*	
	Agriculture	*	**
	Forests		*
Fresh water	Water quantity	*	*
	Water quality	*	**
Biodiversity	Ecosystem	**	**
	Species	**	**
Economic Development	Macroeconomic performance		*
	Sustainable public finance	**	**
	Employment	*	**
	Information and communication technologies	**	
	Research and development	**	
	Tourism	**	**

CSD Indicators in case studies

- Design a good road network in ESA Effective in conservation of biodiversity.
- Using materials from surrounding environment more effective and getting harmony between project and site in addition to realizing sustainability.
- Realizing hierarchy in road network and paths gives good spatial experiences.
- Diversity between trail, walkways and ..... gives diversity in walking and movement activities.
- Using more than design techniques realizes harmony in visual image.
- ESA sustainable development needs to thinking in untraditional solutions.
- Using technology and communications with green materials to get an attractive landscape.
- Developing road networks in high sensitive areas can upgrade economic income and increase employment chances.
- Road networks is one of the most important tools for upgrading quality of life in local communities surrounding lakes.
- Road networks can be used as a tool for land use management.

## Study area

It is one of the ancient natural lakes in the world. It is the remaining part of the ancient Morris Lake. It is globally renowned for the abundance of sea, river, continent fossils which date back to 40 million years like El-Fayoum Giant animal which resembles rhinoceros (EEAA2005). Lake Qarun is a salt water lake in south west of River Nile delta in governorate of Fayoum. Lake Qarun is a saline basin, The Lake is bounded on the east and south by the agricultural cultivated lands, and it located inside the Fayoum oasis, covering an area of 240 km<sup>2</sup>. It occupies the deepest part of the Fayoum depression, so the water surface is at approximately 45 meters below the sea level. Date of Announcement as protectorate area in1989. It is protected area cover 1385 km<sup>2</sup> (FG 2005)

### Qaroun Lake Road network description:

The lake is surrounded by a main road from three sides which are west, east and south sides. This road is in the same time Fayoum main road despite that its width is not more than 20m and roads that linking all villages are have an accessibility to this road. Lake shore is just a narrow strip between the lake and the road. Walkway in south side of the Lake is not continued because of raising water level in lake. on the north side, there is only one trail 50km long.

In addition to that there are not any boat marines linking the north to the south part of the lake. All roads and baths are in bad condition that led to negative influences.

Previous Plans and Policies Interest in the concept of sustainable development has increased in 90s in Egypt .most of these plans were directed to tourism , environment, fishing and agriculture our team has reviewed the previous development plans in the Fayoum Governorate including the following studies:



Careful analysis has shown that very few of the above mentioned plans and its suggested approaches have been implemented. Issues of the regional economic crisis, conflicts between relevant authorities, lack of financial resources, environmental deterioration, language barriers, and availability of documents, local awareness and lack of specificity can be seen as some of the reasons for the difficulty and inability of implementation. For the development of these studies as sustainability plan must take into account the social and physical dimensions and dealing with the lake and the surrounding environment in one framework to achieve the desired integration of these plans.

### Results and Recommendations:

- Towards sustainability achievement it's a must to upgrade road network surrounding the lake starting from design level reaching to planning level.
- The main road has to be transformed to a distance from the lake shore to create wide shore line and to reduce negative impacts of air pollution that results from traffic.
- Establishment of walkways along Lake Shore.
- Creating nodes in intersections of main roads and secondary roads, in addition to collecting commercial activity in these nodes.
- Establishing marine boats near from fishing villages to link between lake sides.
- Design trail network in critical zone in the north side of the lake.
- Using environmental materials from the site in construction of road network.



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