Geomorphological-environmental potentials and their importance in establishing natural reserves in western Iraq using GIS.

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Abstract

Iraq extends over an area estimated at (438,317 square kilometers), while the desert occupies its western part (Western & Southern Desert) with an area of more than 55% of the country's area. With the diversity of its topography in the region, as well as its geographical isolation and its containment of important & different environmental patterns, this helped to provide natural habitats for the biodiversity conservation in it. This opens the way for the establishment of natural reserves, which must be in correlation with the area of the country on the one hand, and the international standards that most countries in the world follow, including neighboring Iraq, on the other hand.

Given the large area of the study area, geographic information systems (GIS) have been used to facilitate the study and obtain accurate data that contribute to determining the areas of natural reserves in it. The importance of using these applications also lies in the ease of calculating the precise areas of the natural reserve and determining the extensions that they must be on, and the ground forms and water resources that are important to the sustainability of the reserve. In addition to the possibility of using this data in proposing places to establish some earthen-concrete dams for reserving and storing rainwater and creating lakes, which also have importance using it in re-injecting freshwater into groundwater reservoirs in the region for their continuity, and thus permanence of life in them. Based on that, the study proposed the establishment of 5 large natural reserves, in addition to many small nature reserves, which represent about 25% of the area's area, with an area of more than 55 thousand km².

The importance of using these computer technologies also lies in the possibility of linking spatial data on natural reserves with the WEBGIS system. This facilitates the process of accessing the data of that reserves and thus using it in developing the reserves in the rest of Iraq particularly, as well as contributing to the development of nature reserves worldwide in general.
Key words: Nature Reserves, Western Desert, Southern Desert, GIS, WEBGIS

1. Introduction

The total area of Iraq (along with the territorial waters) is about 438,317 km², where the Iraqi water area constitutes 0.29% of the land area, meaning that the water area constitutes about 950 km² of the total area [1]. It represents the first home of human civilization since the dawn of History, and in another view, this indicates the extent of the great exploitation that the land of Iraq and its natural environment have been subjected to since the dawn of history until the present day. This imposes on us the duty to protect and develop the various natural resources and preserve them from extinction on the other hand. Not only that, but the continuing phenomenon of climate change, which has accelerated its pace greatly at this time, forces us to pay attention to natural resources that are either exhaustible or those that are vulnerable to extinction and extermination from them. It is no secret that the desert areas of Iraq constitute more than half of its area, which gives it the utmost importance in that, especially as they are fragile areas that suffer greatly from the phenomenon of climate change on the one hand, and direct people to deplete its resources without wisdom or real protection from the central government on the other hand.

Through the use of various geographic information systems applications, we know that the area of Iraqi deserts (northern, western, and southern deserts) is about 275 thousand km² of the total area of the country, which therefore represents about 62% of the general area of the country. For the untrained eye, these barren areas are of little use or importance, but the truth differs radically from this superficial idea, as these dry areas contain non-traditional renewable energies such as solar and wind energy, as well as a unique and very important plant and animal diversity. Both the national and human levels, especially the issue of how these living species evolved and ways of adapting them to survive in such harsh desert environments, as well as their geological - geomorphological diversity and the presence of archaeological sites in these regions.

In addition to the fact that its geographical isolation over millions of years has led to the emergence of many rare and endemic species, which have very special physiological characteristics that enabled them to overcome difficult environmental conditions, and this distinction gives them a very high scientific, economic and medical value, which makes them a field Very fertile for studies and research, especially in the production of medicines and medical and industrial preparations, as well as identifying the supernatural capabilities of their various living organisms in overcoming such harsh environmental conditions, which makes these areas truly unique and worthy of preserving wildlife in them and paying attention to their development and development in a way that serves the reality of the country. In general, its small population (nomadic Arabs - Bedouins) love it and are closely related to it, which in turn leads to the development and revitalization of ecotourism in its various classifications. The issue of
preserving the environment is also considered the basis for the existence and continuity of ecotourism in the long run. In addition to economic considerations, environmental considerations must also be adopted, as well as environmental protection, in addition to taking into account the needs of the host community, thus achieving the principles of sustainable tourism development [2]. Generally, the area of natural reserves should reach about 20% of the total area of Iraq, according to Helliwell [3], who suggested that the global area of natural reserves should reach about 20% of the surface area of the earth, while the percentage of wild reserves does not reach only less than 0.8% of the total area of the country is currently [4].

**Study area:**

The study area was chosen to include all parts of the western and southern desert of Iraq within the administrative boundaries of eight Iraqi governorates, as shown in Figure (1). It is located at latitude 29°00'-34°50' north and longitudes 38°50' - 48°40' east, to represent about more than 210 thousand km2 of the total area of Iraq, which gives it all this importance to be a focus of interest for natural studies (geological - geomorphological), and linking that with this subject of study in identifying and selecting suitable areas for natural reserves in this area specifically.
2. structure of the study area:

The structure of the area is a decisive basis and the first pillar for choosing and proposing appropriate areas to become nature reserves of various types and purposes, and the most prominent pillars of which are:

2.1. Geology and geomorphology of the study area: Geological formations are the cornerstone of the emergence and variation of the surface shapes in the region, which gives it a unique and important advantage in this aspect related to the establishment of natural reserves. Because this part of Iraq is considered a natural extension of the Arabian platform, where its rock layers are revealed directly on the surface in most parts of it, except for some areas covered by a light layer of loose soil while its rocks are mixed with the fragments of its various soil consisting of quartz and feldspar grains, carbon and other formations with each other in other directions, were formed the current surface of the region, which in turn was severely affected by the erosion processes.
that were exposed to it during the Pleistocene - Holocene. While its different geomorphological forms appeared that embroider the surface of this region (Mesa, Butte, Hills, Valleys and Caves and others geomorphological forms), which gives it an important advantage in this subject of study, especially in the topics and purposes of scientific research and scientific-environmental tourism. It is also noted that the general slope of the land from the west to the east had a special imprint that distinguishes these parts of Iraq and reinforces their importance in this aspect.

In general, it is noted that the oldest geological formations discovered in the region date back to the Carboniferous C era - the early Permian (Paleozoic Formations) discovered in the Ga'ara Depression (Western Desert) [5] [6], while it is surrounded by newer rocky discoveries dating back to the Mesozoic eras. - Mesozoic (Triassic T, Jurassic J and Cretaceous K) also in the vicinity of Al- Ga'ara, and then on the periphery of the periphery of the oldest rock discoveries, the discoveries of the Cenozoic rocks of all their eras in the Western Sahara region. While only the rocks of the modern period of life are exposed in most of their known eras in the southern Iraqi desert (Paleocene P1, Eocene P2, Miocene N1, Pliocene N2, Pleistocene PL and Holocene Q), while it is noticeable that any rock exposures of the Oligocene P3 have disappeared in the Southern desert region. As shown in Figure (2).

It should be noted that most of the rock layers exposed in the region are divided between sandy rocks, dolomite rocks, mud rocks, marl, gypsum, flint, conglomerates [7], limestone, gypsum and clay rocks, as well as fragments and gravel of volcanic fragments origin [8] that were brought by the desert valleys from the Arabian Shield regions in Saudi Arabia to these regions from Iraq.

Al-Baroodi [9] mentioned the existence of a great influence of the geomorphological units on the characteristics of natural plants within the arid environment when studying the desert valley's area south of the city of Makkah Al-Mukarramah, which included river terraces, flood plains and the streams of desert river valleys there. Consequently, it was concluded that there is an effect of the geomorphological units on the general characteristics of plant communities, both in terms of the dominance of certain species, also it was found that there are great differences in the characteristics of vegetation cover between the same different geomorphological units. For example, river terraces were characterized by the highest vegetation coverage, followed by flood plains and finally desert valleys.
Youssef et al. (2014), when studying the relationship between vegetation cover and soil in some valleys of the Sinai Peninsula in Egypt, found a close correlation between the distribution of natural plants and some environmental factors, including elevation from sea level, chlorine ion content, soil interaction degree values, gravel percentage, carbonate and bicarbonate content. In addition to the content of both the sodium and potassium ions \([10]\). The culture of developing the natural environment with economic - medical - social benefits suffers from great neglect in Iraq, and that what called us to conduct this study.

2.2. Topography of area: Geographic information systems applications were used to produce a detailed topographic map of the area, and this was done through work on building a geo-
database. Database, to enter and store raw data in it within the Arc GIS environment, by creating shape files and Features data sets, whether they are point, line, or polygon areas, according to the Universal Coordinate Mercator (UTM) system, which is This was achieved by using the DEM digital elevation model of the satellite image with a spatial resolution of 30 meters, using the Arc GIS version 10.2 program and creating a morphometric database within the Arc Catalog, for the purpose of reference to it in future research, and thus achieving the desired benefit by producing a topographic map of the surface of the region. In addition to using the etrex-Garmin GPS device for this purpose also on the one hand, figure (3).

![Figure (3) Extraction contour lines of equal heights for the study area from the digital elevation model file (Dem) using ArcGIS 10.2 software](image)

These applications have also been used for the purpose of knowing the morphometric characteristics of the valleys of this region, as they represent the important lifelines in it. Which in the case of detailed studies can develop projects that lead to making nature reserves in Iraq a reality and tangible for the population of this region in particular, and the population of the whole country on the other hand. It is evident from the results of the office analyzes of GIS
applications, as well as the field study of several important parts of the region that the surface of the region is characterized by its general slope from west to east (from the side of the international borders of Iraq with Syria, Jordan and Saudi Arabia, respectively, and from the north) towards the stream valley. The Euphrates river, whose stream height ranges in the Western Desert between 170-190 m, while it is about 19-5 m within the Southern Desert.

While the general altitudes of the earth's surface vary between the Western Sahara region - in the north, then in the Southern Desert, where the surface is more elevated and furrowed in the Western Desert, which records a record elevation of about 950 m above sea level at mountain Anza, which located at the Iraqi - Jordanian - Saudi border triangle. While the southernmost parts of the desert reach a height of about 400 meters, and its surface is flat on most of its sides and covered with a thin layer of sand, pebbles and small stones, and sometimes it is covered with medium and large stones in other directions, picture (1).

\[\text{Picture (1) Pictures showing the shapes and sizes of some different fragments in the flat areas of the southern desert - the field study for the territory, March - 2021}\]

On the surface of both the Western and Southern Desert, important terrestrial shapes appear, such as mesa, single or connected hills with a series of different ground elevations extending for several kilometers, also appears some cliffs in the territory, picture (2).

\[\text{Picture (2) mesa in the study area}\]

In addition to the slopes of different cliffs and altitude, as well as the streams of desert valleys whose main courses end in the course of the Euphrates River. While some small streams of
desert valleys end in local basins of different size and area, known locally as (desert Faidha, its look like a small circular depression), picture (3).

Photo (3) small desert depression - Faidha, in the region

3. Natural reserves (their importance and conditions for their establishment):
Natural reserves may be defined as a specific geographical area that enjoys special protection over the components of the geographical body related to the quality of protection, such as living plant or animal, land or marine organisms, or natural phenomena of cultural, scientific, tourism or aesthetic value. Effective mechanisms and careful management are administered on the basis of not causing any harm to the environment and people [11]. It is also defined as an area of land or sea that is allocated to protect natural and cultural resources and preserve biological diversity through different and effective legal means [12]. While the Iraqi Ministry of Environment defines it as a large area of land allocated by law to protect natural resources that include vital resources from plant and animal communities, and it is also a means to save rare animal species from the threat of extinction due to their genetic value in addition to their economic return as they possess genetic assets adapted to the local environment for the purpose of developing the production of local breeds that can be multiplied and economically utilized [13].

The International Union for Conservation of Nature (IUCN) in 1994 identified six categories of natural reserves on the basis of management, with the first category divided into two categories (A - B) [14], as follows: Class I A: Strict Nature Reserve; Class I B: Wilderness; Category II: National Park; Class III: Natural Monument; Fourth Category: Protected Landscape – Seascape; Category fifth: Anthropological Reserve - Natural Biotic Area; Sixth Category: Managed Resource Protected Area. Many of these categories apply to the proposed areas as nature reserves in the study area and thus are in line with international standards. In general, biodiversity is one of the pillars of natural resources that are inexhaustible if they are managed rationally, and the future of humanity depends on the human ability to make the best use of these resources, and use it in a way that provides it with the foundations for continuity and prosperity.
The importance of biological diversity increases in arid environments that occupy a large area of the Arab world in general and Iraq in particular, especially as it is characterized by the fragility of its ecosystems due to the scarcity of its water resources, also as a natural, medicinal plant in dry areas, its represent a very important basic biological resource for the local population, and important to their animal feed, fuel, and medicine [15]. Also, Patrick (2004) mentioned that the presence of many plant species in nature is very important for human life and society because the difference in chemical composition between these types provides various sources of food, clothing, shelter, and medicine for humans as well as animals alike [16]. From here comes the importance of introducing the largest possible area of these areas within the borders of natural reserves, provided that this area is in fit with the global requirements assigned to each country, which is to reach a percentage of not less than 20% of the area of any country as natural reserves. What we notice very clearly in the recent approach of the countries neighboring and close to Iraq, which has worked to raise this percentage from less than 2% to more than 17% during the past four years only, as happened in (Saudi Arabia and the UAE). Given that the area of the sedimentary plain is mostly occupied by agricultural activities, except for some areas of the marshes and lakes (which are registered under the Ramsar Agreement [17] or others that not yet), this is a reason to compensate for this in other areas of Iraq, as is the case in the Western and Southern Sahara, in order to reach 20% percent of the total area of Iraq that should fall within its natural reserves areas.

4. The tools & applications used in proposing and determined natural reserves in the region:

The focus is on the use of geographic information systems (GIS) applications, and thus its main applications, in this case, is very important because it saves effort and money, and gives accurate scientific analysis. Also, it is not hidden that the field study is of great importance in maturing GIS outputs, matching them with reality, and correcting their data, which was adopted in this study.

The data of digital elevations were analyzed using the Arc GIS program and matched with the region in general. As a result, we had 4 major hydrological basins regions that included, in turn, the basins of many desert river valleys, with a large fifth hydrological basin area that includes many smaller basins with clear features within the scale used In such large regional studies, as shown in Figure (4).
Figure (4) shows the major hydrological basins in the study area - using Arc GIS 10.2

These results are consistent with the data on the ground on the one hand, and they are consistent with the various field studies that have been conducted in the region now and previously from the hydrological point of view. And by adding the rest of the other important factors in this field (important and rare geological discoveries at the level of the region, the distinctive geomorphological features and the degree of their frequency in the different parts of the region and the possibility of benefiting from them hydrologically and tourism, etc., the homeland areas of rare migratory and local birds - Figure (5), the endemic areas of animals. Rare and endangered wildlife, areas of concentration of rare medicinal plants and others, sites that contain various important human impacts ... etc.), all of this had a clear and prominent impact in choosing and proposing areas of natural reserves in the region and determining their areas.
Figure (A, 5 B) (A) shows the most prominent areas of natural habitats for birds and some wild animals in the region[17]. (B) shows the habitats of birds in Shuaib Abu Talha (Wadi Al-Weir & Sh'eeb Abu-Talha)[18].

Consequently, the following important sites have been identified and proposed to be included within the areas of nature reserves in Iraq, according to the specifications and importance of each of them:

4.1. The proposed large natural reserves:

4.1.1. Ga'ara Reserve: It is one of the most important major natural reserves proposed in the study area, with an area that could reach about 12,500 km², and it represents a major reserve within the Hydrological Basin No.(1) shown in Figure (4). Also, this proposed area for Ga'ara Reserve will include large and important parts of the large well-known valleys in the region, most notably (Wadi Akash, Shuaib Bir Melousi, Wadi Melousi, Wadi Houran, Shuaib Al-Aghari and other valleys), and the surface height ranges between 750 - 250 m from sea level. According to this proposed area, Ga'ara Reserve will be an important habitat for different types of birds and other biological life types, such as wild animals and others, as well as plants of different importance and use.

The site in its northern part includes the Ga'ara depression, which is a natural depression in the western desert of Iraq, where its southern and eastern parts are surrounded by high rocky land and slopes (called Al-Afif), which constitute one of the main features of Ga'ara, and it is not hidden that one of the most important reasons that qualified this site For it to be a natural reserve is a (geological - geomorphological) reason, as Ga'ara is the most important natural geological museum in the Western desert, due to the exposure of the rocky layers from the Paleozoic, Mesozoic and Cenozoic era, Figure (2).

It should be noted that IBAT [24] has introduced the Ga'ara region and another area near the mouth of Wadi Houran in the Euphrates - west of Haqlaniyah, with an area of only 0.89 and 0.54 km² each, respectively, since 1994 and 2014 [25]. Both of these small areas are currently located within the major protected area proposed in this study, as shown in Figure (6). This region includes large and deep valleys surrounded by shallow, wet depressions (small depression of desert - called Faidha) that thrive vegetative from January to March, and it is also an important habitat for important natural plants such as (Haloxylon, Artemis, and Astragalus), as well as birds of prey.

4.1.2. Reserve of Wadi Marah - Al-Nukhayb:

It is an area located in its entirety within the administrative boundaries of Anbar Governorate, as is the case with its predecessor (Ga'ara reserve), where the estimated area is about 14 thousand km² and has taken its location within the second main hydrological basin. It also includes many desert river valleys that were originally flowing rivers and tributaries flowing into the Euphrates River, but they dried up after the end of the last ice age, and traces of water flow can be seen everywhere in the Iraqi desert. In addition to seeing the high valleys ’walls that show the previous wet condition.
These valleys are currently dry, but they overflow with torrential water in the rainy season. Its main importance lies in its being an authentic environment for many living organisms, which can be developed by constructing various dams on its streams and valleys and creating several lakes that represent an essential source of wildlife and its development, also its valleys provide good pastures for the Bedouin herders and their livestock. These areas are generally characterized by being sparsely populated and not reached by the operations of pollution and insane human exploitation, except that they are subjected to the intense and unfair cutting operations of the shrubs, bushes in it, like the rest of the Iraqi desert regions.

4.1.3. Reserve of Shuaib Talha - Wadi Abu Maris: It is the third main area, and it is located in its entirety within the administrative boundaries of Najaf Governorate within the third main hydrological basin. It has been determined to reach approximately 8700 km$^2$ to include many of the main valleys and their branches, as well as many especially geomorphological features. It should be noted that a small part of this currently proposed area (Shuaib Talha - Wadi Al-Wa'ir) has been included in the database of WDPA & IBAT [19] as an important habitat for endemic and migratory birds, but it has not appointed a department within the IUCN organization, as shown in the figure (5 A&B).

4.1.4. Al-Salman Reserve: Most of it is located within the administrative boundaries of Al-Muthanna Governorate. Its proposed area is estimated at 7500 km$^2$, and it is located within the
fourth hydrological basin. This region is also characterized by the abundance of valley channels in it, in addition to geomorphological features and geological formations that qualify it for the establishment of many dams, and thus the emergence of lakes that could become permanent in it, which is also touched by previous studies.

It also includes many archaeological sites and hills dating back to different historical eras. It is no secret that these destinations are the original home of many rare birds such as falcons, peregrine, and Houbara or (bustards, Chlamydotis), and they are also distinguished by their abundance of natural Faidha (small depressions of the desert) covered with wild Rhamnus trees (Ziziphus spina-christi), and various other shrubs that have recently become a tourist-environmental destination for many people, as is the case with Faidha of Hadania, Shawiya, and Rifaey, as shown in the pic. (3).

4.1.5. Reserve of Busayyah - Al-Amghar: It extends over an area of about 6000 km², and it is all located within the borders of Al Muthanna Governorate. It includes many of the streams of the important desert valleys close to Busayyah (Abu Ghar, Abu Ghuwair, Wadi al-Dhiba, and others), where its borders include important sewers and valleys, the most prominent of which is Wadi Al-Amghar, which is bound to Iraq from Saudi Arabia.

In this region, there are many important desert depressions - Faidha, such as Al-Shawiya, Al-Zahra and Fawwar Al-Zahra depression, and due to the proximity of these regions to major cities such as Nasiriyah and others, they are currently subjected to the illegal cutting of their shrubs especially kind (Haloxylon persicum Bunge) and their trees as well because of their use as charcoal for smoking tobacco in popular cafés (Coffee shop)??, In addition to overfishing and environmental pollution.

4.2. The proposed small natural reserves:

There are many important sites that the study seeks to shed light on and then include them within the legal protection to keep them alive in nature, thus the continuation of life in them (plant and animal) and the preservation of their distinctive terrestrial landforms and others. The most prominent of these sites are:

4.2.1. Jabal Anza (Anza mountain) Reserve: It is the highest place in the western and southern Iraqi deserts, it is located at the Iraqi-Jordanian-Saudi border triangle, and it is home to many important life forms. It also represents a distinct geological-geomorphological landmark in the region, which was identified in about 450 km².

4.2.2. Umm Chaimin Depression reserve: It is a very distinctive landform, also it is the most prominent and clearest geomorphological feature in the southwestern part of the western Iraqi desert. It is an almost circular depression with a diameter of 2.9 km and a depth of 28 m. Its carbonate rocks exposed at the surface and in-depth belong to the formation of the Eocene, which forms a flat area in which the layers tend to out of the depression. Therefore, the
depression is not visible unless it is from a distance of a few tens of meters. Many rock fragments of different sizes are observed found near the edges of this basin. This depression has a regular geometrical shape (circular) as shown in the image (4).

![Umm Chaimin Depression - Western Desert](image)

**Picture (4) Umm Chaimin depression - Western Desert**

In the past, various concepts were recorded about the origin of this depression, and those opinions ranged from its origin to that it arose as a result of a meteorite effect, volcanic origin, gas explosion, or karst origin. But recent studies have indicated it as a karst origin. In general, **Umm Chaimin Depression** can occupy a protected area reach about 6.4 km$^2$ [20].

4.2.3. **Reserve of Wadi Masaad - Wadi Houran**: It is a valleys' area with distinctive rock exposures, which in turn represent a very important life environment and have great potential for establishing more dams and creating artificial lakes. It may reach an area of about 1850 km$^2$.

4.2.4. **Reserve of Ain al-Tamr - Al-Ukhaidir**: It is an area that can reach about 2,200 km$^2$, and it is located within the borders of the provinces of Karbala - Anbar. It is characterized by the presence of Al-Ukhaidir Fort, which is of historical and cultural importance, as well as a distinct geomorphological appearance (**edges of Al-Tar**), which includes the caves of Al-Tar, which has an Ancient human history, in addition to that it includes among its flanks many river valleys heading towards Lake Razzazah and the Euphrates River.

4.2.5. **Ansab Reserve**: It is an area located near the border with Saudi Arabia, and it is within the Muthanna governorate that is distinguished by its distinct geology-geomorphology, similar to the one in **Hills and Edges of Al-Tar** in Karbala Governorate. It is also a gathering place for the Valleys flowing from Saudi Arabia towards Iraq, which could form an area estimated at 700 km$^2$. It is also distinguished by the presence of rare wild plant species.
4.2.6. Reserve of Jabal Sanam - Wadi Al-Batin: It is a longitudinal area that extends from the beginning of Wadi Al-Batin's entry into Iraq, along with its extension, to Jabal Sanam (Sanam Mountain). This area is of great importance in biodiversity, which prompted Kuwait to establish a reserve for it along with the extension of Wadi Al-Batin in the Kuwaiti part of it. In Iraq, it may be reached about 1,600 km².

4.2.7. Khor Al-Zubair Reserve: It is the only water area that was proposed in this study, given that most of the Iraqi lakes and marshes (Hor Al-Hawizah, Hor Al-Hammar, Sulaybat, Al-Dalmaj, Al-Razaza, Al-Tharthar ... etc) have been added to the list of wet reserves globally since the year 1994 to the present time.

Although this area is included in the list of natural reserves, we wanted to focus on its importance as a (marine-continental environment), as it constitutes a distinctive global landscape, which qualifies it to be a natural-tourism reserve, with multiple purposes and environmental goals. It can reach an area of about 400 km².

In addition, there are many areas that can be added to these areas from the proposed reserves, whose areas have reached about (55706) km² now, and as shown in Table (1).

| Reserve Nature | Area in km² | Type | It’s important | Biodiversity | The dangers that threaten it |
|----------------|-------------|------|----------------|--------------|-----------------------------|
| Ga'ara         | 12500       | Terrestrial | Geological, tourist, scientific | Birds, plants, wild animals | Overhunting, Illegal logging |
| Wadi Marah Al-Nukhayb | 14000 | Terrestrial | Tourist, economical, environmental | Birds, plants, wild animals | Overhunting, Illegal logging |
| Shuaib Talha - Wadi Abu Maris | 8700 | Terrestrial | Environmental, tourist, economical | Birds, plants, wild animals | Overhunting, Illegal logging |
| Al-Salman      | 7500        | Terrestrial | Environmental, tourist, economical | Birds, plants, wild animals | Overhunting, Illegal logging |
| Busayyah-Al-Amghar | 6000 | Terrestrial | Environmental, tourist, economical | Birds, plants, wild animals | Overhunting, Illegal logging, pollution |
| Jabal Anza      | 450         | Terrestrial | Geological, tourist | Birds, plants, | Hunting |
| Umm Chaimin Depression | 6.4   | Terrestrial | Geological, tourist | - | - |
| Wadi Masaad - Wadi | 1850 | Terrestrial | Environmental, economical | Birds, plants, wild animals | Overhunting, Illegal logging |
5. Entering data into the global database by creating the WEBGIS system:

It is possible to create WEBGIS for any region for the purpose of managing and displaying maps on the Internet, and sharing them with the databases of international organizations interested in nature reserves and their care, or even other national-humanitarian projects. This can be done through the following four stages [22], illustrated in Figure (7):

1 - The first stage (S1): preparation and processing of paper maps and satellite photos;

2 - The second stage (S2): synchronization, editing, coordinate conversion, and analysis;

3 - The third phase (S3): building a database for a map of the sites of proven and proposed natural reserves;

4 - The fourth stage (S4): Building a WEBGIS system for sharing map information.

This study is considered a preliminary stage for entering data on natural reserves in line with international standards according to the total area of Iraq, and according to the importance of this for global biodiversity, especially since these proposed areas have lost much of their biological diversity since firearms came into widespread use, especially at the beginning of the twentieth century.
Figure (7) Stages of building the WEBGIS system for natural protected areas in the study area

Also, the process of entering data into the database of reserves globally will contribute to highlighting the importance of these areas on the part of international organizations, as well as the attention of governments to this issue of great importance, especially with the acceleration of the pace of neighboring countries in expanding the area of their natural reserves in line with international standards and requirements in order to reduce the wide gap between developed countries and other countries that are lagging behind in this regard, as shown in Figure (8).

Figure (8) shows the wide gap between Europe and the Arab countries in the areas of natural reserves (Terrestrial & Marine protected area) [23]
This step requires more detailed studies for each proposed area using available GIS techniques, as well as field studies, and then uploading them to the WEBGIS platform and sharing them with international organizations concerned with the environment and operating under the umbrella of the United Nations.

6. Results:

The issue of preserving biological diversity (plants, animals) is one of the priorities of global human regards, as a result of the great deterioration caused by irresponsible human activities, which resulted in the extinction of many neighborhoods and the threat of the others of them with the same result, which will lead to a threat to human existence on the planet if that goes on without stopping. Therefore, the main objective of establishing natural reserves is for the sake of preserving biological diversity, especially the vegetation cover, which has been subjected to significant deterioration in the past few years, and its great importance in preserving and preserving the soil from erosion, as well as keeping species of wild animals, and this is the main point in process of achievement of sustainable development. The results of the current study showed the possibility of using recent scientific techniques to confront this global catastrophe and strive to correct the course of human activities away from the further destruction of the life infrastructure and the pollution of the environment, which will have important environmental, and good economic consequences of within the near future.

7. Conclusions:

1 - The importance of activating the agreements signed with international organizations concerned with the environment and its preservation, in order to benefit from their expertise and support programs for the preservation of the wild and humid environment in Iraq. As well as providing training - scientific courses for the management personnel of these reserves.

2 - The need to expand the use of geographic information systems applications and employ them in the management, development, and investment of natural reserves throughout Iraq and the study area in particular, as these systems and applications are of great importance in that.

3 - The importance of involving the residents of this region who are settled in its small cities (Salman, Busayyah, Shabaka, Al Nukhayb, Al Rutba, and others) or the nomads among them (Arab Bedouins) in the matter of choosing the reserves nature and involving them in implementing its infrastructure and employing them to protect it. This ensures that the interests of those indigenous peoples' communities in the region are not prejudiced and the success of these important national projects is guaranteed, especially with the convergence of the most important goal between these projects and the region's residents who are closely attached to this land and their psychological connection with all its creatures (living and non-living).

4 - Valleys streams and natural depressions represent a basis and a source for the region's economic, environmental, and tourism development, through the establishment of dam projects on the desert valleys that can provide permanent sources of freshwater, and the emergence of permanent artificial lakes. In order to enhance its fragile potential and support all life forms in it, as well as It can be used to feed groundwater that is at risk of running out of water, by injecting wells with fresh water from the storage of rainwater and torrents in it.
5 - Encouraging scientific research and studies aimed at surveying and classifying all life forms in the region and explaining the causes of extinction some of them, and the reach of some others to the stage of extinction, to stop that.

6 - The necessity of preserving the permanent plants (such as (Haloxylon persicum Bunge, Haloxylon ammodendron, Alhagi, Rhamnus - Ziziphus spina-christi, Acacia laeta, Achillea conferta, Anchusa strigosa Banks and others), and seasonal ones (such as Stipa capensis, Alyssum, Heliotropium eropaeum, Aurea Matricaria and others), as they represent habitats for animals of different species. It is no secret that it is exposed to the largest wave of cutting down trees and shrubs in the country since 2003 until now, which seriously threatens the diversity of life of this fragile region.

7 - The importance of achieving and signing international agreements with neighboring countries that have similar environmental areas to the region (Jordan, Saudi Arabia, and Kuwait) in order to establish large cross-border natural reserves in order to achieve an increase in ecotourism in border areas, and remove what impedes that, as is the case with the Wadi Al-Batin reserve in its two parts. The Kuwaiti part (actually established) and the Iraqi part (proposed in this study) on the one hand. As well as making use of the experiences of these countries in the establishment and management of nature reserves.

8 - The study also recommends the establishment of an association interested in ecotourism under the name (Iraqi Ecotourism Association) to spread the concept of ecotourism and contribute to economic support for small communities in the region, thus contributing to the economic development of the region, and stopping the migration from these communities towards cities based on the Euphrates River.

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