



RESEARCH ARTICLE

ASSESSMENT THE BIODIVERSITY IN THE NATURE RESERVE OF SINJAR MOUNTAIN

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ABSTRACT

Recently increased interest in the natural balance of the biosphere to achieve environmentally sustainable development and achievement the positive interaction to its vocabulary where became the biodiversity issue from priority concerns because of its great importance in the environment and its disproportionate effect on the international environmental variables in general, including Iraq by especial form, the importance of this research, where the wildlife an important part of the ecosystem, in the case preserve their balance and stability so will be an important indicator for the human security by treating with his environment and the sustainability of their welfare. From here came establishment the natural reserves that contribute to biodiversity development in a sustainable manner and achieve the interaction with natural environmental resources, which called the biosphere (soil, water, air) to protect the wildlife of all kinds; flora, fauna, Microorganisms and ecosystems, the study aims to assess the wildlife in Sinjar mountain reserve which have a great role in biodiversity protection, which explain that the rate of plant diversity was 92 species, 84genus and40 family where the coverage proportion reached 95% and density (376,78) plant/m². There are animal diversity in the reserve, such as mammals, reptiles, birds, rodents, rabbits, insects, spiders and other. Clear the type of prevailing climate that drought indicator (14,175) were semi humid, rainfall (422 ml/year), relative humidity (69, 2%-16, 7%), rate of maximum temperatures (32, 9C⁰), Minimum temp. (6,6C⁰), the kind of the soil texture from clay soils, alluvial and gypsum, which characterize availability of water surface, whether from rain in winter and from project of rainwater harvesting in reserve or wells in summer, where the factor of favorable climate that made the stability and sustainability of the nature reserve, though to some of human factors challenges, such as hunting, overgrazing, pollution (acid rain) and desert encroachment, logging, fires, war impacts by stripping the lands from natural content. Although the above, to Sinjar mountain nature reserve has a bright future while appears their sustainability by the content of their biodiversity.

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INTRODUCTION

Problem view

wildlife consider basic pillar for maintaining biodiversity, then the ecological balance., biological diversity is the main source of food energy for all organisms which reacting among them by status of harmonization in side and with their ecosystem in other side, that gets any defects in this harmonization reflects negatively on the biosphere, for importance of wildlife and their systems, so it requires dealing with it in balanced situation to avoid extinction and the degradation of their habitat, where for each type of biodiversity their benefits and harms, human is the only organism that has a perceptive and control to achieve its needs in food, drink, clothing, housing

and therapy, of the necessities of human life to achieve his goal but not at the expense of the natural environment resources and biodiversity, then the principle of the protection of biodiversity should be based on a balance between the needs and stability this diversity for conservation them from extinction without breach to any element. From here came the interest in natural reserves and Sinjar Reserve which was under study that consider the repository for the continuation of wildlife within its ecosystem, which depends upon two production system the plant and animal. Through the assessment of biodiversity characterized by rich and diverse, but finally degraded due to natural and human factors, so it requires attention to the development their resources to remain reserve in their sustainable bestowal in biodiversity. The most unique feature of Earth is the existence of life, and the most extraordinary feature of life is its diversity. Approximately 9 million types of plants, animals, protists and fungi inhabit the Earth. So, too, do 7 billion people, at the first Earth Summit, the vast majority of the world's nations declared that human actions were

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dismantling the Earth's ecosystems, eliminating genes, species and biological traits at an alarming rate. This observation led to the question of how such loss of biological diversity will alter the functioning of ecosystems and their ability to provide society with the goods and services needed to prosper.

Biodiversity is the variability of life on earth, from genus to species and their habitats to ecosystems. Living and non-living components interact in ecosystems. In broad terms, ecosystems support us by providing services on which our health, livelihoods, and well-being depend. To achieve sustainable development, the benefits we derive from ecosystems must be sustained by conserving their biological diversity. Biodiversity is being lost at an accelerated rate: there is ongoing transformation and fragmentation of habitat through land use change and development, deterioration caused by pollution and alien invasive organisms, and exploitation at unsustainable rates. Continual growth of the world's population increases pressure on biodiversity and ecosystems; climate change adds another factor of pressure (Slootweg et al., 2010). Biodiversity is the variability among living organisms and interaction with their various ecosystems includes this diversity within species, between species according to their ecosystems. The importance of biodiversity appears by its ability to innovate and interact with their habitat, where form a main source and a base of the pyramid of food energy either was vegetable or animal, where the human was able to domesticate them to meet the nutritional needs, the therapeutic and other requirements, so contribute in climate stability it gives a beautiful case for nature. In general, the difference in wildlife achieve the status of biodiversity development, as well as the different forms of life on earth, including the variation within species, between species and between ecosystems, So biodiversity is a scale of the biological diversity groups that practice various effectiveness among themselves and with their habitats within the instinct to survive and preserve the species by genetic propagation, environmental variability and their species, genus difference and within a specific area called the reserve (Champan, Hall, 1992; Asner et al., 2004). Characterized the tropics regions in a great deal of biodiversity by the reason of qualifications their warm climate and its universal primary product (Cook, 1999). Wildlife represents the sector of a non-pet of the organisms which still taken from their ecosystems the habitats, consider the biodiversity distribution variance on the earth is completed the natural life because the three wildlife contents; flora, fauna and microbiology where were one of the necessary components that ensure the stability of human life by providing the sustainability requirements, the richness of biodiversity depends on factors and situation of climate. Scientists estimate the number of animal species about 7, 77 million. Where 215,644 of them species were classified while estimate the number of plant species about 289,000, of which 215, 644 species classified. Gets the great extinction on wildlife due to speedy environmental changes (Imad Eddin Bashir Adam, 2001; Phelps and Miller, 2113; Book of Global environment expectations (UNEP), 2000; Macclenny, Jeffery, 1993). Rapid environmental changes typically cause mass extinctions. (Cockell et al., 2006; Algeo et al., 1998; Bond et al., 2008) More than 99 percent of all species, amounting to over five billion species, (Kunin et al., 1996) that ever lived on Earth are estimated to be extinct. (Stearns et al., 2000; Novacek, Michael, 2014) Estimates on the number of Earth's current species range from 10 million to 14 million, (Miller and Scott Spoolman, 2012) of which about 1.2 million have been documented and over 86 percent have not yet been

described (Mora et al., 2011). The number of reserves in Iraq were 20 but the events that have wracked in country prevented its expansion has become the extinction of biodiversity clear where lost 3 species of wild plants, 9 kinds of mammals, 17 species of birds because of the tragedy of war on the country's, Influenced the biological ecosystem in greatly form in Iraq Degraded the ecosystem of water including the deaths of millions of fish in the Shatt al-Arab and shrinking ecosystem of palm trees from 30 to 9.5 million, by proportion 66% and the degraded the ecosystem of the marshes, which consider the nature reserve. Territorial ecosystem affected by increase soil salinity with low ground water level then increasing desertification by 92% and reduced ecosystem for food security to 30%. Where a mountain Sinjar reserve earned from challenges less degree because of its mountain location and their distance from the effects of the human factor, but the environmental factor is one of the main challenges in the reserve. Allowing the scientific progress in the natural sciences to identify the composition and the characteristics of wildlife species which helps to identify the living resources of natural reserves and diversity of genus and species then their characteristics, in the field of the face the climate change that the natural reserves contribute in protect the risk of flooding and drought. So the reserves are exposed to many threats of their most important were; growing of populations and changing the patterns of land use and natural resources, which had a very serious impact on natural reserves and their habitats with the lack of the necessary capacity to manage it from the negative effects that surround the reserves. In addition to the lack of financial necessary (Kunin et al., 1996). Highlights the importance of biodiversity conservation at currently as a result of decreasing the genus number of wildlife in steadily, the data issued by the Animal Association of London showed that the world has lost since the seventies of the last century, nearly a third of the wildlife. The data indicated that the number of species on Earth has been reduced by 69%, while marine species fell by 68% and that live in fresh water by 69%. Statistics show that the human erase about 1% of species on global level in each year, which means that we are living one of the "stages of major extinctions," concludes that the reason due to pollution with spread of farms and the expansion of civilization in addition to over-hunting.

MATERIALS AND METHODS

Mount of Sinjar located in western Iraq within the province of Nineveh about 150 km between the longitudes (420 25- 50=) and (410 37- 36=) to east, between latitudes (360 36- 00=) and (360 15- 00=) to north, reaching the great height the mountain 1463 m and less height 400 m from sea surface level and its width 13 Km. Sinjar mount reserve located down the mountain in the southern part by area (500 donam), rises the region of reserve 583 m above the surface sea level (Jassim K. Shallal et al., 2007). This study was conducted by applied the scientific method; the spatial analysis depending on the morphological characteristics in the diagnosis of the species, genuses of wild flora and fauna in the reserve, that Appears the importance of reserve in geographical position at the feet of the mountain so the diversity of climate in four seasons then their soil fertile and abundant the water from rainfall, wells, underground water and rain water harvesting project in cover their need water by sprinkler irrigation manner in dry seasons, considered the environmental factor an a major factor in the sustaining of the biodiversity, which has been interpreted in the search; Such as adequate rainfall precipitation, relative

humidity, temperature, evaporation, wind speeds, drought indicator, pollution (acid rain), volcanoes, type of soil, desertification, dust and sand storms, transpiration and evaporation-transpiration, where the reserve of its environmental factors outcome, that contribute to enrich the biodiversity as ecosystem. Through the study of climate factors and accounting the drought indicator was evaluation the ecosystem of the reserve. By using the scientific spatial analysis method of reserve and reliance on potential of differences in the flora and fauna was diagnosed interaction wildlife with its ecosystem and in final assess their biological diversity.

RESULTS AND DISCUSSION

The study region of Sinjar mount reserve located in northwestern Iraq as part of Nineveh province, surrounded from the North direction by Aljazeera irrigation project at the south with some hills up to rise 100 m at the west Sinjar Mount in maximum height 1463 m and a width 13 km, mountain length of 80 km, including 50 km in the Iraqi territory and 30 km in the occupied Syrian (Stearns, Beverly Peterson *et al.*, 2000). Clear importance of the reserve by geographical location at the feet of the mountain so the diversity of climate in the four seasons and the fertility of the soil, as shown in the

Table 1. Monthly averages of climatic data for the city of Sinjar

Months	Rainfall/ml	Humidity %	Temp. Ave.c ⁰ /month	Wind Speed km/d	Evaporation-transpiration ml/d
Jan.	78	69.2	6.6	164.16	1.23
Feb.	64	67	8.8	172.8	1.6
March	56	55.2	11.9	164.16	2.6
April	75	51.8	16.1	216	3.85
May	43	38	23.35	233.28	6.27
June	0	20	29.65	250.56	8.72
July	0	18.6	32.9	250.56	9.84
August	0	16.7	32.75	224.64	8.61
Sep.	1	20.6	28.2	198.72	6.91
Oct.	16	35.2	22	155.52	4.09
Nov.	19	41.8	16.2	146.88	2.62
Dec.	70	64.7	8.8	129.6	1.27
Total	422	-	Annual ave.19.77c ⁰	-	-

Table 2. Determine the status of the climate and the type of vegetation in reserve according to Dumbarton equation

Drought indicator	Dominant climate character	Type of Vegetation cover
Less than 5	Dry	Steppe, deserts
5 - 9.9	Semi- dry	Rain fed agriculture
10 - 19.9	Semi- humid	Herbs
20 - 29.9	Humid	Trees
More than 30	Very humid	forests



Image (1) Explain the flora of Sinjar Mountain Reserve

Table (1). From the climate and environmental analysis clear that the rain falling in the winter and spring at month of October and to the end of May with a chance of snow in winter, the rate of rainfall precipitation in the Sinjar area about 422 ml / annually. Characterized the reserve region by severe rainfall storms in addition of fast surface runoff which classified within in intense water flow that causes soil and rocky crumb erosion. The excess rain water were flowing from the mountains and hills to the valleys toward of the north and east, that temperature factor has a large impact on the atmospheric pressure, which affect to the movement and direction of the wind and recent affecting on the average of rainfall, the temperature reached 32.9 c⁰ in July and 6.6 c⁰ in January, the highest rate of relative humidity was (69.2%) during the month of January and the lowest rate was in the month of August 16.7%. Moisture factor related with rainfall which known as the percentage of real steam pressure compared with the saturated steam pressure where inverse relationship with each of the evaporation & temperature and a positive relation with rainfall, either evaporation factor one of the lost watery represents water loss by direct form from earth surface due to solar radiation, wind speed, air pressure and surface area of evaporation. Either The evaporate-transpiration means the resulting evaporation from saturated land with water and covered with a thick vegetarian cover, And it fits both evaporation and evaporation-transpiration in positive relation with temperature and wind speed .reached the value of each of the evaporation and evaporation - transpiration in a maximum 9.48 ml in July and the lowest value 1.23 ml/day January, reached the wind speed 250.56 Km/day during June and July and lower rate 129.6 km/d during December, where the wind speed depends on variation of the temperature, which in their role affecting on atmospheric pressure-transpiration in a maximum 9.84 ml/day in July and the lowest value 1.23 ml/day January, reached the wind speed 250.56 Km/day during June and July and lower rate 129.6 km/d during December, where the wind speed depends on variation of the temperature, which in their role affecting on atmospheric pressure. From the above were classified the reserve region climate by using the Durbaton equation of drought indicator as following: $D I = P / T + 1$

Where P: Total rainfall /ml; T: The annual average temperature C⁰. That (D I) calculated 14.75 when comparing this value with the values of Table (2) conclude that the prevailing climate being classified as Semi-humid type. The study regions includes three forms of the topography, desert - steppes and mountain. The reserve located within mountain foets Zone, the prevailing soils types in the Sinjar Mountain was lion soils and rocky plains shallow limestone which located in the western facade of the mountain with deep grooves. The second type of soils are red brown soils located in the northern part of the mountain which were fertile soils for agriculture, the third type are chestnut red soil characterized by a large limestone in the southern facade of the mountain. Characterized the reserve region by watery reservoir, due to presence units of rocky that in their role formed aqua-water which called Confined aquifer that was penetrates and non-penetrates being confined by thick layers of Marl and Clay classifies confined watery reservoir, where a section of the wells of the type of artesian flowing automatically and other section non-artesian flowing and the latter depends on the hydrostatic pressure by pumps, ranging depths three of their (85,85,65 m), the water with bad smell was sulphurous water by their containing of gypsum (CaSO₄ H₂O) other non-confined that its waters sources from

erosion the torrents of mountain which consider of drinkable fresh water. The above information explain that suitable environmental factors contributed to the spread of vegetation cover, It was diagnosed the herbal and plant diversity (flora) from their; annuals, biennial and perennial herbs, narrow and broad-leaved which belong about 50 families, 84 genus's and 92 species, the coverage percentage reached 96% and a few of shrub, natural pastures plants, legume & cereal plants and plants that bear the water stress of the genus (*Prosopis*) and (*Capparis*). All flora contribute to the process of improving the ecosystem where vegetation treated the pollution that rid of atmosphere from dioxide carbon in their application by photosynthesis operation in absorption of Carbon dioxide and produce oxygen in addition of beautify status. Therefore flora so therefore fauna, it was diagnosed mammals, birds, reptiles, rodents, predators, turtles and other. We conclude from the study that Mount Sinjar reserve enjoy by appropriately ecosystem (climate, soil, water, air) which contributed in spread the biodiversity in two types (flora & fauna) should be care to achieve development to wild life where as sustainable ecosystem and interactive with living existing although the difficult conditions experienced in Iraq and the reserve region from the impact of war and stripping the land of its cover so explosives that have made a lot of organisms migrate their habitats to a safe haven. Sinjar Mount reserve being strategy reserve in terms of location and in biological content has a prosperous future allows to development and expansion towards of mountain to join within the bio-contents of the trees and shrubs such as; wild fig, oak, terebinth and Sumac, the flora clear as in Image (1).

Recommendations

- 1- Efficient management and proper shielded for Sinjar mount reserve must be built on the foundations of the scientific competence of the life sciences to maintain a dominant ecosystem and wildlife in the reserve.
- 2- Getting help of modern techniques in the development of biodiversity, such as genetics, tissue culture and genetic engineering with an emphasis on the collection of wild plant seeds on a regular basis and cultivated to complete their life cycle in drought years. This requires the establishment of a laboratory for this purpose.
- 3- Annually survey for the natural resources of the living and non-living so doing database for use in the development of wildlife in reserve by using modern techniques in monitoring changes.
- 4- Continuous monitoring, surveillance and control of the around of reserve from the encroachment by manner satellite plasma screen.
- 5- Determine the shepherds and cattle trails with educate them not damaging the reserve.
- 6- Development the scientific and technical capacity in the field of maintenance biodiversity and development the reserves degradation by open; sessions, workshops, and make it an academic laboratory for the preparation of reports, studies and scientific research.
- 7- Annual and periodic assessment for reserve and diagnosis of the negative effects to find the methods to their treated with evaluation of climate such as precipitation rainfall so other climate factors such as droughts treatment manner by digging wells and rainwater harvesting.
- 8- Require legislation of laws that govern the relationship between human and nature reserves not to cause any

damage for it such as hunting, logging, fires,...etc., establishment directorates which subsidiary of the provincial directorates which follow the Ministry of Environment to manage and ensure the protection of reserves.

- 9- Conservation the wildlife from extinction, where researchers estimated that 130 plant and animal species were extinction on a global level, where nature containing (380.000) species that 20% be extinction threatened.
- 10-Application of modern irrigation techniques like sprinkler and drip in dry seasons to the abundance of water in the reserve through rainwater harvesting and wells to complete the life cycle of the green cover.
- 11-Establish wooden shadow for the propagation of rare plants threated of extinction to continuation the rehabilitation of reserve in farmed and their sustainable development with the founding of vegetarian lush and open a database to sources of genetic and plant taxonomy for their importance in scientific researches and drying the botanical samples to make it a scientific source for visitors and dealing with global organizations such as (FAO, GFT, UNISCO).
- 12-Establish meteorological station, environmental monitoring and remote sensing devices for the control and monitoring of environmental and climatic changes.
- 13-Considered the reserve academy laboratory for students of Institutes and universities for some specializations such as; taxonomy, biology, botany, environment, genetics, weeds, biodiversity, genetic engineer and classification of plants and animals, to establish academy scientific visits.

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