

A Proposed Framework for Improving the Performance of Egyptian Nature Reserves Through Urban Indicators

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ABSTRACT

This study seeks to improve the performance of nature reserves in Egypt through the use of urban metrics. According to the study, adding urban factors such as population density, land use patterns, and infrastructure development can provide valuable insights into how surrounding urban areas affect reserves. By studying these variables, conservation managers can gain a better understanding of the difficulties and opportunities presented by urbanization and develop strategies to improve the performance of reserves. The study emphasizes the importance of integrating urban planning with environmental conservation initiatives to ensure that natural reserves in Egypt are managed sustainably. It guides policymakers and conservation practitioners in making informed decisions and implementing effective management strategies that balance urban development and nature conservation.

Keywords: *nature reserves, urban indicators, Sustainability.*

1. Introduction

Sanctuaries are a natural resource that is a diverse resource in efforts across various celestial bodies on their various diverse systems and molecular diversity. These reserves, because they are not located in different regions, include a wide range of habitats, including civil society, coastal Algerians and occupied territories. A haven for diverse animal species, some of which are endangered or threatened with extinction. [9]

Nature reserves in Egypt are established and managed by the Egyptian Environmental Affairs Agency, which works in cooperation with local communities, non-governmental organizations and international organizations. The primary goal of these reserves is to preserve Egypt's natural heritage while promoting sustainable development and eco-tourism. [10]

The goals of establishing natural reserves go beyond merely preserving natural resources to being themselves commercial economic projects that return a decent financial return so that the resources of these reserves can cover at least some of their expenses. These reserves also have educational and pedagogical benefits that hasty and ill-considered economic projects will not be able to achieve. If they compete with the reserves in the use of the land available to them, they will not be able to compete with them in their social benefits for improving the conditions of

society. This means that the doors of the reserves are open to the public and that their many benefits are continuously and diversified until the public realizes their benefits and defends their survival, continuation and development. [5]

The general purposes of natural reserves are to stabilize humans using the best scientific methods to preserve the environment and stimulate the development of human health and physical safety by providing the appropriate environmental framework and the impact of the environment on humans, animals and plants and their interaction with environmental elements, protecting endangered species and protecting the natural environments in which they live - and the impact Pollution in the seas and oceans and the resulting extinction of some species of aquatic animals and plants, the threat to fish wealth, and the deterioration of coral reefs - Applying the best planning methods to confront natural disasters such as drought, floods, torrents, earthquakes and volcanoes - studying the effects resulting from excessive use of energy and its resources, such as logging and its impact on national wealth from tree sources - monitoring terrestrial changes, whether natural or from the effect of human activities - and preserving genetic assets. Preserving and propagating wild animals and plants, preserving plants and animals of therapeutic importance, and managing the environment on a sound basis and not distorting it as a

result of technological progress.[6]

Egypt took the initiative to formulate its national strategy for nature conservation within the framework of the Global Strategy for Nature Conservation, issued in 1980, which established the foundations and rules for protecting environmental systems that produce human food, clothing, and building materials, namely agricultural fields, pastures, plants, and fisheries, and allocating areas of state land to preserve genetic assets and coordination between Natural reserves in natural lands and between zoos and botanical gardens. The Egyptian strategy for nature conservation also included allocating a number of natural reserves for the purposes of maintenance, study, meteorology, and cultural tourism, which are available for that purpose.[11]

Law 102 of 1983 is considered a culmination of the success of the efforts made. This law came as a good initiative by the Egyptian legislative authority represented in the People's Assembly. This law provides the Egyptian government with legal guidelines by which it can establish natural reserves in Egypt to protect both natural heritage and cultural heritage. In light of the justifications stipulated in the law in its first article for declaring natural reserves in Egypt, a reserve is any area of land or coastal or inland waters that is distinguished by the living organisms it contains, plants, animals, fish, or natural phenomena of cultural, scientific, tourist, or aesthetic value. It shall be determined by a decision of the Prime Minister based on the proposal of the Environmental Affairs Agency.[7]

The relationship between Egyptian nature reserves and urban indicators can be explored in different ways. Nature reserves are areas designated to protect and preserve natural habitats, biodiversity and ecological processes.

On the other hand, urban indicators refer to measures and factors that describe the characteristics and development of urban areas.[16]

Some possible aspects of the relationship between Egyptian nature reserves and urban indicators

- Urban expansion and urban sprawl: One important aspect is the extent of urban expansion and urban sprawl on or near natural reserves. Urbanization and urban development may lead to fragmentation and degradation of natural habitats, affecting the ecological integrity of reserves.
- Proximity and accessibility: The proximity and accessibility of nature reserves to urban areas can affect various urban indicators. For example, reserves located near densely populated urban

centers may see higher visitor rates, leading to increased pressure on reserves and the need for sustainable tourism management.

- Environmental services: Nature reserves can provide environmental services to nearby urban areas. These services include clean air, water purification, carbon sequestration, and recreational opportunities. Assessing the contribution of nature reserves to the quality and well-being of the urban environment can be an important aspect of the relationship.
- Preserving biodiversity: Nature reserves play a crucial role in preserving biodiversity, protecting endangered species, and maintaining ecosystem functions. Understanding the relationship between the presence of nature reserves and biodiversity conservation within urban contexts can highlight the importance of conserving these protected areas.
- Land use planning and urban development policies: Integrating nature reserves into urban planning and development policies is important. Taking the ecological value of reserves into account during urban planning processes can help mitigate negative impacts on natural habitats and promote sustainable development practices.
- Awareness and education: The relationship between nature reserves and urban indicators also includes raising awareness among urban residents about the importance of environmental conservation and sustainable practices. Educational programmes, public awareness and community engagement initiatives can enhance communication between urban residents and nearby nature reserves

1.1 Research objectives

The main objective of the research is to explore the relationship between Egyptian nature reserves, with a particular focus on Nabq Reserve and Jebel Olba Reserve, and urban indicators. The study seeks to study the interactions, impacts and dynamics between these natural reserves and urban development factors. By conducting comparative case studies between Nabq Reserve and Jebel Olba Reserve, the research aims to identify the specific relationship between these reserves and urban indicators in Egypt.

1.2 Research Importance

The importance of the research is to understand the relationship between Egyptian natural reserves and urban indicators in order to effectively preserve and protect habitats and biodiversity. Through several important insights into how urbanization affects these reserves and their ability to maintain a variety of ecosystems. The results can help prevent potential threats to the ecological integrity of reserves and provide guidance for conservation initiatives.

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sustainable development strategies and urban planning in Egypt

The research can shed light on how to integrate environmental conservation objectives into urban planning actions by analyzing the relationship between nature reserves and urban indicators.

Making better decisions as a result can ensure sustainable use of resources and land while maintaining the ecological importance of reserves. The study will assess how adjacent urban areas are affected, socially and economically, by nature reserves. It can research the benefits of reserves, including income from tourists, job creation, and environmental services received by urban residents. Understanding these impacts can help formulate strategies that support the environmental importance of reserves while promoting sustainable economic expansion.

Highlighting the ecosystem benefits that urban areas close to nature reserves receive by studying the relationship between these reserves and urban indicators, and the benefit of urban areas from these services, which include recreational possibilities, clean air, and regulated water supplies. The results may contribute to a greater understanding of the value of protecting natural reserves for the benefit of city dwellers. It will also inform management plans and policy proposals for the effective conservation and long-term growth of natural reserves in Egypt. Policy makers, conservation organizations and urban planners can benefit from the study's identification of the potential and challenges posed by the interaction between nature reserves and urban indicators, which can improve the management and protection of these reserves.

1.3 Research Question's

1. How do urban indicators, such as population density, land use patterns, and infrastructure development, affect the performance of Egyptian nature reserves?
2. What are the current challenges and opportunities associated with urban expansion in relation to the management of natural reserves in Egypt?
3. How can the integration of urban planning and environmental conservation efforts enhance the performance of nature reserves in Egypt?
4. What are the main factors that must be taken into consideration when developing strategies to mitigate the negative effects of urbanization on nature reserves in Egypt?

1.4 Research methodology

The research design for the case studies of Nabq Reserve and Jebel Olba Reserve follows a comparative approach. This includes comparing and contrasting the two reserves in terms of their relationship to urban indicators. A multi-method approach, combining quantitative and qualitative data, can be used to gather comprehensive insights.

The research sample includes Nabq Reserve and Jebel Olba Reserve as two main case study sites. These reserves were specifically chosen to explore the relationship between Egyptian natural reserves and urban indicators. The selection of these reserves depends on their contrasting characteristics, such as location, proximity to urban areas, and the level of urban development in the surrounding areas, and environmental importance and the relationship is studied through each of the following independent & dependent variables:

First: Urban variables

1. Proximity to urban areas: The distance between each reserve and the urban centers close to it can be considered an independent variable. This variable will help determine the level of exposure and potential impacts of urbanization on reserves.
2. Land use change: Changes in land use patterns, including urban expansion, agricultural activities, and infrastructure development, can be considered independent variables. These variables will provide insight into the extent and nature of human-induced changes in surrounding areas.
3. Policy and planning interventions: The presence or absence of specific policies, regulations and planning interventions aimed at protecting reserves from urban sprawl can be considered independent variables. These variables will help measure the effectiveness of conservation measures in mitigating negative impacts.

Second: The performance of the reserve variables

1. Preserving biological diversity: The state of biological diversity within each reserve can be considered a dependent variable.
2. Environmental integrity: The environmental integrity of reserves, including habitat fragmentation, disturbance levels, and ecosystem performance, can be considered a dependent variable. These variables will provide insight into the effects of urbanization on the ecological health of reserves.
3. Social and economic factors: Social and economic indicators, such as tourism revenues, job opportunities, and local community perceptions, can be considered dependent variables. These

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variables will help understand the social and economic impacts of reserves on nearby urban areas.

Remote sensing data, such as satellite images, were used to analyze changes in land use and urban expansion around the reserves, in addition to literature. Qualitative data collected using an objectively descriptive inductive approach. This is to understand the relationship of Egyptian nature reserves such as Nabq with urban indicators, which are described in detail.

Through these methods, research can bring together a comprehensive understanding of the relationship between Nabq Reserve, Jebel OLBA Reserve, and urban indicators, taking into account environmental, social, economic and political dimensions.

1.5 Previous Studies

1. "A contemporary vision of metal artifacts inspired by elements of natural reserves. South Valley University International Journal " ".Educational Sciences [1]

The study aimed to introduce natural reserves, their importance and types, and to clarify the contemporary vision of metalworks derived from elements of natural reserves through a description of some of the works of artists who dealt with these elements in the field of metalwork. The study concluded that nature and the Egyptian environment are rich in vocabulary and elements that can be inspired by plastic arts through delving into the characteristics and formations it carries through which the artist creates. Through this study, light was shed on the history of establishing reserves.

The following categories of reserves were established in 1982 by the International Union for Conservation of Nature as follows:

- A nature reserve with a strict scientific basis.
- Natural monument.
- Managed nature reserve.
- Protected landscapes
- World Cultural Heritage Site.
- Biosphere Reserve.

From ten years of field work and application of guidelines. Protection works. The conference recommended amending the types of these reserves. The year 1994 witnessed the issuance of a revised classification by the International Union for Conservation of Nature, which is as follows:

- A natural reserve of a scientific nature
- Pure protection of nature
- Wild areas to preserve the environment.
- National parks.

- Natural Monument Reserve.
- Protected species habitat management
- Natural and marine landscape reserve
- .Resource management reserve

2. "Sustainable development goals localisation in the tourism sector: Lessons from Grootbos private nature reserve, South Africa." [20]

The study showed the Grootbus Private Nature Reserve has translated 16 Sustainable Development Goals through various initiatives, including trade, conservation, community and culture. In addition, the study also highlighted some of the critical challenges faced by tourism companies in localizing the Sustainable Development Goals, which require more scientific engagement and research to find innovative solutions. The study recommended that the model be replicated by similar tourism companies located near and in protected areas, to ensure tourism sustainability.

3. "Mortality among birds and bats during an extreme heat event in eastern South Africa." [22]

This study supported recent predictions that songbirds are more vulnerable to lethal hyperthermia due to the relative inefficiency of panting as a means of dissipating heat by evaporation. To our knowledge, this is the first documented heat-related mortality event involving wild birds and bats in South Africa.

4. "Water Quality Modeling for Lake Burullus, Egypt, Part I: Model Calibration." [19]

The lake has great economic importance as a wetland area, fisheries and a resting place for migratory birds, so it was classified as a natural wetland reserve under the 1988 Ramsar Convention and has been declared a nature reserve in Egypt since 1998. Because of its central location, the lake receives most of the Nile Delta region's drainage water from Through eight banks. As a result, the lake's ecosystem is environmentally degraded. There is an urgent need for a water quality management strategy.

For this reason, the study applied a two-dimensional hydro-environmental model of the lake by developing the MIKE21 modeling system. Hydrodynamic and water quality records for approximately one year [starting August 2010] at different stations were used to calibrate the proposed model. Various hydrodynamic and water quality properties were simulated by the developed model such as water level, water temperature, salinity and dissolved oxygen. The calibration results showed good agreement between the measured records and the simulation results.

5. " Environmental monitoring and prediction of land use and land cover spatio-temporal changes: a case study from El-Omayed Biosphere Reserve, Egypt". [21]

The main objective of the study is to determine spatial and temporal changes over 35 years using five Landsat satellites. The study concluded that about 33.55% of land cover has been transformed into other forms. Cultivated land and urban areas increased by about 143.5 km² and 56.17 km² from 1984 to 2019, respectively. Meanwhile, the area of bare soil decreased to about 209.5 square kilometers in 2019. In conclusion, the conversion of bare soil into urban land and cultivated areas is the major change in the past 35 years in the Bureau of Natural Resources. Over the past three decades, the Bureau of Natural Resources has faced dramatic and unbalanced changes to its natural environment. Therefore, monitoring and managing these changes is crucial to establishing linkages between policy decisions and regulatory actions.

In light of these studies, these conclusions highlighted the importance of addressing environmental challenges, such as managing water quality, preserving biodiversity, and monitoring changes in land use, in order to ensure the sustainability and protection of natural reserves in Egypt.

2. Natural Reserves

A nature reserve is a protected area of land or sea that is designated and managed to preserve and protect the natural environment, including its ecosystems, biodiversity and cultural heritage. Nature reserves are created to protect and conserve unique and ecologically important habitats, species and natural resources. Nature reserves can vary in size and may include a range of ecosystems such as forests, wetlands, grasslands, coral reefs or marine areas.

The primary goals of nature reserves are to conserve biodiversity, protect endangered species, and maintain ecological processes. By conserving and managing these areas, nature reserves play a vital role in preserving ecosystems, addressing habitat loss, and promoting the sustainable use of natural resources.

The protection of protected areas and its impact on inclusivity and equality are influenced by several theories and concepts. Here are some basic theories and concepts related to this topic:

Benefit-sharing refers to the fair and equitable distribution of benefits derived from protected areas among various stakeholders, including local communities, indigenous peoples and conservation organizations. This can include financial benefits,

employment opportunities, access to natural resources, and capacity building initiatives. Benefit-sharing recognizes the importance of ensuring that local communities are not disproportionately burdened by conservation efforts, and that they have a stake in the management and success of protected areas. [23] Participatory approaches involve involving local communities and stakeholders in decision-making and management processes of protected areas. These approaches recognize the importance of local knowledge, values, and perspectives in conservation efforts. By involving local communities in decision-making, planning and implementation, participatory approaches aim to ensure inclusivity, empower local stakeholders and build collaborative relationships between protected area authorities and local communities. [24]

Environmental justice refers to the fair and equitable distribution of environmental benefits and burdens, including access to and participation in decision-making processes. In the context of protected areas, environmental justice emphasizes the need to consider the rights and interests of local communities and indigenous peoples who may be affected by conservation policies. It recognizes that protected areas can have both positive and negative impacts on local communities, and calls for ensuring that the benefits of conservation are shared equitably and that the rights and livelihoods of marginalized groups are protected.

Biogeography is a field that focuses on understanding how ecological processes and patterns interact with human activities in order to develop effective conservation strategies. It recognizes that protected areas are not isolated entities but are an integral part of larger landscapes and socio-ecological systems. Conservation biogeography emphasizes the need to consider the social, economic and cultural dimensions of conservation, as well as ecological aspects, to ensure inclusivity and equity in the management of protected areas.

2. 1 Types of reserves in Egypt

It is important to study the types of reserves in Egypt before dealing with the case studies in order to study the extent of the impact of the quality and land formations on the reserve. Egyptian reserves are divided into the following:

1. Wetland reserves
2. Protected areas of desert and mountainous areas
3. Reserved geological and geomorphological formations.

Figure 1 indicates the distribution of natural reserves in Egypt across different categories. The category with the largest number of reserves is wetlands with 11 reserves, followed by desert areas with 10 reserves, while the smallest number of reserves is the category of geological formations, which indicates that the distribution of reserves is mostly determined by the characteristics of Egyptian lands. Egypt's massive wetland ecosystems, including swamps, lakes, rivers and coastal areas, require conservation and management efforts, as evidenced by the large number of wetland reserves. Because they support a wide range of plant and animal species and provide a wide range of ecological services, these wetlands are likely to be ecologically important.

Ten reserves are located in desert areas, demonstrating recognition of the importance of the environment and the distinctive biodiversity of the arid and semi-arid regions of Egypt. The aim of establishing these desert reserves is to protect certain species that have adapted to live in arid environments as well as ecosystems and habitats. These reserves can consist of oases, rocky terrain, sandy deserts and other arid areas. Conversely, the group of geological formations contains the least number of reserves, and this indicates that compared to swamps and desert areas, there is less emphasis on preserving and managing geological and geomorphological features, such as distinctive rock formations, canyons, caves, or sites. Volcanic. It is important to remember that even if there are fewer reserves in this category, the geological formations found there are still of great value from an artistic, educational and scientific standpoint.

Egypt's designation of nature reserves into different categories demonstrates the impact of the many landscapes and ecosystems found there. While the proliferation of reserves in desert areas emphasizes the biological importance of arid areas, the greater number of wetland reserves demonstrates the need to protect important wetland habitats. Egypt's distinctive geological features require more attention and conservation efforts, as evidenced by the small number of reserves in the geological formations category.

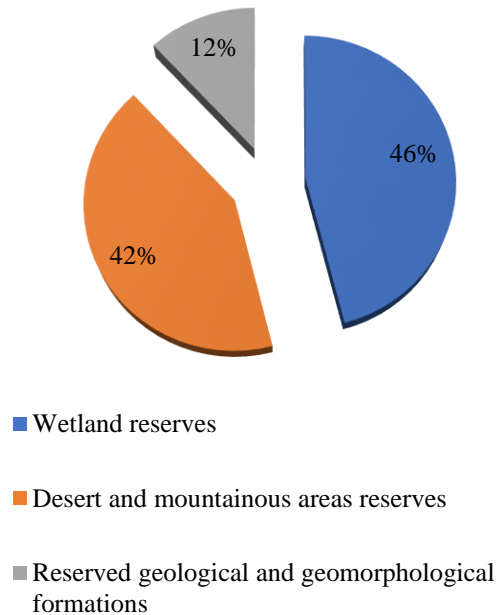


Figure 1- Divisions of reserves in Egypt

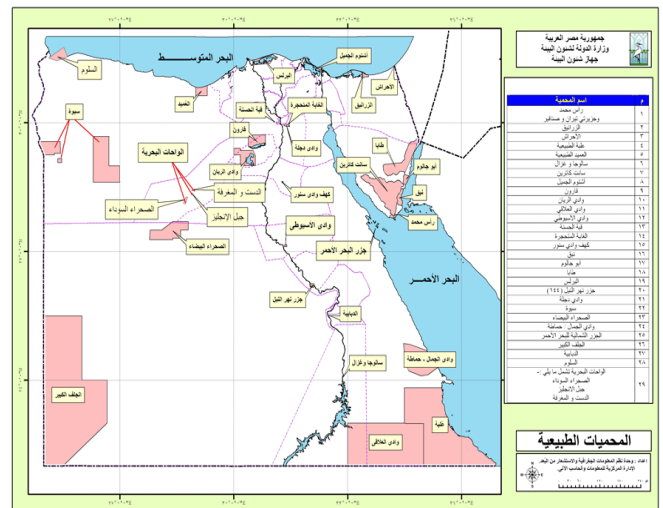


Figure 2- Reserves in Egypt

First: Desert reserves [highlands - valleys – plains

1. Wadi Al-Allaqi Reserve in Aswan Governorate

It is a diverse group of mineral deposits in Wadi Al-Allaqi Reserve, including ancient gold mines, magnesite ores, granite and marble. There are also igneous, metamorphic, volcanic and sedimentary rocks in the reserve, and about 100 species of annual and perennial plants known to exist in its dense plant canopy. Birds and mammals of various kinds also live there. The year 1993 saw the declaration of migratory species as well as a few reptiles and invertebrates as part of the UNESCO network of biosphere reserves.[17]

2. St. Catherine Reserve in S. Sinai Governorate

It has steep, undulating slopes that are difficult to climb. At approximately 2,641 meters above sea level, Mount Saint Catherine is the highest point in all of Egypt. The city of St. Catherine is located on a high plateau surrounded by majestic mountains, such as Mount Moses, which is religiously holy. It is home to the Monastery of St. Catherine, which is considered one of the most important tourist destinations in Sinai due to its natural nature. The monastery is very beautiful, has a good temperature, and has enough fresh water to plant gardens around it. Because of its historical importance in Christian history, thousands of people come here every year. Numerous indigenous plants, medicinal plants, poisonous plants, wild animals and other natural resources are among the important natural resources that define the St. Catherine area. This reserve, included in the UNESCO World Cultural History List, symbolizes the preservation of natural and cultural history [18]

3. Olba Natural Reserves in the Red Sea Governorate:

It includes four main groups:

- Coastal mangrove forests and Red Sea islands.
- Jabal Olba area
- Abraq area
- Al-Dayeb area

The clusters of mangroves on the Red Sea coast, which are believed to be a vital habitat for the development and reproduction of many marine plants and animals, characterize the OLBA region. It is also characterized by several towering coastal mountains resembling the surroundings of mountain oases, or oases of fog or dew, which provide an ideal habitat for the development of plant and animal life. There are a large number of wild creatures and reptiles native to Egypt. Its exceptional plant diversity - more than 400 species - turns its plains, mountains and valleys into

green gardens of rainbow colors and shapes, especially after rain [18].

4. Siwa Natural Reserve in Matrouh Governorate

Located about 300 kilometers south of Matrouh, the abundance of its plant and animal species, including birds, mammals, reptiles and insects, as well as the importance of its natural and cultural heritage, demonstrate its biological diversity and earn it a prominent status among World Heritage Sites. Unique geological formations and natural ecosystems, such as wetlands, sandbars, silts, plateaus and lakes that serve as gathering places for a large number of migratory birds, are other characteristics of the area. Great attention is given to the advancement, development and protection of the region economically and socially, given the broad components and areas of tourism development and the promotion of the concept of the role of ecotourism. Resources from the natural, historical and cultural fields to achieve the idea of sustainable development of the region as a treasure of the present and future and an attraction point for visitors from all over the world. The reserve is divided into three sectors: the eastern sector, which includes the areas of Sitra, Al-Nawamis, Al-Bahrain, Al-Arj, Tabbaghbagh, and Al-Jarrah, and is located on the outskirts of the Qattara Depression. The three regions are Umm al-Saghir in the center, which includes the Bir Wan area, and Umm al-Ghizlan and al-Shiyata in the western region, which is located on the Libyan border. [17]

5. Al-Ameed Natural Reserve in Matrouh Governorate

There are many differences in ecosystems, biological communities, land use patterns and desert population settlements in the region. Since 1974, Alexandria University has used these sites to study the desert environment. In 1981, UNESCO included it within the network of international biosphere reserves under the auspices of the International Man and the Biosphere Program. [4]

6. Al-Assiut Valley Reserve, Assiut Governorate

The presence of many species of wild animals in this valley and its environs, the availability of food, shelter, and water that wild animals need to drink, and the location of the reserve on the current Cairo/Aswan land road, are the main reasons for the importance of the reserve. Many rare or endangered species of wild animals & plants have designated it as a breeding site.[8]

7. Taba Nature Reserve in South Sinai Governorate

The wide range of unusual and potentially extinct

creatures and plants that make up the Taba Reserve sets it apart from others. It also has a network of valleys, many mountain passes, caves, and geological formations. It also contains a large number of archaeological drawings and inscriptions.[3]

8. Wadi Degla Reserve in Cairo Governorate

The Eocene of the Tigris Valley represents a diverse array of plant and animal species. As part of its effort to attract tourists to view wildlife, ancient geological life, and the desert environment near the city of Maadi, the reserve also symbolizes scientific, cultural, and recreational importance .[4]

9. White Desert Natural Reserve in New Valley Governorate

The White Desert is one of the most popular tourist destinations to enjoy the stunning views and geological formations dating back to the Cretaceous and Paleocene eras. Geological units in the form of chalk columns and mushrooms are scattered on the floor of the chalk depression, formed by wind sculpting factors. In addition to water springs and fossilized tree remains, the white lower chalk of the Farara Oasis, which forms the northern border of the protected area, contains shark teeth and invertebrate fossils. There are also remains of ancient Roman houses and ceramic storage containers used by humans. Because it contains unique and endangered species, as well as plant communities typical of the desert ecosystem, it also has a high degree of biodiversity. There are many archaeological sites in the region that include a group of prehistoric inscriptions, mummy remains, caves, and tombs, all of which can be found in the many archaeological sites in the region. [18]

Second: Wetland reserves (seas - lakes - Nile Islands)

1. Ashtoum Al-Jamil Reserve [Lake Manzala] in Port Said Governorate

This reserve is located in the northeastern part of Lake Manzala. Lake Manzala represents part of the system of semi-salt lakes in the Nile River Delta. It also represents an important source for fishing and is an essential source for the economic development of the lands adjacent to it. The lake has international importance as an area where large numbers of water birds winter. It is rich in large numbers of birds and fish, and there are human settlements around Lake Manzala that engage in fishing and bird hunting.[15]

2. Al-Ahrash Reserve in North Sinai Governorate

The Forest Reserve is located in the sandy outcrops

between the cities of Rafah and Al-Arish in North Sinai Governorate and close to the Mediterranean coast. It contains dense areas of acacia trees, shrubs and herbs, making it a resource for pastures and wood and a shelter for wild animals and birds, in addition to stabilizing sand dunes and stopping the encroachment of sand.[9]

3. Saluga and Ghazal Islands Reserve in Aswan Governorate

This reserve includes a vegetation cover that includes more than 100 species of plants and more than 60 species of rare birds that are threatened with extinction despite its small area, including species that have been breeding on these islands since the days of the ancient Egyptians recorded in their inscriptions, such as the black ibis.[7]

4. Al-Zaraniq and Sabkhat Bardawil Reserve in North Sinai Governorate

It is located in the northeastern region of Lake Bardawil, which has international importance as a resting place for birds migrating from European and Asian countries to Africa. It is a habitat for a large number of rare bird species, and it is also one of the most important places for commercial fishing. Its location is a tourist attraction.[2]

5. Reserves of the Nile River Islands in the different governorates

The number of these islands is 144 islands [95 islands along the main stream from Aswan to the Delta Barrage - 30 islands in the Rosetta branch - 19 islands in the Damietta branch] and they extend in 16 governorates and are important in preserving the natural heritage, which is represented by vegetation, birds and some It is also necessary to preserve the aesthetic appearance of these islands due to their importance in tourist attractions, provide them with appropriate services, and prevent the dumping of waste or drainage on the Nile River. .[17]

6. Wadi Al-Rayyan Reserve in Fayoum Governorate:

The goal of the reserve is to preserve the lakes of Wadi Al-Rayan and use them for multiple purposes, as well as to preserve the natural springs in the heart area of the reserve. Wadi Al-Rayyan Reserve is a candidate site for establishing a breeding center for endangered animals and plants due to the presence of natural springs, sand dunes, and diverse plant and animal life. There are also many important marine fossils, including the Wadi Al-Hitan, which has been declared on the World Natural Heritage List.[12]

7. Ras Mohammed Reserve and the islands of Tiran and Suna Fair in South Sinai Governorate

It is located at the southern end of the Sinai Peninsula, and is characterized by coral beaches, colorful fish, sea turtles, and other marine life such as molluscs, sea algae, and coral reefs that surround Ras Muhammad on all sides. The nature of the geomorphological composition of the region also constitutes a unique formation that has a great impact on shaping the natural life of the region. Water caves and various rock formation[10]

8. Nabq Reserve in South Sinai Governorate

The area represents several unique ecosystems, desert, mountain, humid and marine, including coral reefs, sea grasses and other marine organisms. It is the northernmost limit of the geography of the Shura plant, which is found in abundance and is the natural habitat for resident and migratory birds, the most important of which is the osprey. As for the terrestrial part, it contains sand dunes and valleys that shelter some mammals such as deer, tigers, hyenas, some types of reptiles, and others.[10]

9. Abu Galum Reserve in S. Sinai Governorate

The importance of the Abu Galum area is the presence of a special topography where the mountains are close to the shore, and that it contains diverse ecosystems of coral reefs, marine organisms and sea grass. The mountains and valleys are also full of wild animals, birds, and plants, making it a tourist attraction for diving, safari, and bird and animal watching enthusiasts.[13]

10. Lake Qarun Reserve in Fayoum Governorate:

Lake Qarun is considered to be of international importance due to it being a wintering ground for water birds. In its northern part, it includes Mount Qatrani, which contains fossils of mammals, including the oldest monkey in the world and the ancient Fayoum animal that resembles a rhinoceros. There are also the ancestors of hippopotamuses, dolphins, sharks, the ancestors of birds, some fossilized trees, and many other areas. Pharaonic and Roman archaeology.[14]

11. Lake Burullus Reserve in Kafr El-Sheikh Governorate

Lake Burullus is considered the second largest natural lake in Egypt in terms of area. It has many sources of biological diversity and contains a salt marsh environment and many wild plant species [fodder, medicinal, and fiber]. The reserve aims to preserve the biological diversity of Lake Burullus, monitor

environmental variables in the lake, and protect wet areas. Spreading environmental awareness among visitors to the reserve, encouraging eco-tourism, conducting scientific research, and preserving natural resources, especially those that have an economic return. [11]

Third: Geological reserves

1. The Petrified Forest Reserve in Cairo Governorate

It contains prehistoric fossils that are now included in the collection of fossils used to document and understand Earth's early existence. The area is covered by a dense layer of fossilized tree trunks and stems that lie adjacent to the Jabal al-Khashab Formation, which dates back to about 35 million years.

2. Dome Al-Hasna Reserve in Giza Governorate

The geological features in the reserve are of scientific and educational importance for geology students and researchers. It can be considered a scientific, cultural and tourist attraction. Additionally, it is an accessible museum that displays every trace of extinct life, along with the ecosystem and climate that existed 100 million years ago during the Cretaceous period. Dome is also a small chalk island. There is no relationship between it and its surroundings in terms of age, fossil content, or geological structure.

3. Wadi Sanur Cave Reserve in Beni Suf Governorate

It contains Egyptian alabaster, which is considered one of the best types of alabaster in the world, as it is arranged in geological formations known as stalactites and stalagmites in a beautiful, ideal shape. It was formed about 60 million years ago, during the Middle Eocene epoch. The cave is a popular tourist destination. The fact that these formations are rare in the world explains their importance. It explains paleoclimatology and provides the opportunity to conduct comparative research with the caves of Mount Mokattam, as shown in Table [1] showing the total area of natural reserves in Egypt.[17]

Table 2- The most important Egyptian reserves and their area.

	Reserve	Area	Percentage
National park	Ras Muhammad	778.21	2%
	Olba	30461.9	80.2%
	Valley of Camels	6729.42	17.7%
Protected for sustainable use of natural resources	Bahariya Oasis	102.64	0.3%
	The northern islands of the Red Sea	709.71 1	5.8%
	Nile River Island	140.0	0.5%
	Abu Galum	425.74	1.4%
	Nabq	518.8	1.8%
	Wadi Al-Alaqui	22779.02	77.1%
	Assiut Valley	35.29	0.1%
	Wadi Degla	37.17	0.1%
	Rayan Valley	757.91	6%
	Qarun	1340.9	4.5%
	Alamid	691.84	2.3%

3. Case studies

The selection of Nabq and Jebel Olba reserves as case studies for the research can be attributed to several reasons. Among these reasons is the environmental importance, as the Nabq and Jabal Olba reserves are considered among the areas of environmental importance in Egypt. As well as biodiversity; Nabq and Jabal Olba reserves are famous for their rich biodiversity. It is home to many plant and animal species, including endemic and endangered species. The mention of urban indicators in the context of these reserves indicates that the research aims to study the interaction between urban development and protected areas.

Nabq and Jabal Olba reserves may be located close to urban centers or face pressure from nearby urban expansion. Studying the relationship between urban indicators and the performance of these reserves can shed light on the challenges and opportunities associated with urban expansion and its impact on protected areas.

The selection of Nabq and Jabal Olba reserves as case studies reflects their ecological importance, value of

biodiversity, management approach, relevance to urban indicator studies, and policy importance. These factors make them suitable sites for research to gain insight into the protection of these reserves and the broader implications for inclusive and equitable conservation practices. Figure No. [2] Shows geographical images of the Nabq and Jabal Olba reserves.



Figure 3- (a) Topography of Nabq Protected Area (b) Jabal Olba Protected Area

3.1 Challenges facing natural reserves in Egypt

Natural reserves in Egypt face a number of challenges, including the following

- The extent of community integration with reserves in terms of employment, language, culture and community participation.
- The environmental, societal and economic impacts of the resort projects in light of the urban indicators of their area.
- Present and analyze the collected data based on the research questions, and analyze and interpret the results.

First: Nabq Reserve

The ecosystem in Nabq Reserve is diverse, which indicates the presence of biodiversity and the completeness of the environment and also contributes to increasing the stability of the reserve. Ecosystem diversity is key to maintaining ecological balance, and it thrives in the high desert environment with sand dunes, where it is famous for its mangrove plants. The bottom of the bay in this area is rich in coral reefs, colorful fish, crustaceans, shellfish, and valuable animals such as deer and other animals. Table [2] describes the statistics for the Nabq Reserve.

The climatic factors of the research cases are one of the most important aspects to be examined. The reserve is located in a hot tropical desert area known for its harsh climate and high temperatures. However, there are various factors that affect temperature changes in the research area, and marine influence is considered necessary because the eastern border of the Nabq Reserve is located next to the coast of the Gulf

of Aqaba. The region's climate is significantly affected by its proximity to the seashore, which moderates temperatures. Coastal regions have lower temperatures, resulting in a smaller annual temperature range and higher average temperatures.

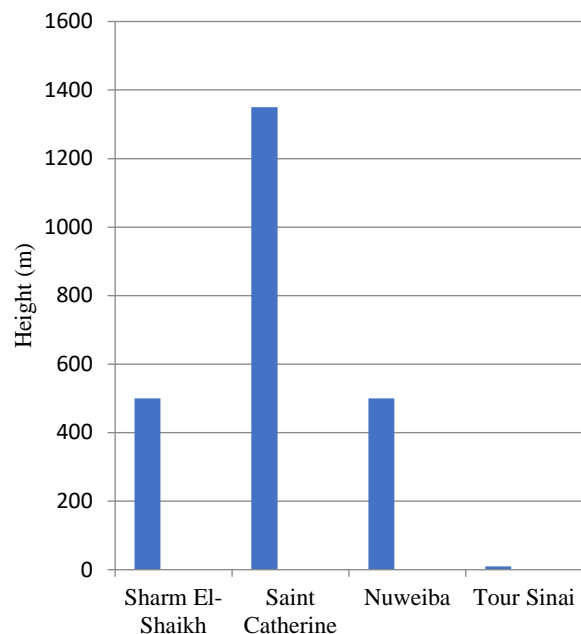


Figure 4 -Height from the surface of these stations.

Moreover, temperature fluctuations are affected by the altitude of the research area, which is located in the center of the Egyptian Sinai Peninsula. The presence of mountains and high elevations results in lower temperatures, with Mount St. Catherine sometimes experiencing sub-zero temperatures and snowfall throughout the winter. As spring arrives, snow melts, affecting precipitation patterns, wind directions, relative humidity, and evaporation rates. Understanding current climate conditions is crucial to understanding their impact on the surface of an area. This research focuses on changing phenomena that have already occurred due to erosive forces. The study used multiple meteorological stations to obtain climate data. Table [3] shows the climatic factors for Nabq Reserve. Figure No. [4] shows the height above the surface of these stations.

Table 3- Description (environmental - climatic –

demographic) of Nabq Reserve

The date it was approved as a reserve 1992	
Place	This reserve is located on the Gulf of Aqaba in the area between Sharm El-Sheikh, Dahab, and Wadi Umm Adawy in South Sinai
Area	km ² 600
Average temperatures	In winter, it is between 14.7°
	In the spring, it is between 20.3°
	In the summer, it is between 27.6°
	In the fall, it is between 23°
Number of tourists	The percentage of tourists represents 0.68% of the total number of tourists in South Sinai Governorate
Water Resources	The most important sources of water are wells, and their water is fresh and pure - enough for humans and animals to drink, meaning it covers the local consumption of the residents of this region. The region and other surrounding areas.
the climate	The climate is dry, with rainfall rates less than 10 mm.
Land area	440 km ²
Water range area	km ² 130
No. different plants types	134 species of plants, including at least 86 species that have completely disappeared in other places
Types of plants present	Mangrove plant known as shuri plant.

Table 4- Multiple meteorological stations to obtain climate data for Nabq Reserve

Name of surrounding station	Height from surface (m)	longitudo	latitude
Tour Sinai	2.7 m	33/37°	28/14 °
Nuweiba	54.2 m	34/41°	28/58°
Saint Catherine	1349 m	34/4°	28/41°
Sharm El-Shaikh	53.8 m	34/24°	27/58°

Through this study, it became clear the importance of preserving and protecting the Nabq Reserve to preserve its biological diversity and unique ecosystems. Efforts should be made to prevent further loss of plant species and protect the natural habitats in the reserve. Also, due to the relative decrease in the percentage of tourists visiting the reserve [0.68% of the total tourists in South Sinai Governorate], which is likely due to the height above the ground of one of Nabq's stations [St. Catherine], which is considered an important factor affecting the environment, weather, topography, and plant and animal life. There is

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potential to promote sustainable tourism practices. This could include creating awareness among tourists about the importance of preserving the environment and reducing their impact on the reserve. Accordingly, regular scientific research and monitoring programs must be conducted to better understand the environmental dynamics of the Nabq Reserve. This can help implement effective conservation strategies and make informed decisions for long-term management of the reserve. In addition, cooperation between government agencies, local communities and conservation organizations is crucial to the effective management of Nabq Reserve. In addition, raising awareness and educating the local community and visitors about the importance of environmental conservation can contribute to the overall protection of the reserve.

Although a number of plants are threatened compared to the total number of plants, they are considered to have a positive impact on biodiversity by preserving rare and endangered plants. The percentage of tourists there remains relatively small, and this requires attention to resources, both plant and aquatic, to increase this percentage and increase national income.

Second: Jabal Olba Reserve

By studying the area of the Olba Reserve, it was found that it represented a 59-fold increase compared to the Nabq Reserve, which contributed to providing more space for animals, plants, and other organisms to live and reproduce. In doing so, preserving biodiversity. While the many mountain ranges in the reserve facilitate the accumulation of rain and snow in the mountains, springs and rivers, which provides an important source for plant, animal and human life in the reserve and in the surrounding areas.

While it poses a natural threat from landslides, earthquakes, and heavy snow, which poses a threat to plant and animal life. These mountains helped reduce the cultural sweep of this reserve, unlike the Nabq Reserve, which has three Bedouin villages with different population numbers [600,800,700] despite its small area compared to the Jabal Olba Reserve.

It is characterized by animal and plant diversity, as there are 350 species of plants, representing 14% of the plant life in Egypt, of which 121 species are specific to the region, which gives it botanical distinction compared to the Nabq Reserve. Which causes a shortage of water in the region, and this affects biodiversity as well as the Wildlife and potentially increased fire danger. Therefore, it is important to take protection measures for natural reserves in areas with a dry climate. Table [5] represents the biological description factor for Jabal

Olba Reserve.

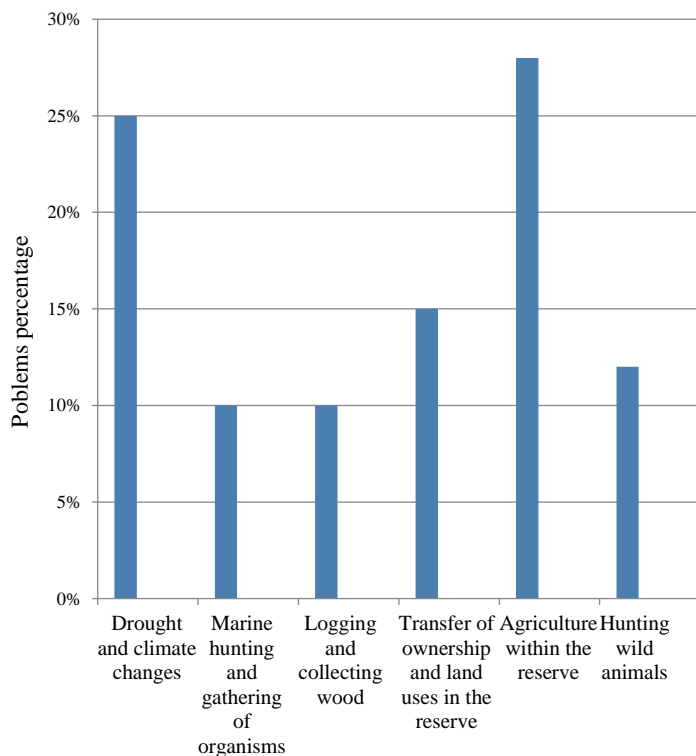
Table 5- Description (environmental - climatic – demographic) of Olba Reserve

Date of approval as a reserve: 1986	
Place	located in the southeast corner of the Halayeb Triangle
Area	35.600 km ²
Mountain range	<p>Mountain range [Olba - Shandib], where the peak of Mount Shandib rises about 1912 m above sea level and Mount OLBA to 1436 m. Some of the most important mountains and their heights are:</p> <ul style="list-style-type: none"> - Mount Abu Dahr, 1124 m - Mount Al-Faraid, 1234 m - Mount Harhjet, 542 m - Mount Al-Hawdain, 716 m - Mount Zaraqat Al-Na'am, 823 m - Mount Al-Naqroub Al-Fawqani, 1078 m - Mount Umm Al-Tayur Al-Fawqati, 777 m - Mount Abu Hadid, 1486 m - Mount Ararib 1273 m - Mount Al-Sol Hamid 599 m - Mount Shalal 1409 m - Mount Gash Amer 724 m - Mount OLBA 1474 m - Mount Shandib 1911 m - Mount Sawarib 1383 m - Mount Hanqaf 1430 m
Animal resources	<p>The most important rare species found in the region are the sand fox, mountain rabbit, mountain goat, Egyptian gazelle, super rabbit, wild ass, European sheep, extinct since 1972, nymph, and ostrich.</p> <p>The Egyptian nymph, the eagle, the wild cat, and the hedgehog.</p> <p>The OLBA area reserves are characterized by the abundance of Egyptian wild animals</p>
the climate	The climate is dry, and rainfall rates are less than 10 mm.
Types of plants present	It contains 350 species of plants, representing 14% of plant life in Egypt, including 121 species specific to the region.

The conclusions of the table indicate that the Olba Reserve is considered an area with rich biological diversity and contains a variety of animals and plants. This reserve must be preserved and its unique biological diversity protected. The most important obstacles that would negatively impact the OLBA

Reserve have been represented according to Fig. 5.

Figure 5 - The most important problems facing the Jabal Olba Reserve



The results revealed the uniqueness and importance of the two reserves in terms of biological diversity and environmental importance, the most important problems and obstacles hindering these reserves, and proposing ways to solve them. Solving problems related to civilizational intervention, dry climate, hunting of animals, and extinction of plants in a natural reserve requires multiple efforts and a comprehensive methodology, such as:

- Developing integrated plans based on the challenges present in the reserve, as these plans should include strategies to deal with civilizational interference.
- Raising awareness of local communities and visitors about the negative impact of human intervention and animal hunting on the environmental balance and biodiversity, with an emphasis on the importance of preserving endangered plants.
- Biodiversity in the reserve must be protected, and then strategies must be developed. Endangered

plants must have safe havens, and threatened animals must be encouraged to reproduce.

- Taking measures to preserve water resources in the reserve. This includes controlling the irrigation of plants in dry areas, using water harvesting and storage systems, and promoting sustainable agricultural and domestic water use.
- Strengthening cooperation and partnerships with relevant institutions, government agencies and the local community to exchange knowledge, resources and financial support.

It is clear that the Nabq and Olba Reserves play a crucial role in preserving Egypt's natural heritage. The comparative analysis highlights the rich wildlife and flora within the Nabq Reserve, along with its distinctive mountain range and diverse climatic conditions. However, it is necessary to obtain more information about the Olba Reserve in order to make a comprehensive comparison between the two reserves. However, the study emphasizes the importance of protecting and preserving the unique ecosystems found in the two reserves for the benefit of current and future generations.

3.2 The reserves Performance indicators study

- Preserving biological diversity

The state of biological diversity within each reserve can be considered a dependent variable.

- Environmental integrity

The environmental integrity of reserves, including habitat fragmentation, disturbance levels, and ecosystem performance, can be considered a dependent variable. These variables will provide insight into the effects of urbanization on the ecological health of reserves.

- Social and economic factors

Social and economic indicators, such as tourism revenues, job opportunities, and local community perceptions, can be considered dependent variables. These variables will help understand the social and economic impacts of reserves on nearby urban areas.

Table 6- Description (environmental - climatic – demographic) of Olba Reserve

Urban changes		Impact on the adjacent nature reserve
Halayeb and Shalatin	Developing a water station with an efficiency of 6000 cubic meters per day.	The increase in water use is likely to result in a shortage of water resources in the Jabal Olba Reserve.
	-Construction of a water tank with a capacity of 10000 tons.	A change in water flow may affect the ecosystem and biological species in the Jabal Olba Reserve.
	-Expanding the water network to a length of 64 km.	The expansion of the water network may affect the distribution of water resources and wildlife in Jabal Olba Reserve.
	-Construction of 1200 housing units	An increase in population may lead to increased pressure on the reserve and the degradation of natural resources and biodiversity.
	Building a housing project consisting of 30 buildings	It is likely to affect the Jabal Olba Reserve and cause an increase in urban infrastructure, leading to a change in the landscape and impact on neighboring wildlife.
	Building a solar power plant	It is likely to affect the Jabal Olba Reserve and cause an increase in environmental pollution, which will affect the ecosystem in the reserve.

4. Urban indicators for the reserves under study

- Proximity to urban areas: The distance between each reserve and the urban centers close to it can be considered an independent variable. This variable will help determine the level of exposure and potential impacts of urbanization on reserves.
- Land use change: Changes in land use patterns, including urban expansion, agricultural activities, and infrastructure development, can be considered independent variables. These variables will provide insight into the extent and nature of human-induced changes in surrounding areas.

- Policy and planning interventions: The presence or absence of specific policies, regulations and planning interventions aimed at protecting reserves from urban sprawl can be considered independent variables. These variables will help measure the effectiveness of conservation measures in mitigating negative impacts.

5. The relationship between the performance of the natural reserves under study and the urban indicators of their areas

By reviewing the urban and cultural changes in the city of Halayeb and Shalatin, affiliated with the Nabq Reserve, many projects were completed during the year 2023. Table [5] shows the most important of these projects and their impact on the Jabal Olba Reserve.

The impact of these urban and cultural changes on the Jebel Olba Reserve is represented by the negative impact on water resources, changes in water flow on the ecosystem and biological species, as well as changes in the distribution of water resources and wildlife, as well as urban sprawl, which causes increased human pressure and deterioration of natural resources as well as diversity. Biological, landscape change and its impact on neighboring wildlife, which causes an increase in human activity and affects wildlife and all sources in the reserve, which increases environmental pollution in the reserve. It is concluded that it is necessary to take into account these influences and their negative impact on the Jabal Olba Reserve, which represents 59 times the area of the Nabq Reserve.

Whereas, On the contrary, by studying the urban and cultural changes in the areas surrounding the Nabq Reserve, such as Sharm El-Sheikh and Wadi Umm Adawi, it was found that the city of Sharm El-Sheikh receives a lot of attention due to its tourist importance. Sharm El Sheikh has been transformed into a green city by applying an environmental sustainability approach in the fields of transportation, energy, waste, water, and biodiversity.

The South Sinai Governorate, in which the mentioned reserve is located, was distinguished by winning the Excellence Award in Geographic Information Systems. Al-Sheikh Central Park was also established as part of transforming Sharm El-Sheikh into a green city, and technological services were enhanced in the governorate.

Accordingly, the reserve is likely to be exposed to more human pressures due to population growth, the economy, and tourism. This can lead to degradation of water resources, environmental pollution, and modifications in the fauna and ecological ecosystem of the reserve. In order to effectively eliminate pollution and preserve the natural resources and biodiversity of the reserve, advanced water resource technologies must be put into practice. All development initiatives in the region should have a plan to track the impacts of plastic pollution and incorporate sustainable standards and practices.

6. Research Results

In light of the comparative analysis conducted between the Nabq and Olba reserves, it highlights the importance of these natural reserves in preserving Egypt's natural heritage and promoting environmental and social tourism. The following key points summarize the findings:

1. Potential to enhance the enjoyment of endangered plant and animal species: Both reserves have the potential to significantly enhance the enjoyment of endangered plant and animal species and contribute to conservation efforts.
2. The importance of implementing environmental conservation laws and regulations: It is necessary to ensure the implementation of environmental conservation laws and regulations to protect the safety and sustainability of reserves.
3. Nabq Reserve: The diverse wildlife, mountain range, and unique climatic conditions that Nabq Reserve enjoys make it a valuable site for preserving biodiversity and worthy of protection.
4. Limited information about OLBA Reserve: The study highlights the need for more comprehensive data and attention to fully understand the importance and challenges facing OLBA Reserve.
5. Obstacles and challenges: The analysis reveals several obstacles facing both reserves. In Nabq Reserve, major challenges include surface-related issues, such as land use and hunting, as well as factors such as drought, climate change, logging, timber control, and marine fishing.
6. Conservation efforts needed: To ensure the long-term protection and preservation of these reserves, it is necessary to address identified obstacles and implement effective conservation measures.

7. The research emphasizes the importance of protecting and preserving natural reserves in Egypt, especially highlighting the biodiversity and unique characteristics of the Nabq Reserve. It also emphasizes the need for more research and attention to fully understand and address the challenges facing the OLBA Reserve. By taking appropriate protection measures, these reserves can continue to protect endangered species and provide opportunities for environmental and social tourism in Egypt.

7. Research Recommendations

In light of the findings of the study, the study recommended the following:

1. Both reserves require stringent efforts to conserve endangered plant and animal species within their borders. This includes enforcing strict laws prohibiting poaching, habitat destruction, and illegal wildlife trade.
2. Effective management and conservation of reserves requires cooperation between government agencies, local communities and environmental organizations. It is crucial to engage local people in conservation activities, promote sustainable livelihoods, and raise awareness of the importance of these areas.
3. Both reserves have the potential to attract ecotourism, which can benefit local residents while also contributing to environmental conservation efforts. However, it is necessary to create sustainable ecotourism methods, reduce environmental impacts, and protect the cultural history of the region.

By implementing these recommendations, Nabq and OLBA Reserves can flourish as invaluable nature reserves, preserve Egypt's biodiversity, and provide environmental, economic, and educational benefits for future generations.

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