

Research Article

Land Evaluation Sales Comparison Method and its Effect on the Sustainable Development of Natural Reserves in Egypt: Case Study of Petrified Forest in New Cairo

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Abstract

Protected areas in Egypt suffer from severe negligence in terms of sustainable development. One of the reasons is the absence of the role of the planner, designer and evaluator capable of evaluating protected lands, and convincing its residents and responsible organizations to draw up sustainable development plans, using the economic and environmental values of the land. They also lack any knowledge of the beautiful aspect and value of the land. This often leads to encroachment on the land and on important natural areas on the reservation. Consequently, it affects the environmental systems present through the loss of the natural resources that should be protected. Examples of this include the clear encroachment of touristic activities in Sharm el Sheikh on the lower border of the Nabaq Reserve, the presence of a large commercial mall in the city of Shalatin to trade with the Sudan, in the center of Elba Reserve, the exploitation of the Nile Islands Reserve with residents building on the land, in addition to the attempt by the Housing Ministry to sell parts of the Petrified Forest Reserve to residents. Thus, this research aims to examine the current status of lands surrounding the Petrified Forest Reserve to pinpoint the main reasons for negligence and the problems this area suffers from. In addition, this research aims to solve the problem of sustainability in the Petrified Forest Reserve to halt its deterioration.

Keywords: Land evaluation, sustainable development, protection from different kinds of pollution. protected Petrified Forest

Introduction

This research will showcase the methods for maintaining sustainable development in areas in the reserve and in surrounding natural areas in order to reach a more sustainable structure. In order to achieve this objective, a theoretical framework to use these lands shall be presented in order to evaluate such lands, and accordingly be able to reuse them. This will lead to an increase in the value of the these lands. Revenues resulting from such re-evaluation will be used in the protection of the reserve. Furthermore, the reserve shall be protected against visual pollution as well as air and land pollution resulting from the status quo of the surrounding roads. The second step would be to present a scientific framework that includes environmental, economic, social, and urban views, as well as those related to planning in one general framework, that provides the steps that should be followed when dealing with the Petrified Forest Reserve and the lands surrounding its borders, by examining the profits resulting from using the land under sustainable development. The study shall apply this system to the Petrified Forest Reserve in New Cairo in Egypt. The final step involves the discussion of related basic hypotheses, strategies and plans, as well as the qualitative analysis of the results on

functional, environmental and beautification bases; in addition to applying this suggestion to similar reserves.

1. The Petrified Forest Reserve

The Petrified Forest Reserve in Maadi, Cairo governorate, is one of many natural reserves in Arab Republic of Egypt, and that is in accordance with the Law on Natural Reserves no. 102 of 1983. The reserve was established pursuant to the Prime Minister's decision no. 944 of 1989. (EEAA 1988) (www.eeaa.gov.eg)

1.1 Definition of a Petrified Forest Reserve

Petrified forests are formed of trees that time and circumstances have teamed up to change them into stone. An example is a forest in the state of Arizona in the United States (US) that dates to 160 million years ago. When the trees died, some of them fell into the water stream, and were carried to a shallow sea near the area. Then, repeated volcanic eruptions covered the trees with volcanic ash containing raw silica in the water, and gradually changed the trees into quartz with beautiful colors. There are also semi-precious stones like agates and Yamani beads in abundance, and hence the place is named The Rainbow

Forest. (Tourism Development Authority1998)]
www.nationalparks-worldwide.info/egypt⁽¹⁾

The Petrified Forest in Maadi was formed millions of years since the Oligocene Age (35 million years ago), during the third age of the Cenozoic Epochs, which is considered an important and rare part of geologic history. It is important to protect this natural treasure that is rare and unique as a cultural, scientific and touristic heritage. This Petrified Forest is given the name of Wood Mountain in many scientific references. It was mentioned many times in foreign references, making it interesting to scientists and researchers of geology departments in scientific faculties in both Egyptian and international universities. It is also for those interested in the history of the earth, its treasures, and natural history, as well as those who study sediments and fossils related to geological chemistry and geological physics. This area is considered a rare geologic monument that has no equivalent in the world regarding its spaciousness and completeness. ⁽³⁾ UIA1992⁽⁹⁾ www.eeaa.gov.eg

1.2 Location of the Petrified Forest Reserve

The Petrified Forest Reserve lies 18 kilometers to the east of Maadi city, Cairo governorate, and north of the Katameya-Ain El-Sokhna road with 1.8 kilometers facing the south part of the Katameya-Ain El-Sokhna road and at a distance of 2.7 kilometers north (off the road) and an average area of 5.5 km². The area lies between the longitudinal axes of 31°27'30" – 31°28'30" and the horizontal axes 29°58'30" - 29°59'40". (Map (1) shows location of the Petrified Forest Reserve.)



Map (1) shows the location of the Petrified Forest Reserve.

The Western Border: From point (A) on the northern border of Katameya road for a distance of 2.803 km in the northern direction till point (B) so that the western border

is 200 meters from the eastern border of the two urban settlements 3 and 5 (El-Fagr urban settlement with its southern and northern parts).

The northern border: from point (B) for a distance of 1.877 km till point (C) in the west. And from point (C) at a distance of 215 meters in the north till point (D) in the east.

The Eastern Border: from point (D) for a distance of 2.411 km south till point (E) on the northern border of Katameya road. And from point (E) at a distance of 557 meters in the southern direction till point (F) in the east.

The Southern Border: from point (F) at a distance of 1.096 km till point (G). And from point (G) at a distance of 1.125 km till point (A), parallel to the northern border of Al-Katameya Road.⁽⁹⁾ www.eeaa.gov.eg

1.3 Surface Geology of the Reserve Site

In the Petrified Forest, there is a condensation of stems and roots of petrified trees that contribute to the Wood Mountain formation. The mountain is formed of layers of sand, pebbles, clay and petrified wood, with thickness ranging from 70 to 100 meters. Although these sediments are poor in fossils and organic remains, they are significantly rich in roots and stems of large petrified trees, which take the shape of siliceous rocks with cylindrical cross-sections that vary in dimension from centimeters to few meters, and join together to form the Petrified Forest. The formation of the Petrified Forest in Maadi is attributed to that many geologic ages ago a branch of the Nile River carried these trees from distant areas to this location where they became petrified.⁽¹⁾ EEAA 1988⁽⁹⁾ www.eeaa.gov.eg

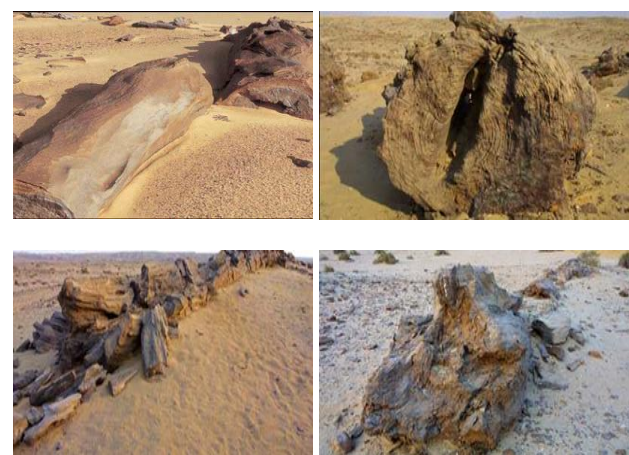


Figure (1): Surface geology of the reserve site.

Tree roots are present on the surface or intermingled with sand layers, forming the Wood Mountain. The roots and stems are arranged horizontally in two main directions, the first is 30 degrees north-east. The lengths of the stems of this group are about 15 meters, with an average diameter of 40 centimeters. The other direction is 20 degrees north-east, and this is the most abundant with roots reaching more than 25 meters in length and about 1 meter in diameter. It is worth noting that the direction of the roots coincides to some extent with the direction of the main

faults in the area. Hence the geologic history of the area can be summarized as follows: the formations of the lower and middle Eocene epoch precipitated under environmental marine circumstances. This era was followed by the retreating of the coast and the formation of a surface of that eroded and decayed, resulting in the appearance of many drainage channels. Under these circumstances, the layers of sand and gravel were formed and many trees were carried through these channels floating on water to the Reserve site.(3 UIA1992)(9 www.eeaa.gov.eg)

1.4 Different Areas in the Reserve Park

The area of the Petrified Forest Reserve in Maadi, resembles an almost-flat hill with some groves and ridges that were eroded by the wind. The area is mostly covered by the Wood Mountain formation.(9 www.eeaa.gov.eg)

2. Examining the Status Quo of Areas Surrounding the Petrified Forest Reserve

2.1 Lands Surrounding the Reservation

Lands surrounding the reserve area are sold in one of the following methods:

- 1- As land for housing without a high economic value as it covers areas of 300 m² on the eastern border of the Reserve or 600 m² on the northern border of the Reserve. Its value does not differ from areas with streets having the same width. This shows that the person evaluating the lands surrounding the Reservation did not heed the value of the view of the open space of the Reservation. In other words, this piece of land, for the evaluator, resembled an empty space that would not be used at present or in the future. (Source: The Researcher)
- 2- Lands allocated for constructing low-cost residential buildings on the western border of the Reserve.



Figure (2) shows low-cost residential buildings surrounding the Reserve. (Source: The Researcher)

- 3- Lands allocated to the German University in Cairo (GUC), however the designer of the university did not bear in mind the value of the surrounding view of the open space of the Reserve. In other words, the view represented an abandoned land that will not be used at present or in the future, so the designer had the service buildings facing the street in front of the Reservation. The designer considered this area fit for the prospective expansion of the university. This is clear in the aerial photography of the university buildings. (Source: The Researcher).



Map (3) shows the use of lands in areas surrounding the Reserve. (Source: The Researcher)

- 4- Lands sold and allocated as areas for industrial purposes on the south-eastern border of the Reserve. The urban designer bore in mind that the winds in this area are north-western winds which will take any industrial air-borne wastes away from the Reserve, which would protect the Reserve from air pollution. However, the designer did not bear in mind the other wind directions. (Source: The Researcher)

2.2 Roads Surrounding the Reservation

There is a main network of roads surrounding the Reserve. This network is separated from the Reservation by a fence that passes all the negative effects to the environment, particularly lead oxides resulting from the exhaust of vehicles passing on the roads. Lead oxides which are carried by the wind to the various parts of the Reserve will cause many prospective environmental problems. (Source: The Researcher). The roads surrounding the Reservation are:

- A regional road linking Greater Cairo to the Red Sea governorate. This road is called the Cairo-Ain El-Sokhna Road and lies on the southern border of the Reservation.
- Main roads surrounding the Reservation ranging between 20 meters and 40 meters in width. Figures 2-9 are pictures taken at the site and show the different angles of the network of roads surrounding the Reserve.



Map (4) shows the main, regional and branching roads surrounding the Reservation. (Source: The Researcher)



Figure 1 A photograph Angle F



Figure 2 A photograph Angle A



Figure 3 A photograph Angle G



Figure 4 A photograph Angle B



Figure 5 A photograph Angle H



Figure 6 A photograph Angle C



Figure 7 A photograph Angle I



Figure 8 A photograph Angle E

Figures 5 (1-8) are pictures taken at the site and show the different areas and angles of the network of roads surrounding the Reserve. (Source: The Researcher).

2.3 Sources of Pollution Surrounding the Reserve

The Reserve is affected by several sources of pollution including visual, air and land pollution:

- **Visual Pollution**

The northern border of the Reserve is surrounded by residential building that are four floors high and in varying architectural styles. Their facades have 14-meter standard dimensions with six-meter structural setbacks between the pieces land. This causes a type of visual pollution. Moreover, the low-cost housing on the western border of the Reservation with its recurring grey-colored facades creates visual pollution, in addition to the residential buildings on the eastern border of the Reservation with their small areas that reflect small-area facades covering nine meters and that are 13 meters in height.

Moreover, there is the design of the German University and what it represents in terms of modernity and technology in building materials and construction methods.

The abovementioned and the fact that the dimensions of the Reservation are relatively small in size, reaching approximately 2x3 km has resulted in that any visitors to the Reservation can see the surrounding buildings during their visit. These buildings are contrasted to the history of the Reservation dating back millions of years. This negatively affects any visitor’s experience and leaves a negative effect on the visit and the visitor’s perception of the place and the value of the area. (Source: The Researcher).



Figure 6 shows a picture of the roads surrounding the Reserve. (Source: The Researcher).

- **Air Pollution:**

In addition, to the factors of erosion that change the nature of the lands surrounding the Reservation and due to their closeness to residential areas, it is clear that roads negatively affect the environment, particularly due to lead oxides resulting from the exhaust of vehicles passing on nearby roads. Lead oxides are carried by the wind to the various parts of the Reserve. This is likely to result in destroying the Reserve and the rare geological formations in it. (4 Brundtland1987)

- **Land Pollution**

By examining the contour lines of the lands surrounding the Reservation, it becomes clear that the contour line extending from the north to the south allows the leakage of water from water and wastewater networks beneath the Reservation. This harms the soil as well as the formations created by continental sediments and fossils along the main faults in the area. Moreover, the presence of many waste channels that contain several levels of sand and gravel harm the soil. Figures 7 and 8 show the contour sections in the Reservation and explain the different levels of the Reservation.

Trespassing on the Reservation by throwing construction and human wastes inside the Reservation as well as breaking the surrounding fence negatively affect the soil due to the decomposition of these wastes.



Figure 7 shows a cross-section of the Reservation from east to west.

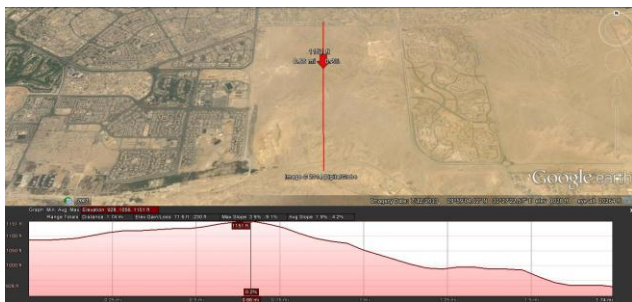


Figure (8) shows a longitudinal-section of the Reservation from north to south.

• Water Pollution

By examining the Petrified Forest in Maadi, experts attribute the formation of the Petrified Forest to that many geologic ages ago a branch of the Nile River carried these trees from distant areas to this location where they became petrified. Most of the petrified formations are arranged horizontally in two main directions. The first is 30 degrees north-east, while the second is 20 degrees north-west and is the most common. It is worth noting that the direction of tree roots is consistent to some extent with the directions of the main faults in the area. Many waste channels were formed – over time – and under continental river conditions, layers of sands and gravel were formed. Many trees were carried through these channels. This means that the presence of these wastewater channels may carry rain water filled with industrial dust and exhaust to neighboring areas.

By examining the abovementioned sources of pollution and their effects, it becomes clear that pollution will eventually lead to the destruction of the Reservation along with all the rare geological formations present there that are not found anywhere in the world.

3. Sustainable development alternatives for the status quo of the petrified forest reservation.

By examining the status quo of the Reserve, its surroundings, the misuse of surrounding lands and the

closeness of the Reserve to main roads, all which subject the Reserve to many sources of visual, air, land and water pollution, it becomes clear that a number of steps need to be followed in order to preserve and protect the Reserve.

These steps are:

1. Making use of the structural setbacks present between the fence of the Reservation and the road on the western border of the Reservation to create the following suggestions.(6 Musgrave1973)
2. Excluding a part outside the periphery of the Reserve at 100 meters in width, making sure that this area does not have any geological formations, and that it is situated on the eastern, northern and southern borders of the Reserve near the main roads leading to it, to host to the following suggestions to protect the Reservation.

4. Suggested Solutions To Cure Prospective Negative Effects

The abovementioned areas can have eco-buildings that make use of the surrounding natural environment. These buildings should be similar to those present in Saint Catherine Natural Reserve and the Petrified Forests Reserves in the US. This will halt the negative effects of the roads surrounding the Reserve and eradicate visual pollution(7 Kelso, W. (1984)).

Similar Reservations or protected areas in the US are surrounded by high-value buildings that require that surrounding open space. Such buildings include transmission stations, and radio and television reception. They are often light one-floor buildings with satellite dishes and without towers.(8)

Figures 9 and 10 show the methods for using Reservations in similar areas in the US. Illustrates the form 11 model construction proposed in the reserve.(10)



Figure (9) shows the buildings surrounding Petrified Forest reservations in the US.

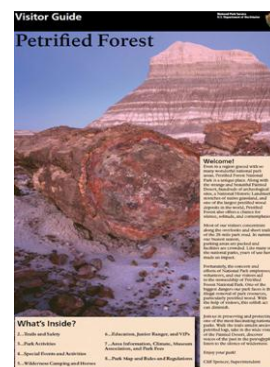


Figure (10) shows the Petrified Forest reservation in the US.(11)



Figure (11) shows the construction of the proposed model in protected (Source: The Researcher).

- Establishing administrative buildings for international companies that need large surrounding open spaces, such as establishing Smart Village buildings that are compatible with the natural environment of the Reserve and by using eco-architectural techniques in the Reserve itself. Thus, the returns from using the surrounding land will be greater than using the land to build villas and homes. In addition to the possibility of raising the prices of areas near the outer borders of the Reserve. These buildings should be in the direction of the Reserve and should include green areas as well as parking lots. The network of roads should be placed at a farther distance from the Reserve so as to avoid air pollution resulting from lead oxides coming from the exhaust of cars used on the road. This situation is the opposite of what is happening at the Reserve at present, as there is only a fence separating the main road and the Reserve. This fence is useless and allows the air to pass through transferring the negative effects on the environment, particularly lead oxides, to the Reserve. Glass covering should also be constructed to protect rocks from pollution.(7)
- Reserves similar in America , for example, are enclosed in buildings of high value need to void the environmental surrounding , such as broadcast stations and reception of radio and TV , which often consists of Buildings mild one role in addition to dishes transmitter without Towers . Illustrates the form of No. 16 Station TIME WARNER CABLE to send TV on the borders of protected overpeck county park.



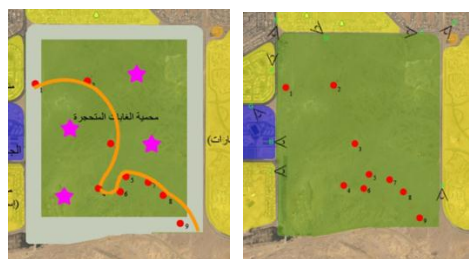
Figure (12) Station TIME WARNER CABLE TV to send to the limits of the protected (Source: The Researcher).



Figure (13) protected over peck County Park and the sports and permitted by the jaw and moved from one place to another according to block the absorption of the site, as well as office buildings, built on the borders of the reserve. (Source: The Researcher).

- Establish some sports facilities lightweight easy to remove and install to move from place to place throughout the year to practice some sporting activities is harmful environment protected , such as the activities of running, walking , cycling and some ball games such as aircraft and the accompanying these facilities, buildings and light to sell the tools to exercise these mathematics.
- Establishing several national projects in the surrounding area that are not visited often by the population such as research centers, a geological museum of the Reserve or a geological library connected to other international libraries.
- Establishing light and easy-to-dismantle sports activities like jogging, walking, bicycle-riding, and volley ball along with small shops to sell equipment for such sports.
- Establishing environment-friendly resorts and promoting one-day tourism as well as creating links between this Reservation and other neighboring reservations such as the Wadi Degla Reserve. A center for handmade products may also be established.
- Making a field survey of the most important environmental areas in the vicinity and putting them on a map. Designing a proposed track for touring and defining certain areas for camping. Constructing pergolas from natural materials for visitors as well as increasing the number of entrances, each with a specific sport or activity, to the Reservation and creating a Visitors' Center at each entrance to sell equipment for the activities that can be performed at each entrance. Activities include: touring and exploring, camping, and sports. Reservation guards may organize programs for scout students aged 7 to 15 years by creating weekly, monthly and annual passes to the Reservation. Creating an entrance to the library and scientific research activities as the Reserve is a good place for research studies in the various flora, fauna and geological fields. The Reserve is also

a natural laboratory for university students to study geological development. (8)



Camping sites  Proposed path

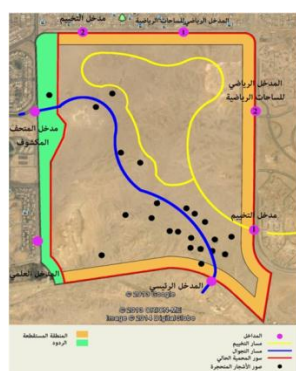


Figure (14) shows the proposed scheme for the sustainable development of protected and preserved them from persistent negative - planning motion paths and driveways and camping places, according to the carrying capacity of the reserve. (Source: The Researcher).

5. Recommendations

- Changing the housing activities on the borders of the Reserve to managerial and administrative activities in return for fees and pre-emption rights for the view. Revenues from these fees will benefit the Reserve. This is to be done on condition of changing the facades of buildings to suit the Reservation.
- Creating architectural designs and formations at the entrance to the Reservation, as well as planting arable areas in the Reservation with trees and plants, particularly with endangered plants to use the water leaking in the underwater channels below the Reservation and to use it as a research laboratory.
- Providing water and electricity as well as providing various services like cafeterias to encourage visitors to come to the Reservation, in addition to creating shops to sell souvenirs representing the Reservation.
- It is very important to implement the UNESCO’s World Heritage Convention that – legally – bans the transfer of fossils and natural treasures including fossil remains, rocks and rare metals.
- Implementing a media campaign in co-operation with the Egyptian Tourism Authority on both the national and international scenes as this will promote tourism for the Reservation.

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