

Iraqi Contemporary Environmental Issues Between Challenges and Sustainability

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Abstract: Due to the geographical location of Iraq, Iraq has been singled out for its clear skies, remarkably high temperatures, low relative humidity, and no precipitation for nine months of the year. Extreme summer temperatures result in high evaporation rates, water shortages, marsh and wetland depletion, and poor infrastructure. The consequences of such reflect environmental degradation, animal deaths, and demographic changes. The author's lived experiences are reflected in the research work. This paper intends to highlight such issues and find means for curbing such localized ecological problems and solutions for sustainability in parallel with economic growth. Iraq population is well above the world growth rate of 1.7%, which averaged over the last ten years to about 2.8%. Our planet Earth is a closed environmental system. Internal and external environmental issues are tackled in this work, and a proposed model for solving any environmental problem has been suggested. Economic growth, economic development, geographic and geopolitical influences are being considered. Those local and cross-border issues can bring the decision-makers' attention to consider in planning sustainable growth.

Keywords: Environment; Sustainability; Economic Growth; Eutrophication; Degradation

1. Introduction

Iraq's geographical location, together with its flat arid land, and the abundance of water, contributed historically to be habitat for the confronting powers. During the last century and thereafter, the oil discovery and other energy sources made it even more tangential to be the center of conflict among the super-industrial powers. The wars left irreversible damage to soil, degradation of natural biodiversity, frequent sandstorms, desertification, and drought, in addition to human displacement. Up to the middle of the 20th century, floods were a major environmental issue. With the ongoing development and growth of cities due to mass migrations of countryside population, this resulted in no doubt hard-pressed, overpopulated cities. The over pressed infra structure made living unsustainable due to the proven drinking water, electricity generation, and sewer disposal. Dams were built to curb the flooding issue and to generate electricity, in addition to regulating the water supply where it is needed. In 2014, ISIS came about, and the mass displacement of people became a major issue for instability. However, environmentally related issues are to be studied and discussed in this paper. The Iraqi environment faces serious deterioration in terms of soil salinity, poor water quality, and air pollution [1]. Shams AL-Din and Ali targeted their research towards environmental and climatic changes, which have a direct impact on the agricultural sector and hence Iraq's food security [2].

1.1 Research Methodology

It is intended to study the insight of such environmental issues thoroughly and analyze ways to achieve sustainable solutions in a short- and long-term manner. The study investigated the available real data

and the authors lived exposures to three wars and the resulting negative consequences of such wars on the Iraqi environment. The study adopted a deductive approach together with an analytical descriptive approach to investigate the many environmental issues that Iraq was exposed to during the period following the 2003 invasion. In addition, the author witnessed and experienced many wars. During this period, a clear deterioration of environmental issues like desertification, eutrophication of rivers and marshes, drought, people displacements, uncontrolled population growth, water pollution, water scarcity, and air pollution due to electricity cogeneration.

1.2 Research Outcomes

It is intended to study the insight of such environmental issues thoroughly and analyze ways to achieve sustainable solutions in a short- and long-term manner.

2. Contemporary Environmental Issues

The study is directed to investigate the insight of the following contemporary issues, and how they are related to environmental degradation, country instability, and delayed economic growth:

2.1 Desertification

Iraq's desert accounts for about 40% of the total country territory. Iraq's total area is 434128 sq. km, and desertification contributes to around 70% of its irrigated land [3]. According to the World Bank, desertification propagates at the rate of 9% annually. This issue has been forcing rural areas, particularly the marshes' descendants. Iraq has been a habitat for many wars, where the crust of the desert has been uprooted, resulting in an increase in sandstorm frequency [4]. The draught and water flow rationing from the two main water resources has been throttled, which led to water scarcity. Figure 1 shows clearly the wetland depletion that has been experienced because of the geopolitical water policy. The marshes, which have been declared an international reserve by the United Nations, suffered complete intended drying by the previous regime, unfortunately. The total area of wetlands was 9560 square km, which can expand to 20000 square km during the flooding seasons. A joint effort by the Italian consultants and the Iraqi Water Resources Ministry has put protocol to reduce it to 5000 square km via ensuring water supply from both Tigris and Euphrates, and the resulted treated grey water [5].

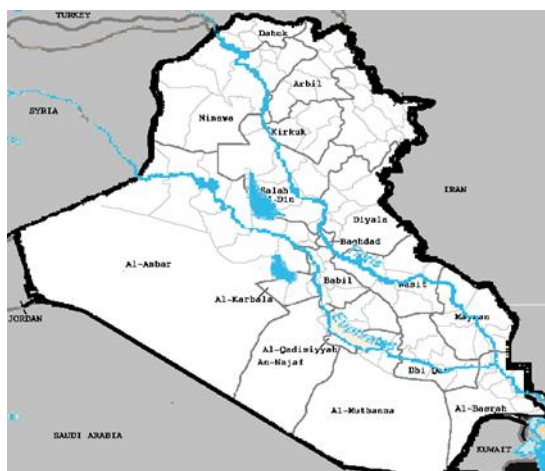


Figure 1: Iraq water sources Rivers + lakes [5]

2.2 Eutrophication

Even though Iraq is considered the OPEC Plus second exporters of oil, its revenue has not been used to build proper infrastructure. Waste by-products of refineries are not controlled or well-treated. Fifty percent of the treated sewer waste is still allowed in the main rivers. Similarly, cities and towns wash

out during the rainy season and seep into the lower levels of rivers, too. Such influent waste will certainly decrease the dissolved oxygen DO to less than 8 ppm [6]. The study by Abdullah et.al. (2024) indicated that Iraq's water quality index (WQI) is extremely poor, particularly during summer, when WQI is around 23%, while in winter, it is around 57%. However, the overall WQI is found to be 49% with SD 18%, which constitutes its inadequate quality throughout. [7].

2.3 Corruption

Iraq is considered one of the most corrupt countries in the world. Coalition forces were doing little to prevent the widespread looting, plundering, and destruction of Iraq's world-famous historical sites [8]. Corruption has spread over the various sectors of society, where 500 billion dollars have been lost since 2003. Iraq is the 12th most corrupt country in the world [9]. It has unfortunately become a principle that no one can pursue their case in a real estate office, tax office, courts, etc., if no commission is prepaid.

2.4 Social peace and security

In the absence of security, the ruthless spread of arms, and the numerous sources of power, like tribal power, sectarian power, all led to complete peace disorders. And hence a disregard for environmental care. The lack of national loyalty, on the other hand, weakens the individual's honesty in their duties. Corruption is linked to environmental degradation in many cases. Land reform budgets often fell short of their targets, corrupted farmers claimed cultivated grain that had been imported from other sources, roads project done short of the actual assigned specifications.

2.5 Biodiversity

The ongoing increase in population, the horizontal expansion in buildings, and the conversion of agricultural land into residential land all contributed negatively to the loss of biodiversity. The native species and wildlife have already disappeared[10].

2.6 Population growth

Uncontrolled population growth has made Iraq a young society; the young generations contribute to 60% of the total population. This should be used to mobilize development and land reforms. The population of Iraq was recorded as 43.5 million in 2023, and the growth rate 2.28 %, which is higher than the world average of 1.7%. The Total fertility rate is around 3.3; three governorates, Baghdad, Ninawa, and Basra, contribute to 47.7% of the total population[11]. Iraq's population growth rate, as shown in Figure 2, is alarming; it is, however, higher than the world average of 1.7%. An average growth of around 2.2% for the last 5 years. It can be clearly seen that Iraq's population growth is exceeding the world growth by 0.5%. It can be clearly seen that Iraq's population growth rate in the decrease following the 2013.

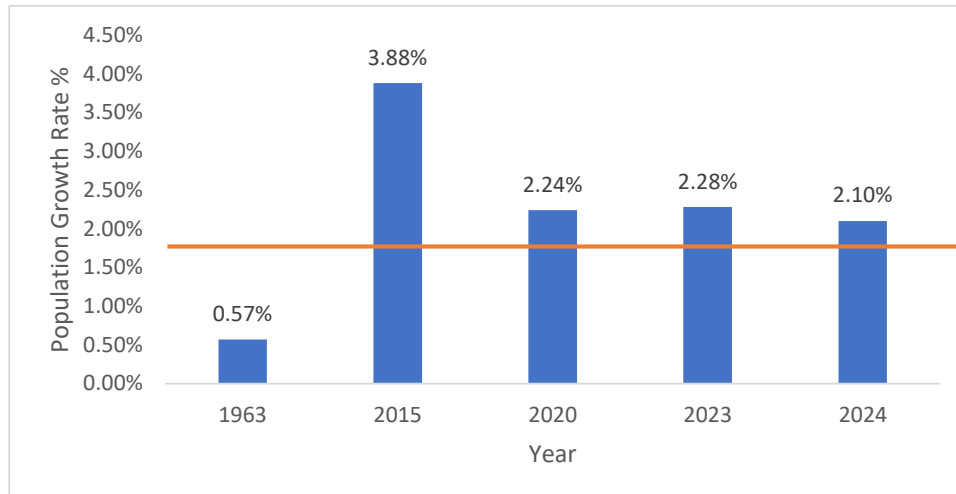


Figure 2: Histogram shows Iraqi population growth rate for different years compared with the world average of 1.7%. (author's work)

2.7 Terrorism

To a certain extent, large areas of farmland have been subjected to fire spread, the cause of which is classified as of unknown origin. Millions of fish farms have been destroyed, reports of unknown origin. Terrorism, in other forms, has been noted, where some targeted high-tension towers for prearranged contracting gains for restoration.

2.8 Multi-Axes of Powers

The central government has difficult and challenging tasks to face; the axes of powers are numerous, sectoral, religious, tribal, militia, political masses, parties, racial, and loyalties to outside countries. Environmental decision-making alongside other decision-making is so difficult to implement.

2.9 Water Scarcity

Recently, Iraq suffered major shortages of water that is due to the roots of supply, many geopolitical and general drought reasons, as an apparently. Both Turkey and Iran have managed the water resources in away makes it difficult for Iraq to get its needed proportion. This issue led to mass migration of decent families to the hard-pressed cities, in addition to the loss of animals and habitat degradation.

3. Pollution

Pollution is defined as the changes that take place in air, soil, and water, physically and chemically, which lead to abnormal variation in concentration and content. In brief, the pollution can be categorized into the following:

3.1 Air Pollution

The main sources of air pollution are due to power generation, national and local, in addition to the traffic and industry. Airborne particulates stay suspended continuously, which causes lots of respiratory diseases and intellectual disabilities in children; they are products of NO_x, SO_x, and CO_x. In many cases, home run oil refineries are noticed as a widespread practice. It is worth mentioning at this stage that during the first and second gulf war's considerable amount of Depleted Uranium U238 was dropped on Iraq; these types of radioactive pollutants seeped into soil and water alike. The increase in cancer and birth deformity cases in the south and western region is being noticed [12]. The oil-accompanied gas diffusion contributes to considerable pollution of the environment in the whole of

Iraq. The increase in greenhouse gases GHG in Iraq is mainly due to the poor quality of fuel being used in public power generation, cogeneration, and transportation. It has been indicated that the CO₂ emission from these sources was greater than 300%, this has been estimated to be 14000Gg to 5800Gg for the years 1990 and 2017, respectively[13]. Recently, brown fumes have been covering Baghdad City, which is mainly contributed to by improper solid waste disposal, congested traffic, factories, refineries, and plume application, as shown in Figure 3 [14]. This clearly shows the extremely polluted city, which will, no doubt, result in acid rain. There is a drastic difference between Erbil Moderate 37 and Baghdad Extreme 257. It must be mentioned here that Erbil governorate has lifted the cogeneration throughout the city. Statistical analysis shows that the pollution in Baghdad is exceeding Erbil by 594%.this will need to say that Baghdad is not sustainable for living.



Figure 3: Shows a random check to Baghdad City, Erbil city early morning [14](Plume Application, 2025)

3.2 Water Pollution

The main source of water pollution is due to sewage wastewater. Iraq's daily wastewater is around 6 million cubic meters per year. The wastewater treatment plant that serves the city of Sumawa is facing major problems related to improper design and/or implementation of structural plan, lack of professional operators, power shortage, and lack of maintenance [15]. Unfortunately, they all seep into the soil and the rivers. The poor, incomplete treatments are still not sufficient to meet the standard. The average salt content Tigris River is an example, around 180 ppm at the border entry, while the average is 1400 at Basra. Erbil city is an example; it has no sewage water treatment; wastewater is seeping towards underground water resources and gravity driven towards the Tigris Valley. Figure 4 is a sample of this soil water canal.



Figure 4: Shows a sample of wastewater flow at Erbil city (author's real photo, 2025)

Another source of concern is the growth of an indefinite plant called Nile flower. A reduced water flow rate leads to shallow water of the river Tigris at 270 km south of Baghdad in 2008, as shown in Figure 5, which, of course, causes dissolved oxygen DO and water flow rate reduction in rivers and canals. Dissolved oil droplets in river water are noticeable in large scale; it has been noticed in some fish farms that droplets of oil are within the fish meat. The rationing of water flow in the rivers is a major problem, as the concentration of water-borne pollutants is on the rise. At large, the results of the Iraq water quality index (WQI) for the Tigris River in southeast Iraq revealed acceptability, with scores of 65.32, 53.03, and 57.15 during winter, spring, and autumn, while the summer season exhibited poor water quality with a score of 23.45. An average WQI of 49.45% with $SD = \pm 18.256$ suggests the entire Tigris River potable water is unsustainable for use [16]. The drought and limited water supply to marshes led to the reduction of the marshes to about 1/5 of their total area. The estimated evaporation rate is considerable, and water loss due to evaporation is about 2 million cubic meters per year. It is estimated by using the MSARIMAX model that by the end of the year 2025, the amount of water remaining in the marshes amount to 114.53 million cubic meters, which is a rather alarming case that threatens the global environment and biodiversity alike [17]



Figure 5: Shows the shallow water of the Tigris River at a place 270 km south of Baghdad in 2008 (author's real photo, 2008)

3.3 Soil Pollution

Solid waste disposal in pits is normally exposed to rainwater, where pollutants seep into the underground water, rivers, and lakes.

4. Challenges and Sustainability

The basic principles of sustainability are expressed in a biodiverse environment, chemical recycling, and the use of alternative energies, in addition to controlled population growth. The ever-subsidized fuels and lack of legislative measures to curb the ever-dependence on fossil fuels led to overconsumption of high-quality energy like electricity. The lack of environmental awareness, on the other hand, and the tradition of the Iraqi society, Iraqi individuals are affluent in all aspects of life. The electricity supply eruption, unemployment, and illiteracy all helped in an increase in population of around 0.8% more than the world average. Uncontrolled immigration also led to a rapid increase in population. The whole episode, of course, led to the need for infrastructure development. The drought helped to cause the mass displacement of rural areas to cities, where 70% of Iraq population lives in the already stressed cities. The spread of corruption within the public establishments makes life unsustainable for individuals. Uncontrolled arms within society make life less safe, even for families living in their homes, land, and house. Confiscation of land is also a problem. The eutrophicated rivers reflect a high rise in cancer diseases throughout, particularly in the south and the middle.

4.1 Remedial Better Than Treatment: Prevention is cheaper than restoration via:

4.1.1 Greenhouse gas reduction

To reduce emissions of greenhouse gases GHG, measures must be taken, which are:

1. Use of mass transport, cycling, and walkways
2. Introduction of hybrid motor vehicles
3. Remove old cars from the road.
4. Deployment of environment-friendly oil refining and capturing oil accompanied gas.

4.1.2 Sustainable potable water:

This is simply done through controlled sewage treatment, polluters should pay, shutting off overflow of municipal, industrial, and refining wastes.

5. Proposed Sustainable Solutions

The ever-increasing air pollution, water pollution, and, of course, soil pollution due to the precipitation of acid rains are all severe challenges to Iraq's environment. To find a solution to any problem, an environmental problem is an example. It is recommended to follow this basic rule: Understand the problem, Plan what to do, then Work, and finally Result, respectively, yes Y or no N, as shown in Figure 6.



Figure 6: Shows the sustainable path for any environmental problem. (author's path)

To curb such challenges, certain measures for the short and long-run strategies that can be considered can be simplified as shown in Figure 7 and as follows:

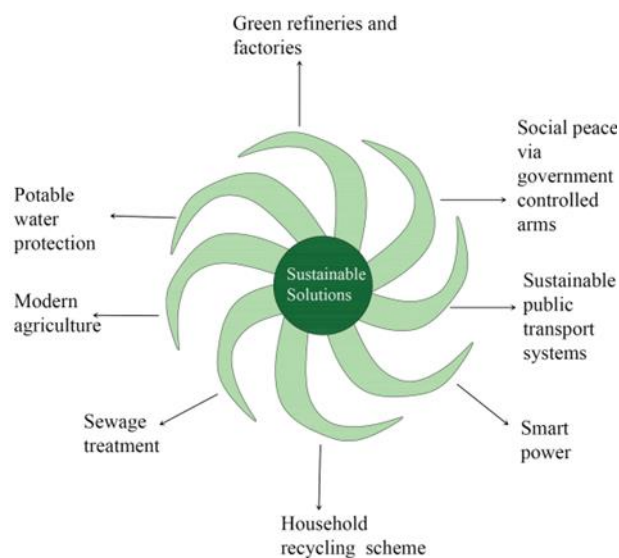


Figure 7: Shows factors to be addressed to reach sustainable solutions. (author's plan)

6.1 Green Refineries and Factories

Adopting environmentally friendly reefing systems and factories will certainly cut off the gaseous liquidous wastes issues. Adopting an electrostatic precipitator, effective equipment, and waste treatment.

6.2 Potable Water Protection

Severe laws on the industrial and agricultural sectors to eliminate potable water eutrophication for all rivers and lakes.

6.3 Modern Agriculture

The usage of alternative energy for irrigation and underground water pumping.

6.4 Sewage Treatment

Adopting the principal polluter pays, sewage treatment for water recycling and fertilizer making to full fill the needs of agricultural and landscape use.

6.5 Household Recycling Scheme

Spreading awareness among all households to adopting pre organized solid waste collection in two forms, organic waste and recyclable metal, glass, and paper.

6.6 Smart Power Generation and Distribution

What are called smart grids to control and optimize power consumption.

6.7 Sustainable Transportation Systems

This can be summarized in considering sustainable mass transportation and hybrid, efficient motor vehicles.

6.8 Social Peace Through Government-Controlled Arms

Government-controlled arms and weapons disarmament are essential to protect individual and social peace and the living environment.

7. Conclusions

To ensure sustainable living, economy growth for the long term development in Iraq, environmental governance should be incorporated and enforced. Central to achieving this is the principle of polluter pays, with its stringent application, and without exception in agriculture, industry, and infrastructure, through new technology which can provide higher yield with lower environmental load. As important are intense environmental awareness campaigns backed up by stringent environment laws to regulate solid, liquid, and gaseous pollution. The widespread use of renewable energy and propagation of deciduous trees is an important way to reduce pollution damage and improve ecological resilience. In addition, involvement of the young through schools and religious institutions is a prerequisite for creating a nature-conscious society. But technical solutions are inadequate in the absence of effective governance mechanisms that curb corruption, fragmented power structures, and key social challenges like arms proliferation and low public awareness. Given this situation, the study results of this paper offer a strategic perspective for decision makers to control further environmental challenges and lead Iraq toward sustainable development.

Author's contribution

The author confirms that the work is solely based on my own findings and experience.

Conflict of Interest

The author declares no conflict of interest

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AI tool Declaration

The author declares that no AI tools were used in any part of the preparation of this manuscript.

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