National Strategy for the Protection and Improvement of the Environment in Iraq

2024-2030

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THE NATIONAL STRATEGY FOR PROTECTING AND IMPROVING THE ENVIRONMENT IN IRAQ (2024-2030) WAS DEVELOPED WITH TECHNICAL SUPPORT FROM THE UNITED NATIONS DEVELOPMENT PROGRAMME, AND FUNDING FROM THE UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

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Opening Remarks—His Excellency the Minister of Environment

I am pleased to place the new National Strategy for Environmental Protection and Improvement in Iraq that covers the period 2024 – 2030 in your hands.

This strategy has been devised in a way that reflects the high level of commitment of the Republic of Iraq and the official, civil, and local organizations it represents to the global agenda for sustainable development by working effectively within international fora and global agreements to achieve the required level of environmental protection, conservation of its components, and integration into development plans within the system of sustainable solutions.

This strategy, along with the pollution reduction strategy, represents a roadmap for the Ministry of Environment, and many national partners have essential roles in it by dint of legislation that accorded them a major role in planning and implementation, as well as our full conviction in the Ministry of Environment of the importance of the public participation role to ensure the highest levels of coordination, and organizing the authorities, responsibilities, and duties among all national institutions.

Confronting the increasing environmental and development challenges requires strengthing the Ministry of Environment's role at the legislative, administrative, and technical levels, and that is what we continuously work on with all our partners to confirm the development of the Ministry's ability in all dimensions to undertake its role and duty in protecting and improving the environment's elements and the sustainable use of natural resources in the context of comprehensive plans for sustainable development in Iraq.

Finally, I would like to extend my gratitude to all members of the working group participated in preparing this strategy from the Ministry of Environment and other ministries and partner institutions for their great efforts and commitment. I also extend my gratitude to the United Nations Development Programme (UNDP) and United States Agency for International Development (USAID) for their financial, organizational, and technical support for preparing the strategy.

His Excellency the Minister of Environment

Nizar Muhammad Saeed Amedi

The Summary

This document represents the national strategy for protecting and improving the environment in Iraq and the basic pillar through which the Ministry of Environment tackles environmental issues within the national development policy frameworks. The Ministry has- up to the present time- developed several legislative frameworks, including laws and regulations for environmental protection and climate change, among others.

The National Strategy for Environment Protection and Improvement document was prepared based on an assessment of the current state of the environment according to scientific reports and published data from different sectors.

The Republic of Iraq has always faced environmental risks, pressures, and challenges, such as population growth-- which has led to increased pressure on the natural environment-- unsustainable use of natural resources, the construction of dams, and measures to divert waterways by neighboring countries, which has led to a decline in the level of water resources and a negative effect on the environment. Neglecting environmental dimensions during the planning and implementation stages of development projects led to multiple environmental problems. These encompass not taking the necessary measures, enacting regulations and legislation, reorganizing the exploitation of land, water, and natural resources, and preventing harmful practices that impose pressure on environmental elements-- such as grazing, poaching, cutting trees, and hunting wild animals-- in addition to not regulating irrigation to stop the encroachment, and legalizing irrigation to stop this harmful encroachment of millions of tons has led to an increase in the area of desertified lands or those threatened by desertification.

Iraq seeks to continue developing environmental protection capabilities by reducing pressures on different social, development, and environmental systems, by implementing comprehensive protection measures considering gender aspects. Therefore, this national strategy has been developed to integrate environmental protection measures within all the relevant sectors in Iraq. The process of preparing the national strategy followed a set of steps that aimed at ensuring the effective participation of different institutions and experts under the leadership of the Ministry of Environment as the national authority responsible for environmental protection in Iraq, where it coordinates national efforts in terms of policies, legislation, and implementation of measures and procedures related to environmental protection at the national level.

The strategy addressed the strategic framework: vision, mission, core values, and five strategic programs that include all technical and environmental dimensions and good governance of environmental activity.

The Vision

Healthy and sustainable environment conducive to the development of a safe & healthy society with green economy

The Message

Protection and Improvement of the Environment & work for the sustainability of all its components by adopting comprehensive planning approaches built on governance and partnership between institutions and individuals.

Strategic Programs

- Protection & Improvement of the Environment
- Climate Change Programs
- Partnership Programs
- Environment Education Dissemination Program
- Environmental Governance Programs

Core Values

- Sustainable Health Environment
- The Right to a Safe Environment as a Basic Right for Citizens
- Evidence-Based Decision-Making
- Respect for National and Local Context
- Attention to Social & Cultural Diversity “Social Participation”
- Inclusivity

The first strategic program "Protecting and Improving the Environment" encompasses nine sectors that were identified through dialogues and consultations with the stakeholders (Figure 1)

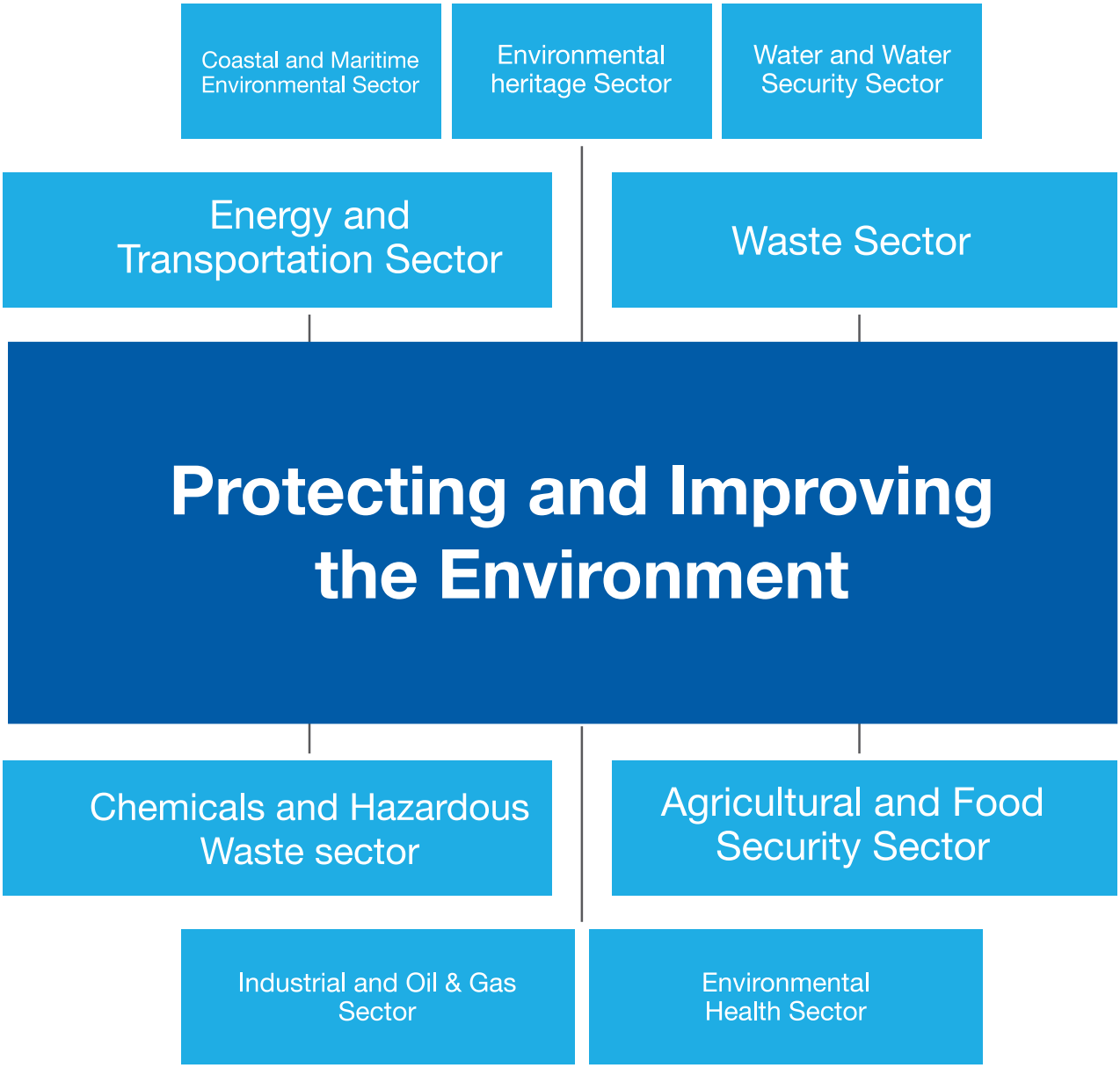

Figure 1: "Environmental Protection and Improvement Program" sectors

Several strategic goals have been identified for each program. Twenty-eight strategic goals would contribute to achieving the desired sustainability at the environmental activity level in all sectors. The strategy also includes several supporting sections, including financing to clarify the sources available to finance the strategy from national and external sources. In addition, the strategy encompassed a monitoring and evaluation plan that aimed to monitor the implementation progress, which included performance measurement indicators and a road map.

Finally, the national strategy encompassed an action plan, which included an estimated budget for achieving the suggested strategic programs.

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Part One: Introduction

"Iraqi Ministry of Environment has accorded the utmost importance to the development and preparation of this strategy for environmental action in Iraq to serve as a guide and a platform for action for all stakeholders working in the public and private sectors and civil society organizations. The strategy aims at addressing the fundamental problems facing the environmental elements of Iraq over the next seven years."

The Challenges to the Iraqi Environment

The area of Iraq is (435,052 km²) where land comprises most of the area, while a limited sea outlet overlooks the Arabian Gulf. Iraq is famous for its large river system consisting of the Euphrates and Tigris rivers and their tributaries and the Shatt al-Arab, where the Tigris River supplies approximately (65.77%) of the total annual water quantities in Iraq. The natural environment features in Iraq are diverse, as the mountainous areas, valleys, and forests located in northern Iraq are spread in the Kurdistan region, to the hills represented by the Hamrin and Makhul hill series and others, to the plain areas located between the Tigris and Euphrates rivers, to the wastelands and arid steppes and the desert western plateau. The Mesopotamian Marshes, located in southern Iraq, are considered one of the important natural environments, in addition to several natural and artificial lakes suchas Lake Sawa, Al-Tharthar, Al-Razzaza, and others, Dokan, Darbandikhan, Dohuk, Samaquli, and Kuma Span, which hold international importance.

Iraq is considered one of the dry and semi-arid geographical regions, increasing the fragility of its environments, ecosystems, and biodiversity. Climate changes, such as low rainfall rates, have also affected Iraq, causing a decline in lakes and rivers water levels. Rising temperatures have also affected Iraq, which have led to an increase in drought, desertification, fires, and the intensity and frequency of dust storms. Despite these pressures, large areas of Iraq are still of global and local importance that require protection, such as the marsh areas- which have been included on the World Heritage List- in addition to the declaration of many protected areas of natural importance and the environmental services they provide with important economic returns.

The pressures and challenges are not limited to climate change, as the environment of Iraq faces many challenges, such as population growth-- which has led to increased pressures on the natural environment and the unsustainable use of natural resources-- and the construction of dams by neighboring countries, which has led to a decline in the level of water resources and a negative effect on the environment. Neglecting environmental dimensions during development projects' planning and implementation stages has increased environmental stress. These include not taking the necessary measures, enacting regulations and legislation, reorganizing the exploitation of land, water, and natural resources, and preventing harmful practices that put pressure on environmental elements such as grazing, poaching, cutting trees, hunting wild animals, and legalizing irrigation to stop this harmful encroachment of millions of tons of shifting sand, which has led, in turn, to increasing the area of desertified lands or those threatened by desertification. It is worthwhile to note that the areas exposed to the problem of desertification in Iraq are increasing, as they increased from (26.8 million dunums) in 2018 to (27.3 million dunums) in 2020, in addition to the increase in the area of lands threatened by desertification from (93.7 million dunums) in 2018 to (94.3 million). dunams) in 2020.

The Regulatory and Legislative Framework in Iraq

The Environmental Protection and Improvement Council associated with the Ministry of Health (1995-1997) is considered the first organizational structure that assumed responsibility for issuing environmental laws and instructions in Iraq until 2003, which witnessed a political change that led to the establishment of the Ministry of Environment for the first time in Iraq's history to assume leadership of environmental legislation. Thus, environmental activity has transformed to institutional work with a comprehensive vision that confirms that the environment is one undividable unit and is not limited to areas or environmental sectors alone.

The Ministry of Environment Law No. (37) of 2008 was issued, clarifying the structure and responsibilities of the Ministry, the goals it seeks to achieve, and the tasks assigned to it. Environment Protection and Improvement Law No. (27) of 2009 followed, consummating the legislative process for protecting the environment, noting that there are many regulations and instructions related to the Kurdistan region, the most important of which are the Environment Protection and Improvement Law in the Kurdistan Region No. (8) of 2008 and the Environmental Protection and Improvement Authority Law in the Kurdistan region No. (3) of 2010.

The first version of the environmental protection strategy was developed in 2013 to achieve visions of sustainable development. Still, the implementation of that strategy has stumbled as it was prepared at the level of projects in the different sectors related to environmental issues as well as the security conditions

that Iraq underwent because of the military actions to eliminate the ISIS terrorist organization. Also, the National Strategy to Reduce Environmental Pollution and Action Plan in Iraq 2022-2030 has been launched to control and reduce pollution by setting specific strategic goals that would be achieved through an action plan. Accordingly, the proposed national strategy to protect and improve the environment in Iraq (2024-2030) would comport with Iraq's Vision 2030, which is deemed a comprehensive framework for the development process in Iraq linked to achieving sustainable development goals, and works on creating a sustainable environment that comports with the national development plan for the years 2018-2022, which is considered the most important step in Iraq's sustainable development journey towards a future in which it aspires to be an advanced country on the economic, political, cultural, social, and environmental fronts.

Concomitant with the requirements of the international community to confront climate change, Iraq submitted its nationally determined contributions to the United Nations Framework Convention on Climate Change (UNFCCC) in October 2021 with a pledge to reduce greenhouse gases by (17%) by investing 2% as unconditional contributions and 15% as conditional contributions by 2030.

The Stakeholders

The strategy's importance emanates from its inclusion of the respective environmental sectors and does not exclude any of the Iraq state's sectors: Thus, all are partners in protecting and improving the environment and its sustainability. It will be effective on all levels, as shown in Figure 1.

Figure 1: Interactivity and stakeholders in environmental protection, improvement, and sustainability

Part Two: Strategic Plan

2

The Vision

Safe & healthy society
with green economy

Leads to
establishment of

Healthy & sustainable
environment

The Message

Via

Implementation of comprehensive planning approach that is based on governance & partnership between institutions & individuals.

Protection & improvement of the environment & work towards its sustainability

The Core Value of the Strategy

The strategy is based on the following core values:

Sustainable healthy environment

The sustainable environment positively interacts with society and the economy and supports human well-being, which establishes the necessity of adopting a comprehensive environmental approach that addresses environmental challenges hand-in-hand with physical, biological, social, economic, and political factors.

Right to safe environment is a basic pillar for Iraqi citizen's rights.

The sustainability and safety of the environmental elements of water, air, soil, and biodiversity is a fundamental pillar of the citizen's right to a healthy environment and ensuring environmental justice as one of the basic pillars of human rights, which supports the stability of environmental, social, political, and economic conditions, which, in turn, is reflected in the proliferation/prosperity of development programs.

Evidence-based decision-making.

Dialogue with effective solutions "in reality" characterizes decisions based on scientific facts. Therefore, decision-making regarding issues related to the environment needs to be based on the available evidence and scientific information, which requires conducting research, providing information, and relaying and making it available to all stakeholders. Cooperation between different relevant parties in providing the necessary information is extremely important to reach evidence-based decisions.

Respect for the national and local contexts

The governorates of Iraq and its geographic areas differ tremendously in their areas, geographic characteristics, population, economy, and environmental problems, which necessitates considering the specificity of each area within a comprehensive framework that guarantees the special procedures unique to the regulations of protecting and improving the environment and caters to the national aspirations regarding achieving the goals of sustainable green economic growth and international commitments.

Inclusivity

The inclusiveness of the National Strategy for Environmental Protection and Improvement emanates from how its addresses all the enabling factors that can lead to environment population and its elements or that can lead to disturbing the environmental ecosystem, and the strategy's ability to pose solutions for addressing the negative effects of these factors, prioritizing the provision of water, soil, and high-quality environmental ecosystems, adequate sanitation services, adequate waste management, preventing pollution, preserving biodiversity, in addition to providing healthy, sufficient food to avoid unnecessary expenses resulting from curable pathogens. The inclusivity of the strategy also emanates from its inclusion of the climate component, which boosts immunity, raises the preparation level for adapting to the negative consequences of climate change, and limits the dangers of natural disasters and contributes to its limitation through limiting gas emissions and in a way that achieves national aspirations and compliance with international treaties alike.

Attention to cultural and social diversity and encouraging societal participation.

Attending to cultural and society diversity and enabling society's members, including young adults and women, to have pioneering roles is one of the fundamental pillars of implementing a strategy for protecting and improving the environment. Environmental activity accentuates the need for including all society's groups, including young adults and women, through their expected major role in spreading environmental awareness and fair interaction with environmental resources—through a green environmentally sustainable, socially inclusive economy—which, in turn, greatly and fundamentally curtails environmental problems. Encouraging societal participation would bolster the needed entrepreneurship and innovation for facing the environmental challenges through transforming into a green economy where young adults and women play a primary role.

Strengthening International cooperation

Environmental activity is not confined to national, or even regional, borders, and it necessitates an international view. Goal 17 of the Sustainable Development Goals stipulates the reinforcement of the methods of international cooperation and invigorating it for sustainable financial development. To revive the global partnership for sustainable development,

environmental activity in Iraq would, thus, contribute effectively to the achievement of sustainable development goals and the reinforcement of international partnerships and strategic programs for Iraq's environment in 2030.

The National Strategy for Environmental Protection and Improvement in the Republic of Iraq aims at achieving five major programs across all the target sectors and they are:

Environmental Protection, Improvement and Sustainability Program: The strategy seeks to protect and improve the environmental elements of soil, air, and water and to preserve biodiversity and land, water, and marine ecosystems. This program encompasses monitoring the quality of the environment's water, air, and soil components, implementation of programs to control economic and human activities, licensing procedures, environmental approvals, environmental impact assessment, and law enforcement studies, among others.

Climate Change Program: It includes assiduous and sustained action to mitigate the effects of climate change by reducing greenhouse gas emissions and adapting to the effects of climate change in the context of the gradual transformation of the green economy, investing in green infrastructure, and promoting green jobs. This program encompasses involving all relevant governmental bodies that regulate the work of sectors that climate change affects and that are affected by it, involving the private sector, civil society institutions, and other relevant actors effectively, as well as empowering partnerships with international organizations.

Strengthening Partnerships Program: Strengthening and ensuring the Ministry of Environment's capacity to coordinate with a wide range of relevant sectors and organizations to achieve national priorities and international commitments-- including relevant sustainable development goals and environmental agreements-- and to cultivate sustainable communication channels at the national, local, and international levels. Efficient coordination encompasses ensuring the implementation of necessary linkages (nexuses), such as the energy-transportation-urban environment nexus and the food / agriculture-water-energy-environment nexus, which lead to institutional and effective action and ensure that there is no duplication of roles that the different entities play.

The Environmental Cultural Dissemination Program: Ensuring the promotion and upgrading of the knowledge level among all sectors of society and at all levels of the importance and preservation of the environment and the multifaceted relations of the environment with all actors in Iraq. This program encompasses the design and implementation of awareness programs, which include target selection and tools that are needed and appropriate to convey the environmental message efficiently and influentially.

Environmental Governance Program: Providing rational governance that is capable of managing the environmental profile that integrates roles between different entities and contributes positively to integrating environmental considerations into the design, planning, implementation, and environmental control stages, implementing laws and legislation in force at the sectoral level, and influencing and developing policies and legislation to ensure strong institutional growth.

Part Three: Strategic Programs

3

Waste Sector

Facts and Figures

The number of municipal service establishments in Iraq increased in 2020 to (256) compared to the 2017 baseline of 251 municipal waste collectors (61.9%), (64.6%) in rural areas, and (87.7%) and (89.9%) in urban areas for the years (2017) and (2020), respectively.

As for the rate of waste generated per person, it was approximately 1.5 kg/day, having increased by (25%) in 2020 from the baseline year (2017). Statistics indicate that the normal amount of waste raised and transported to health landfill sites was in the range of (20.37) and (19.7) million tons/year during (2017) and (2020), respectively. Landfill in sites without environmental approvals is the most approved method of disposing municipal wastes, and sites with environmental approval account for 28% of the total number of healthy landfill sites. Iraq's governorates saw a total of 87 transfer plants, of which only 14 have environmental approval. 2020 statistics indicate two waste screening and recycling plants in Iraq, which recycled 11,495 tons of regular waste during 2020-- representing a very small proportion compared to what has been transported to landfill sites (19.7 million tons). Furthermore, in the Kurdistan region, a waste transfer station in Tangro produces RDF as fuel for cement plants and waste sorting plants in Dohuk/Kwashi and Akre.

Two Strategic Goals will be achieved in this sector, and they are:

Strategic Goal (1): Reducing the loss of natural resources and building sustainability programs through raising the waste collection and management capacity.

Strategic Goal (2): Increase the material recovery rate by increasing the waste handling capacity and moving towards an efficient circular economy.

The proposed programs for the Waste Sector

- Developing a financially sustainable national strategy and action plan for municipal solid waste.
- Strengthing the municipal waste management authority's financial management and capacity for strategic planning.
- Developing programs for waste management and a circular economy to reinforce invention, training, research & development, and investment.
- Working on establishing hazardous waste treatment and landfill sites, increasing investment opportunities, and generating added returns from them.
- Building municipal solid waste infrastructure and establishing sanitary landfill sites to reduce pollution and promote recycling.
- Proposing a public-private road map to shift towards limiting the usage of single-use plastic on the household and commercial levels.
- Conducting a market assessment and feasibility study to determine investment projects and programs related to organic waste.
- Preparing a baseline study and a roadmap to shift to green jobs in the waste sector.
- Developing and implementing a policy and national construction and demolition waste management programs.
- Designing and implementing national awareness campaigns of waste management.

Ecosystems and Biodiversity Sector

Facts and Figures

Ten environmental areas were identified in Iraq that are deemed environmentally important, and 4500 plant types were recorded in Iraq, of which 195 are endemic species while 30 exotic and invasive plant species were recorded.

Fifty-two fish species were recorded in the Tigris and Euphrates Basins, dominated by the shipwrecked family, as well as 13 species of invasive fish. In the marshland area, 25 marine fish species were registered, and six exotic species were found in both the rouge and the Al-Hawiza marshes.

Looking at mammals in Iraq, 80 species have been registered, two of which are considered endemic to the Arabian Peninsula region. The list of mammals includes six species of insect eaters, 20 species of bats, 19 species of predators, eight species of bones, and 26 species of rodents. Ten amphibian species have also been registered in Iraq, one of which is endemic to the Kurdistan region of Iraq, and 97 reptiles. Invertebrates comprise a large number of species; two crustacean species, 28 insect species, 102 radial vases, and two stingrays have been detected to date.

As for birds, of the available data from 2014, 410 species had been registered including more than 200 resident species, 182 migratory species, and 18 species deemed priority protection. The proportion of resident breeding birds in Iraq is as high as 50%, underlining the significant role of marshlands as winter habitats for migratory waterfowl. This is evident when we consider the presence of 68 important waterfowl species within the marshland region, each contributing to the significance of this area in the context of migratory corridors. The region's importance to birds stems from the fact that it constitutes a shelter for migratory water birds that spend winter in the north and are an important starting point for some species of migratory water birds from western Siberia and Central Asia to eastern and southern Africa. Iraq has 74 important bird areas, biodiversity and endemic bird areas. In the Kurdistan region, a type of tiger has been recorded.

Two strategic goals are accomplished in this sector, and they are:

Strategic Goal (1): To protect and ensure the sustainability of natural heritage, and ecosystem services and to in order to ensure the fair and equitable sharing of their genetic resources.

Strategic Goal (2): To protect, restore, and promote the sustainable use of terrestrial and marine ecosystems, forest management, combating desertification and halting and reversing land degradation.

The proposed programs for the Ecosystems and Biodiversity Sector

- Development of Iraq's network of natural reserves to ensure integrity and comprehensiveness of ecosystems.
- Developing the laws and regulatory frameworks for the natural heritage protection program.
- Developing a strategic plan for Ecosystem-based adaptation and ecosystem-based solutions in Iraq.
- Developing a strategy for restoring critical habitats in Iraq.
- Creating a biodiversity and environmental systems database.
- Assessing climate change effects on ecosystems and biodiversity in Iraq.

Water Resources and Water Security Sector

Facts and Figures

The quantity of water processed for different uses (agricultural, domestic, industrial, and environmental) is estimated at about 31.82 billion m3 (2018). The data shows that the percentage of drinking water and household use in 2017 and 2020 are 6.8% and 14.5% respectively, noting that one of the most important challenges is the overconsumption of water due to the lack of citizen awareness according to the reports issued by the relevant authorities.

The groundwater level differs between (3-300 m) While groundwater depths in some areas of the Kurdistan region range between (200-700 m) and their annual renewable quantity is almost (4.3-5.243 billion m3) and increases or decreases depending on the amount of rainfall. Their quality and salinity change according to their source of nutrition, being generally carbonic and fresh within Iraq's northern and northeastern regions, "Sulphuric" with weak and medium salinity in the eastern and western parts and turns into chloride water with high salinity within the central and southern parts of easy sedimentary.

The marshland areas, which decreased from 15000 - 20000 km2 to fewer than 2,000 km2 of the Central Marshlands, the Hummar Marshland, and Al-Hawiza, shrank by 97%, 94%, and 66%, respectively, and they transformed into dry land with the migration of the majority of the inhabitants of the marshland. The dehydration process coincided with a sharp decline in the water levels of the Tigris and Euphrates rivers following the construction of the dams in Syria, Turkey, and Iran. The drying of the marshes contributed to changing climate conditions as the average temperatures over the 10 years before drying were (23.9) °C and were (25.17) °C in the 1990s; the high temperature were also (31.6) °C and (33.2) °C, and the amount of humidity was 61% and became 41%. According to the year (2020)'s data, the rate of immersion falls between (75-82%).

The data shows that both Nineveh and Salahuddin governorates registered the highest acceptable rate in the turbidity test, salinity, and bacteriological and residual chlorine tests at (100%) during (2017 and 2021), while data shows that Thi-Qar governorate registered the lowest acceptable salinity level at (20%) and (4.1%) during (2017 and 2021). Basra Governorate registered the lowest acceptable percentage of salinity (11.08% and 2.6%) during the years (2017 and 2021), respectively.

There was also a 22.2% increase in the number of central medium and small-size treatment plants and units in the sewage services sector, compared to 2017 and 202. There was a 34.4% increase in treated wastewater and a 1.73% decrease in the sewage servers service recipients (wastewater and shared) and an 11.52% and 5.3% increase in service recipients of the independent treatment system (ground tank) and the percentage of rainwater networks recipients, respectively.

This indicates that most of Iraq's human populations lack basic sanitation systems and 61% of the village inhabitants deliberately used areas nearby their homes to drain directly. Since more than one-third of villages use water untreated directly from the river or marshland, the current sanitation situation raises serious public health concerns as water-borne diseases risks and the provision of wastewater treatment services is of the utmost importance. In the cities of the Kurdistan region, there are no sewage treatment plants yet.

Four strategic goals will be achieved in this sector:

Strategic Goal (1): To reduce water pollution and ensure the sustainable management of water resources to maintain their sustainability and to promote sanitation for all in Iraq.

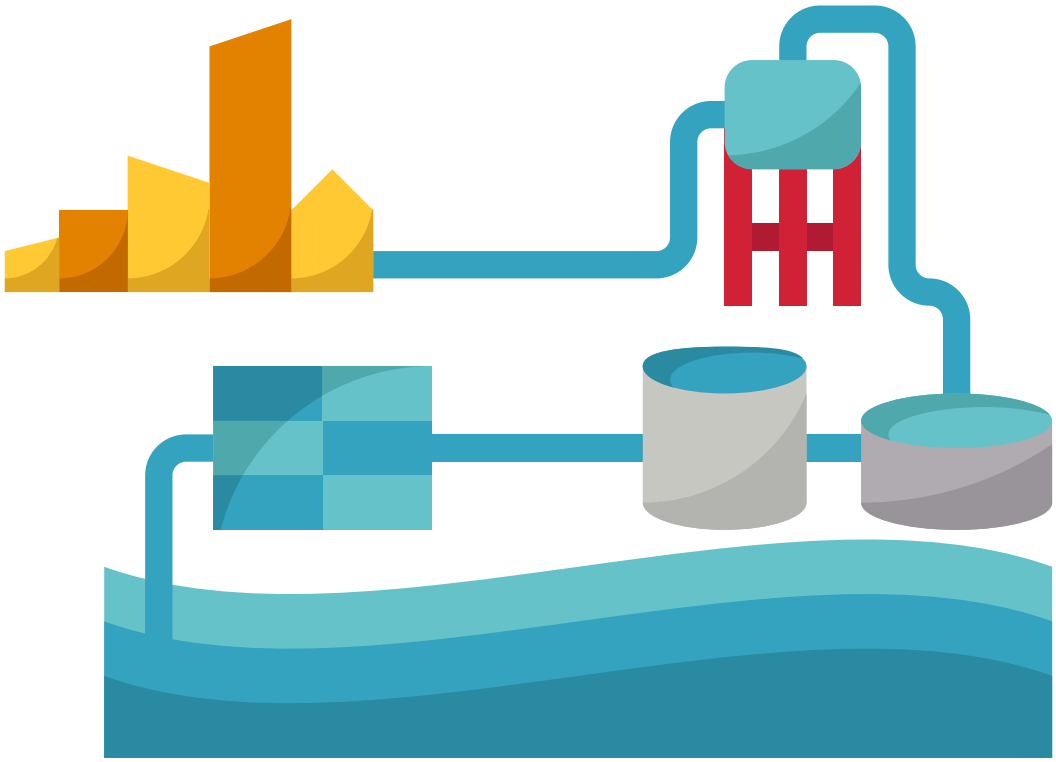
Strategic Goal (2): Reduce water loss and increase water efficiency in all sectors and ensure sustainable withdrawal and supply of freshwater to address water scarcity, and greatly reduce the number of people who face water scarcity.

Strategic Goal (3): Enhance water demand and water supply management.

Strategic Goal (4): Provide new non- conventional water resources.

The proposed programs for the Water Resources and Water Security Sector

- Establishment of a financing facility/mechanism for the rainwater harvesting project.
- Implementation of new central water projects to improve water supply.
- Operationalizing the system of incentives, law enforcement, and mitigation measures against violators of water sources, as well as the water networks operating to prevent contamination from citizens and other sectors.
- Rehabilitation and regulation of water systems through using main velometers and locks, as well as linking all participants systematically (household meters) and pursuing the electronic automation system project in the water sector.
- Developing awareness programs for efficient use of potable water (reducing consumption) and, thus, reducing water loss.
- Implementation of "Baghdad governorate water supplies improvement" project.
- Improving irrigation efficiency programs.
- Encouraging and supporting farmers to use modern irrigation methods and activating the roles of water users' associations.
- Establishing industrial wastewater treatment plants.
- Enhancing energy efficiency in well fields and pumping stations.
- Improving decentralized water supplies and sanitation solutions at the governorates level.
- Conducting feasibility studies to rehabilitate rainwater drainage systems.
- Improving the surface and groundwater quality
- Desalination of seawater through renewable energy sources.
- Improved infrastructure for municipal and agricultural water transmission and distribution networks.
- Sustainable use and reduction of over-pumping of groundwater.
- Continuous assessment and strict monitoring of water emerging from wastewater treatment plants towards water sources.



Coastal and Marine Ecosystems Sector

Facts and Figures

The Arabian Gulf is Iraq's only port in the world, as Iraq's sea coast reaches a length of about 58 kilometers and the port of Umm Qasr in Basra is one of the most important Iraqi ports overlooking the Gulf. Coral reefs exist in Iraqi coastal waters covering an area of 28 square kilometers in the Arabian Gulf in the Shatt Al-Arab estuary. Coral reefs are important and indicative of adaptation to one of the world's harshest coral reef environments, with seawater temperatures in this region ranging from 14 to 34 degrees Celsius. The coral reefs also encompass many living stone reefs, eight corals, opiooroids and the two-shelled ones.

The production of fish from inland waters in 2017 is about 28,900 tons, having sharply declined from 53,460 tons in 2013. While it reached about 6,300 tons in 2017 in sea water. The main fishing gear used for fishing are gill nets, traps, and trawls operating with 332 estimated fishing vessels in 2017, as well as 6,500 small indoor boats. Total employment in the sector in 2017 was 1, 521 people in the domestic sector with an additional reported 832 people for coastal marine fishing. Regarding aquaculture, has been active in Iraq since the 1970s and started in fresh water on a limited scale, with the expansion and semi-intensive production in the ground basins and, according to recent statistics from the State Authority for Fisheries Resources Development, aquaculture production has increased in recent years, from 14,000 tons in 2004 to a record 31, 800 tons in 2017. Ostensible fish consumption was estimated at 2.6 kg/person in 2016 and imports of fish in 2017 and fish products were estimated at $148 million and exports at $80,000.

Two Strategic Goals will be achieved in this sector, and they are:

Strategic Goal (1): Protect coastal and marine ecosystems and promote habitat and species recovery.

Strategic Goal (2): Develop an integrated coastal area management approach participatively with all stakeholders.

The proposed programs for the Coastal Ecosystems Sector

- Implementing monitoring programs to monitor the marine ecosystems and operationalize control and law enforcement tools.
- Implementation and development of a comprehensive strategy for integrated coastal area management.
- Developing legislation and regulations that respond and align with integrated coastal area management principles.
- Developing marine biofouling mitigation strategy.
- Establishing and developing a marine reserve within the nature reserve network.

Agricultural and Food Security Sector

Facts and Figures

The agricultural sector employs approximately 18.7% of Iraq's workforce and women comprise 23.3%. It is considered the second largest contributor-- at 5%-- to domestic output after oil. It is one of the most water-consuming sectors, consuming approximately 30 billion m3/year by 75-80% of Iraq's water resources. The decline in water resources would result in the loss of much land area, causing heavy losses, as well as the increasing percentage of the unemployed due to the interruption of many agricultural projects, resulting in high poverty rates. The use of unlined, open, and old irrigation channels, not upgrading the infrastructure, and using old irrigation techniques have also only increased the Earth's water levels, waterlogging, and soil salinization.

Agriculturally productive land comprises approximately (23.4 million Dunums), but the area currently under cultivation is estimated at almost (13 million Dunums). Crop production is considered the main source of income for the majority of farmers (about 75%), while the remaining farmers depend on livestock or mixed crop and livestock production systems. There was a 42% reduction in the arable land area for the period between 2017 and 2020, with a 1.7% increase in desert land and 0.53% increase in land threatened by desertification, while the area of demic land comprises the largest area with 6.7 million Dunums, which irrigated land followed-- (5.0) million dunums-- and the land using wells at (2.8) million Dunums.

The number of insecticides used in 2016 reached (133.437.482 litrs) in 2016 of liquid substances and (14.792.3755 kg) of solids and fungicides, (8.252.945 litres) for liquid materials, and (1.584.121.46 kg) for solids. The quantity of insecticides was (4.872.29065 litres) for liquid substances and (186.156 kg for solid materials) and these numbers exclude Nineveh, Salahuddin, and Anbar governorates because of lack of data due to poor security conditions. Fertilizer use in the governorates for the year 2016 reached 35,830.6996 tons of Urea fertilizer and 2.181,575.66 tons of composted fertilizer. As for the exorbitant use of fertilizers and pesticides, large quantities of chemical fertilizers and salts are discharged into rivers through irrigation or rainwater, where direct agricultural drainage in rivers increases the concentration of nitrates, phosphates, and heavy metals. Therefore, the system of agricultural drainage systems would preserve the fresh river environment from pollution.

Two Strategic Goals will be achieved in this sector, and they are:

Strategic Goal (1): Promote the pattern of environmentally friendly and climate-resistant agriculture to ensure the reduced use of pesticides and chemical fertilizers to protect environmental components.

Strategic Goal (2): Protect and restore pastoral spaces and increase green speaces to ensure sustainable use of biodiversity and achieving food security.

Proposed programs for Agriculture and Food Security

- Developing a strategy and action plan for improving the agricultural sector's market (rationalization and orientation of domestic consumption, exports, and imports).
- Enhance and increase the packing, storage, and cooling infrastructure for fruits and vegetables that the private sector manages.
- Strengthening organic agriculture through sharing knowledge and market development.
- Conducting agricultural research to improve the suitability of innovation efforts in the agriculture sector.
- The development and implementation of a national afforestation programme in Iraq that comports with nature-based solutions and adaptation-based ecosystems.
- Supporting rural green growth and employment through ecosystem restoration.
- Promote flexible crop planning, a comprehensive crop selection methodology and decision-making process based on appropriate concepts of soil, water, and economic competitiveness.
- Increased use of hydroponics and environmentally friendly agriculture in urban and rural areas.
- Assess the national and market feasibility of utilizing the agricultural sector's biological waste as resource potential.
- Design and implementation of capacity-building programme in agriculture and forestry.
- Strengthening the agricultural sector against the negative effects of climate change.
- Adopting and spreading tissue agriculture for different fruit trees and crops and its importance in palm propagation.
- Using modern technology in early warning and predictive climate scenarios to enhance the resilience and sustainability of the agricultural sector
- Building an agricultural database that matches the requirements of international support mechanisms.
- Supporting innovation and creativity with awards in the fields of green development and green economy.
- Inspection visits to work sites to evaluate the work environment (including the private sector).
- Recording statistics on work injuries and occupational diseases.

Health Environment Sector

Facts and Figures

The healthcare sector generates an average of 331 tons/month of hazardous medical waste in Iraq. The sector has generally adopted the separation of medical waste from non-medical waste--but 57% of healthcare institutions only partially separate waste. The sector generally processes medical waste by autoclave, which is currently used in all health services, not to mention one incinerator for each 250 kg/hour. It is worth noting that the percentage of incinerators in hospitals is limited (54%) while the presence of cutting devices with high pressure is estimated at (18%); according to data from the Ministry of Health, the percentage of treated solid waste is estimated to be 100%.

In addition, governmental hospitals use shredding and cutting machines or through medical incinerators. Private hospitals and other health institutions transfer their medical waste to the nearest government hospital that owns the above incinerators so they can dispose of it if they cannot do so themselves. The Kurdistan region generates 63 tons/month of healthcare waste and, on the level of healthcare organizations, the environmental statistics for 2020 estimate the number of organizations with chemicals, vaccines, and expired medicines at (169) health organizations and at (11.7%) of the total number of healthcare organizations in Iraq.

One strategic goal will be achieved in this sector:

Strategic goal (1): To protect the environment, preserve public health from pollution of all kinds, and prevent diseases that affect humans, animals, plants, and food safety.

The proposed programs for the Health Environment Sector

- Develop a national database of health damages arising from pollution.
- Encourage and stimulate scientific research to assess the relationship between environmental pollution and public health.
- Develop a national strategy to integrate environmental health considerations into the Ministry of Health's public health programmes.
- Develop a strategic plan for integrating green building concepts into the infrastructure.
- Developing green spaces in ways that are compatible with national considerations.
- Develop programmes to address and adapt to diseases resulting from the negative effects of climate change.
- Preparing and implementing the National Strategy for Disaster Risk Reduction.
- Conducting periodic professional examinations (medical and laboratory) for employees.
- Recording statistics on work injuries and occupational diseases.

Industrial and Oil & Gas Production Sector

Facts and Figures

Statistics indicate that the number of industrial facilities in the public and other sectors increased by 3.9% compared to between 2017 and 2020, reflecting an increase in the amount of hazardous and non-hazardous waste of 100% and 117.9%, respectively. The number of large industrial enterprises operating in 2020 was 719, which is divided into extractive industries (excluding oil) and manufacturing industries, which accounted for 50%; this is followed by the food products industry at 30%, while the rest of the industrial activities were limited to 20%. Engineering sector companies and factories comprised the largest number in 2020, 15 companies and 77 laboratories, while discontinued factories accounted for 31.1% of the total number of labs. Comparing the number of enterprises operating for the year 2020 with the year 2019 of 670, the number of enterprises increased by 7.3% due to the growth of private activity in the manufacturing sector and in all governorates.

Available data indicate that the industrial sector greatly contributes to air pollution while noting the absence of data on air pollutants that result from industrial operations due to the absence of equipment to measure air pollutants. Available information shows that several industries contribute to air emissions, such as cement factories, where their number (except in the Kurdistan region) in the year (2017) reached 19 factories. Data also indicate that there are 58 dust deposits in these factories. Most cement factories have been constructed without an environmental impact assessment study, and all cement factories dump cement dust that is deposited from ovens in unorganized landfill sites. While in the Kurdistan region, all cement factories have had environmental impact assessment reports. In (2017), (673) brick factories were distributed in Baghdad and the governorates. Available data indicate that 78% of the factories contain automated burning systems and mechanisms for monitoring environmental performance, as 66 legal procedures have been issued against brick factories that violate environmental requirements. The asphalt factories numbered almost 350 in 2017. Available data for the year 2017 indicate that 33% of these factories do not carry methods of controlling gas emissions such as dust deposits and that 9 legal measures were taken in the same year against the asphalt factories that violate environmental requirements. The data shows that there is 282 food industry factories in 2017, noting that a large number of them do not have environmental approvals and 96 legal actions were taken against factories that violate environmental requirements.

Companies and factories belongs to the Ministry of Industry consume about 119.3 thousand cubic meters of water per day and 39.7 thousand cubic meters are discharged to water sources. It is worth noting that the chemical and petrochemical sector consumes 48.8% of the water used. The discharge of liquid residues from industrial activities in various sectors pollutes the environment, especially when the necessary treatments are not made to reduce the pollutants. Data available from 2020 indicate that 49.3% of industrial sector companies and factories rely on liquefied water as the main source of water, followed by the Tigris River at 29.5% and the Euphrates at 11.6% and 35.1% do not use water or stop working. Figures for the year 2020 indicate that slaughterhouses consume about 155 thousand m3 of water annually, as 82% of this water is processed from the public network, 9% from tanks and 8% from groundwater. Data also indicate that most of the water consumed in the slaughterhouses is disposed of as wastewater, with about 145 thousand cubic meters per year of wastewater from the slaughterhouses in 2020. They are disposed of in sewage or processing units. The data also indicate that 40% of these industries rely on the wastewater drainage system while, 24.5% collect this water in specific locations, while 51.1% of these industries do not dispose of any water.

As for the disposal of non-hazardous waste, reuse is the most frequent method, while available data indicate that the amount of hazardous industrial waste produced in 2020 was 2.5 tons per day and that the engineering sector produced most of this waste-- at 68% of the total waste. Data also indicate that transferring hazardous industrial waste to other

sites is one of the most applied methods. As for oil production, Iraq has the fifth largest oil reserves in the world and the tenth largest gas reserves. In view of the increasing global demand for crude oil and Iraq's need for the financial resources on which it relies to implement development plans, there is an increase in the quantity of crude oil produced or exported when comparing 2017-2020 and the increase in production and export would constitute increasing pressure on the components of the Iraqi environment. The movement towards increasing gas production to generate more profitable exports and generate power would be the basis for the transition towards gas exploitation instead of oil. Data also indicate that the investment in the amount of natural gas increased from 44% in (2017) to (52%) in the year (2020).

As for the refinery sector, total refining capacity rose from 187 million barrels in 2017 to 200 million barrels in 2020. Petroleum reservoirs contain water, which is drawn off during the production process and is one of the largest liquid residues in volume containing a mixture of organic and inorganic pollutants, as well as residual chemical additives used in the drilling process, which can contain quantities of petroleum material ranging from 500-2000 ppm.

Solid waste constitutes the largest volume of waste from oil industry activities, and rock cover represents an important part of this waste, and other waste includes drilling mud and rock crushers. This waste that the oil sector generates is one of the most dangerous solid pollutants as it contains heavy hydrocarbons, such as aromatics and heavy metals. Then, the release of these materials into the environment greatly contaminates it. Solid oil pollutants can be divided into residues of operations that refine solid oil, residues of heavy petroleum materials that result from oil derivatives processing units, slime, and underdeveloped plumes of industrial water treatment units, and sediments gathered in reservoirs, most of which comprise of heavy petroleum materials, as well as sand used in filtration operations, drilling rigs, and empty and damaged barrels of some kinds of enhancers and chemicals, indicating that solid pollutants that refining processes are estimated at about (2-3 kg) per ton of crude oil. The toxicity of these residues is up to 80%. The amount of gases that are burned in oil sites throughout Iraq is a direct cause of the high proportion of gases emitted in or near the oil site.

Two Strategic Goals will be achieved in this sector, and they are:

Strategic Goal (1): Promote the efficient use of resources by integra environmentally-friendly and modern technologies into production and promoting environmental consideration into the sector.

Strategic Goal (2): To enhance awareness and the capacity to improve the understanding, management, enhance/promote reuse, recycling, replacement, protection, and resource values

The proposed programs for the Industrial, Oil and Gas Production Sector

- Developing support mechanisms to encourage creativity, innovation and scientific research on green production and environmentally-friendly industries
- Enhance waste management within the circular economy concept, in particular industrial waste management and application of recycling principles.
- Development of a national strategy to increase water efficiency and access to treated wastewater in the industrial sector.
- Development of a national strategy to increase energy efficiency and movement towards clean energy in the industrial sector
- Develop a national strategy to reduce the environmental threats posed by the oil and gas sector and integrate societal and environmental responsibility considerations within it as the principle of Extended Producer Responsibility.
- Developing environmental monitoring programs in the industrial and oil and gas sectors.

Chemicals and Hazardous Waste Sector

Facts and Figures

The Ministry of Environment's 2020 inventory estimates hazardous waste at 2547 tons: 39% from the agriculture sector, 26% from the industrial sector, 23% from the oil sector, and 9% from healthcare waste. Additional hazardous wastes encompass imported/used products such as automobile parts, used tyres, leather, used electric devices and electronic appliances, and used household equipment, which constitute a greater burden-- in addition to the domestic burdens-- and are prohibited under import controls for used materials and international agreements.

Farmers' lack of awareness and weak controls by the responsible authorities led to the exorbitant use of fertilizers and pesticides in agricultural activities. Farmers can easily purchase fertilizers and pesticides from local markets without restrictions, resulting in high consumption rates, and exorbitant use of agrochemicals leads to an accumulation of non-biodegradable chemicals in the soil. In 2019, Iraq's pesticide consumption rate (excluding the Kurdistan region) was estimated at 428 thousand kilograms and 238 thousand liters of insecticides, while fertilizer consumption was approximately 490 thousand tons. There are also 55 government-owned pesticide storage units, which store containers and expired materials, of which 74% do not comply with regular storage specifications. At the same time, 258 private storage units exist, of which 93% do not comply with storage specifications. Improper storage of agricultural chemicals in warehouses causes damage to the containers or causes products to expire. Accordingly, damaged and expired containers are usually destroyed or buried, which leads to frequent spillages that contaminate the soil, as well as increasing the risk of fire.

The major challenge that faces Iraq in waste disposal is in the hazardous wastes of both solid and liquid streams, as production of such wastes increases due to increased activities, particularly in the oil production sector, while noting the absence of a hazardous waste landfill in Iraq as the amount of raised hazardous wastes raised is estimated at (1191.7) and (1053) tons per year during the years (2017) and (2020) respectively.

Available data indicate that the quantity of hazardous industrial wastes produced in 2020 was 2.5 tons per day and that the engineering sector produces most of these wastes at 68% of the total of such wastes. Data also indicate that transferring hazardous industrial wastes to other sites is one of the most applied methods.

Two Strategic Goals will be achieved in this sector:

Strategic Goal (1): Implement and activating integrated hazardous chemicals management plan.

Strategic Goal (2): Implement and activating integrated hazardous waste management plan.

The proposed programs for the Chemicals and Hazardous Waste Sector

- Developing a capacity-building and awareness strategy for the chemicals and hazardous waste sector.
- Implementing and developing policies and legislation to address the effects of chemicals and hazardous waste on the environment and society.
- Developing strategic environmental assessment and licensing policies.
- Developing and implementing legislation that governs handling hazardous chemical substances and wastes.
- Development of the necessary infrastructure for treating and safely disposing of hazardous wastes.
- Conducting periodic professional examinations (medical and laboratory) for employees.
- Recording statistics on work injuries and occupational diseases.

Energy and Transportation Sector

Facts and Figures

The past years have witnessed a great development in road networks that connect regions or towns and villages, which led to double their previous size, and other transportation sectors such as air transport (airports and aircraft), road transport (railroads and trucks) public transportation (buses and public fare) has also witnessed rapid acceleration in government investments. The data cited in Iraq's State of the Environment Report for 2017 indicate that the transportation sector accounts for 40-50% of outstanding minute emissions and 80% of carbon monoxide emissions which are an element of air pollution.

Road Transport Statistics Reports for 2016-2020 indicate that the percentage of buses operating to transport passengers was 53.6%, 38.3%, 32.9%, 35.3%, and 70.4% of the total number of buses available at the state company for transporting passengers for the years 2016 – 2020, respectively. The percentage of trucks operating for the public transportation of goods reached 74.8%, 72.8%, 82%, 78.7% and 75% of the total number of trucks available by the state company for road transportation for the years 2016-2020, respectively. In the government transportation sector, the total number of vehicles (cars and motorcycles) in the government sector in Iraq for the year 2019 was 9137,371 vehicles, which witnessed a 5% increase over the year (2018), as the total number of vehicles reached (130,775) vehicles. The total number of private sector cars in the Kurdistan region (7,026,106) in 2020 was 0.2%, according to private sector car reports for the years 2016-2020. Railway statistics report for the years 2017-2020 shows the total number of diesel trailers reached 375 trailers with a 12% operation rate/ratio for 2017 and 11% for the years 2018-2020. The total number of Chinese trailers was 120 for the years 2017-2020 with operational rates of 91-100%

On the other hand, the number of planes operating in Iraqi airports reached 32 for the years 2017-2020. The total number of flights landing and departing in Iraqi airports for the different Iraqi, Arab, and foreign airlines for the year 2020 was 43,367. The flights saw a noticeable drop of 43% compared to previous years as a result of the restrictions the coronavirus pandemic imposed. Iraq's Water Transport Statistics Reports 2016-2020 show the number of vessels for cargo carriage from Iraqi ports reached 2,868 for 2020, up from 2019 in the number of vessels coming from Iraqi ports, amounting to 2,060 for 2020 and 1,836 for 2019. In contrast, the number of vessels departing from Iraqi ports decreased from 2019, reaching 808 for 2020 and 1,284 for 2019. As for the State Shipping Company, the company owned eight operational vessels for the years 2016-2019, while the number of vessels was seven for the year 2020.

Looking at the energy sector, the number of power plants, excluding those in the Kurdistan region, increased by 6% between the years of 2017 and 2020. The increase in the per capita share of energy other than the Kurdistan region is estimated at 453.8 kWatts per hour, noting a decrease in the per capita electricity sold (Mega Watt). Hour/year) 2.34%. The reason for this decrease in the per capita energy processed is the violations and illegal connection to and the lack of application of mitigation measures. Gas plants play the greatest role in electricity production, with 37 gas plants producing approximately 40.8% of the total electricity output. At the same time, 12 diesel stations had the lowest production rate for the same year, contributing about 0.5% of total electricity production.

Iraq's energy sector witnessed a noticeable improvement in electricity production between the years 2014-2019, as the annual rate of increase in electric power production was approximately 4,000,000 m. and that production increased from 67,767,995 Megawatts in 2014 to 85,508,046 Megawatts in 2017 to become 87, 899, 993 Megawatts in 2019. To guarantee full electricity coverage, Iraq's annual electricity import rate between the years 2014 and 2017 was approximately 12,000,000 megawatts-- however, this value increased in 2018 and 2019 to approximately 22,000,000 and 35,000,00 Megawatts, respectively. The percentage of lost electricity produced comprised approximately 61.3% of the net output in 2019,

equivalent to 53,882,695 megawatts, of which technical loss did not exceed 22% only of the net energy processed. The residual value of 39.3% represented administrative loss that did not have a negative effect compared to environmental technical loss. The data also show that total electricity consumption for each of the household, commercial, government, agricultural and industrial sectors was about 42,088,620 Megawatts for the year 2019, which witnessed a 6% rise over 2018 consumption value of 39,593,993 megawatts.

Realizing the Ministry of Electricity's awareness of the danger of being affected by climate change, it was planned to move towards using renewable energy projects, as contracts were made with reputable companies in this field to implement these projects to produce electrical energy using solar cell technologies to reach 12 kilowatts during the year 2023.

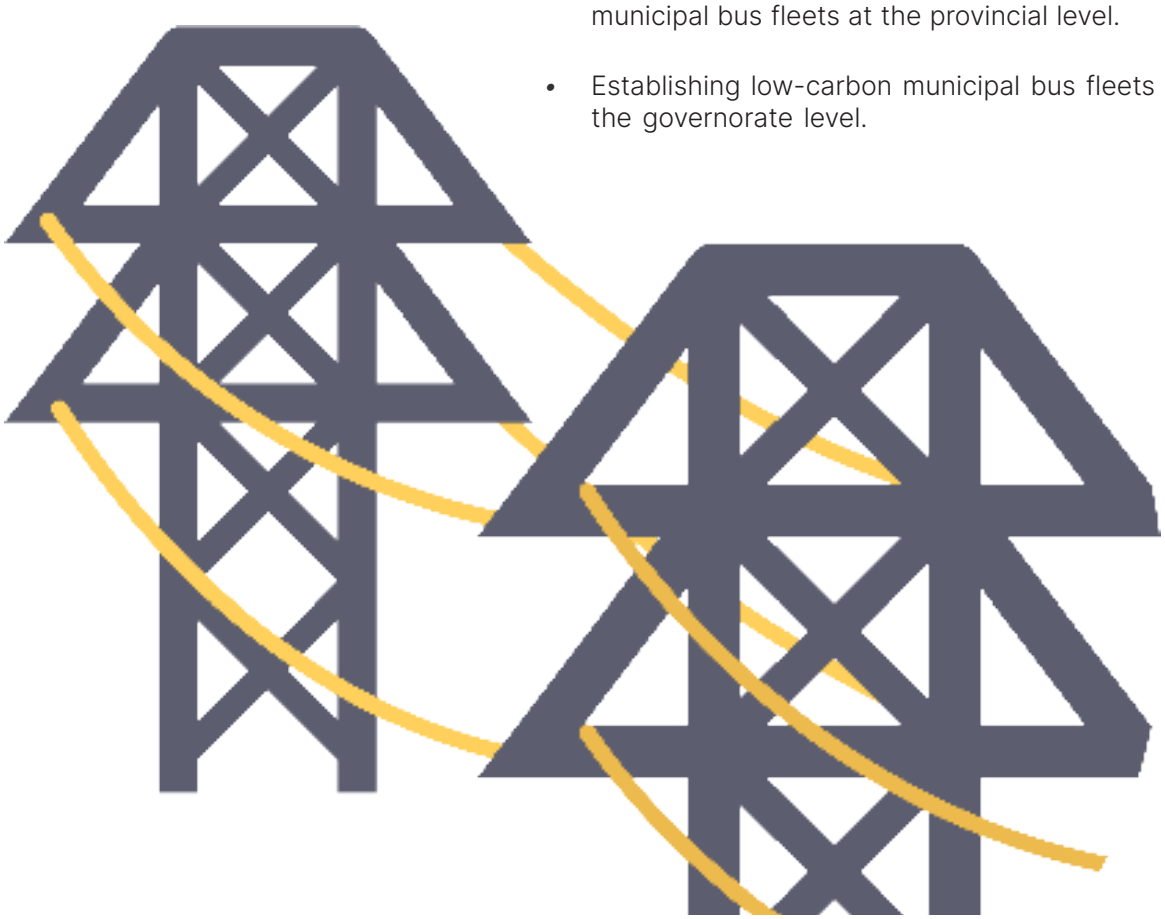
Iraq contributed about 72,658 gigagrams equivalent of Carbon Dioxide in 1997, which is the baseline year, to the atmosphere greenhouse gases, of which the energy sector is the largest percentage as the emissions from the energy sector comprised about 75% of the total emissions, the equivalent of 54,419 gigagrams equivalent. Operating processes generate both types of residues, liquid and solid. Solid residues include iron residues, colored metals, and empty barrels estimated in 2021 at 13,739 tons of scrapes.... etc. Moreover, industrial wastewater from power sector installations increased by 2.9% between the years of 2018 and 2021.

One Strategic Goal will be achieved:

Strategic Goal (1): Invest in Infrastructure and innovation in such a way that ensures the application, improvement, and innovation of clean technologies for mitigate the impacts of climate change.

The proposed programs for the Energy and Transportation Sector

- Improve energy demand management through the development of a smart power grid.
- Development of the renewable energy roadmap and investment plan.
- Enhance and adjust power infrastructure in public buildings.
- Adopt the concept of international environmental certificates in different sectors and buildings.
- Developing necessary legislation to shift towards electric transport.
- Implementing electric vehicle charging stations and services through a public-private partnership.
- Increase public investment research and development in the energy sector.
- Improving the enabling and legislative environment and supporting capacity development for the growth of the energy services market.
- Implementation of the energy sector monitoring, reporting and verification system.
- Adopt and operationalize the National Public Transport Fund and identify mechanisms to increase the capital for public transport infrastructure.
- Development of public-school bus services in all governorates.
- Implement programs to improve pedestrian green infrastructure in local commercial areas and near public transport.
- Support deploying smart transport systems (ITS) to allow ideal integration and fare for public transport systems.
- Develop a public-private strategy and road map to improve the environmental sustainability of the sector's logistics. Establishment of low-carbon municipal bus fleets at the provincial level.
- Establishing low-carbon municipal bus fleets at the governorate level.



Climate Change Program

Five goals will be pursued under this program

Strategic Goal (1): Mitigate greenhouse gas emissions from the different sectors to achieve low-carbon economic development and transformation towards sustainable technologies.

Strategic Goal (2): Assess the vulnerabilities and vulnerable areas and identify national and international adaptation actions.

Strategic Goal (3): Provide funding for implementing mitigation and adaptation programs that support Iraq's ambition to reduce emissions, address climate change's negative impacts, and achieve nationally determined contributions.

Strategic Goal (4): Capacity-building related to the framework convention on climate change, associated conferences, climate negotiations, Paris Convention, and carbon markets.

Strategic Goal (5): Reduce the risk of natural disasters resulting from the impacts of climate change and establish monitoring and early warning systems for natural disasters.

Partnerships Strengthening Program

Two Strategic Goals will be achieved in this program.

Strategic Goal (1): Develop partnership opportunities at the national, regional, and international levels in such a way that achieves Iraq's Vision 2030.

Strategic Goal (2): Promot green job opportunities suitable for the informal sector in waste management through multiple legislative and technical tools.

Environmental Education Dissemination Program

Strategic Goal (1): Disseminate the strategy in a way that guarantees that it reaches all stakeholders, local communities, and the public to induce social support for the efficient implementation of the strategy.

Proposed programs: Awareness in the field of risk management in the work environment for chemicals and hazardous waste, Awareness in the field of safe handling of fertilizers, Health Awareness, Implementing safety requirements for workers.

Environmental Governance Progam

Two Strategic Goals will be achieved in this program:

Strategic Goal (1): Institutional development for the Ministry of Environment to reach the ambitious goals and lead the next phase in environmental protection.

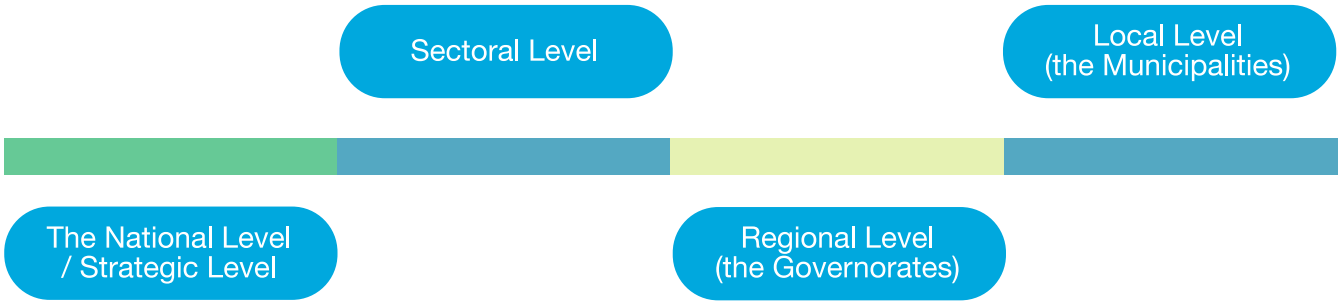
Strategic Goal (2): Participate actively in formulating environmental policies and legal frameworks to ensure rational governance and transparent management.

Proposed programs: The national policy to support and include occupational health and safety in all sectors, Legislating a special law for occupational health and safety that includes all social groups of workers in various sectors.

Part Four: Strategy Implementation

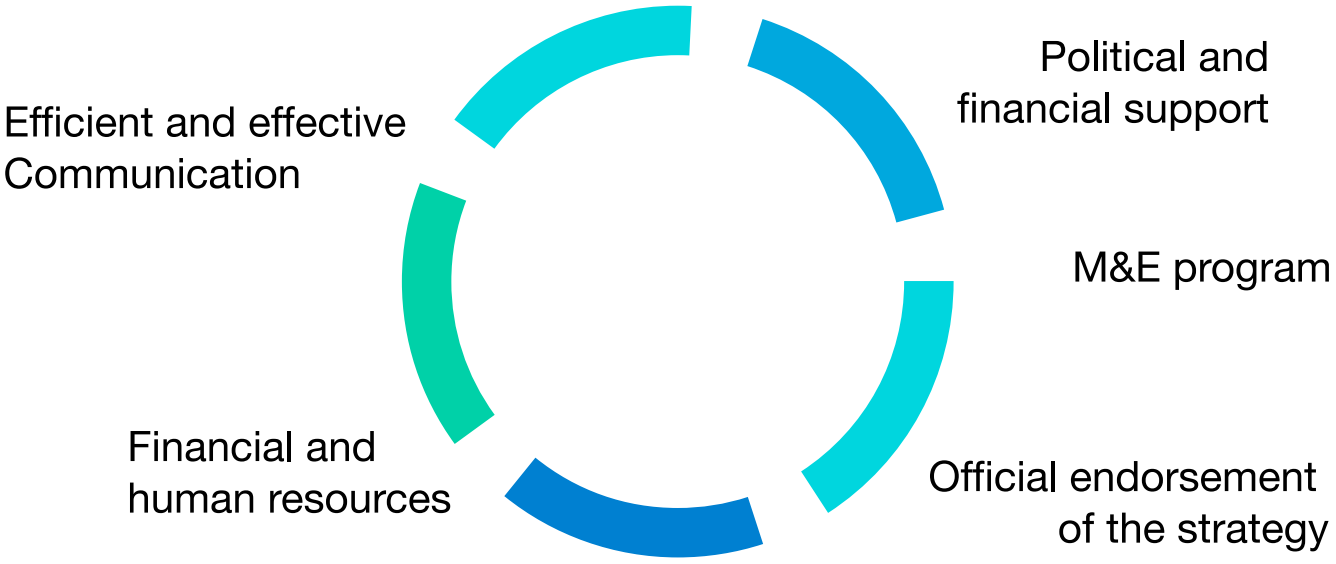
4

The Ministry of Environment is the main body that implements and responsible for organizing and implementing this strategy. The Ministry of Environment must follow up on the implementation and submit implementation reports periodically to official bodies. Ministry of Environment must form a ministerial committee that comprises representatives from all the concerned sectors in the strategy. This committee is responsible for overseeing and coordinating the strategy implementation. Sectoral ministries, ministerial bodies, and governorate committees must implement, within their specialty, the Strategy's goals, contents, and solutions in coordination with the Ministry of the Environment.



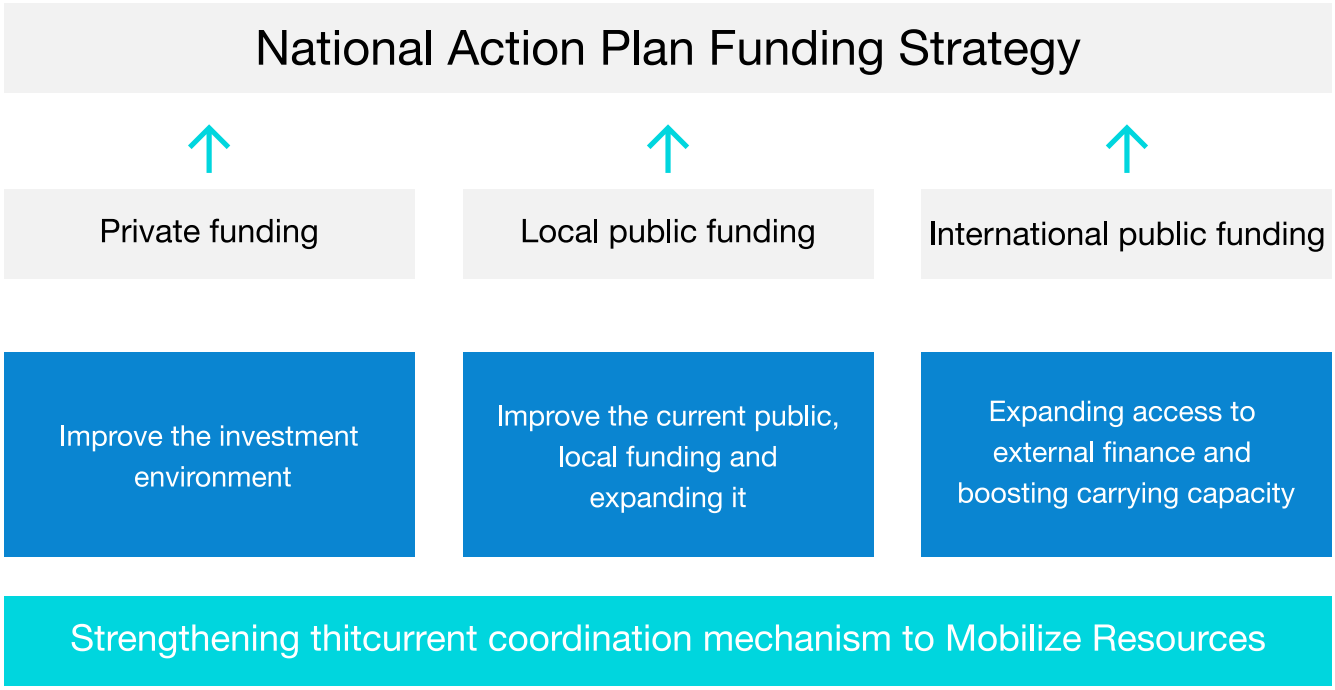
The Ministry of Environment should coordinate with donors and international organizations to align and integrate international support for implementing the strategy's goals. Civil society and other organizations must also join the environmental protection efforts, in line with the strategy's goals, and oversee the environmental protection activities that the different stakeholders (state, companies, and individuals) are implementing. For the successful implementation of this strategy, a number of factors must exist, which are illustrated in Figure 3.

Figure 2: Success factors for the strategy implementation



Funding and Sustainability

The funding strategy for Iraq's National Action Plan is structured around the following pillars.



The following funding sources can be beneficial for the strategy implementation:

A. General budget: Allocate a dedicated budget for implementing this strategy upon approval by the Prime Minister's Office. This allocated budget will be utilized within the budgets of the Ministry of Environment and other ministries responsible for carrying out the strategy.

B. External aid (grants and loans), international financing, and benefitting from international funds, such as the Green Climate Fund, the Adaptation Fund, and others.

C. Public-private partnership projects.

D. Participatory engagement with civil society organizations and guiding their programs towards achieving the ambitious objectives as a priority.

Monitoring and Evaluation

The monitoring and evaluation process (M&E) aims to provide continuous feedback on how the action plans associated with the proposed programs and objectives of the strategy are achieved and track the progress of the desired results, whether from government and private sector institutions or local and international partners. The monitoring and evaluation process is also important as it identifies potential early-stage challenges and suggests ways to resolve them. It also contributes to efficiently tracking the implementation of objectives and targets and proposes necessary improvements. Finally, it supports assessing the efficacy of the strategy and achieving the envisaged results and their effect on the protection and improvement of the environment.

The M&E methodology encompasses a number of steps summarized in the following:

- The Ministry of Environment shall coordinate with the different sectoral bodies to identify the body/entity (focal points) that shall be responsible for overseeing the collection and updating of the required information related to the strategic objectives.

- To develop an electronic verification and assessment system (Monitoring and Evaluation System) centered at the Ministry of Environment. This system will incorporate a set of measurement indicators and will involve data input from sectoral authorities and all partners based on their respective roles. This arrangement will empower the Planning and Monitoring Department of the Ministry of Environment to take a prominent role in monitoring and overseeing the process, culminating in the preparation of periodic reports to assess progress in achieving the goals and their impact on preserving and enhancing the environment in Iraq.

- The monitoring process shall occur throughout the implementation phase of the strategy, aiming to enhance its overall structure and execution. This involves collecting fundamental data to answer questions related to progress, constraints, and challenges that may impede the plan's successful implementation. The relevant are responsible for periodic and regular data collection, which may involve reports or meetings.

- Ministries carry out the evaluation process by assessing the programs and projects that have been completed and implemented. This evaluation is based on measurement indicators at either the sectoral level or the level of strategic objectives and their associated targets.

- The purpose of the evaluation process is to derive insights and propose enhancements to the overall strategy. This iterative approach allows for adjusting objectives and targets during the strategy's implementation phases every two years, contributing to realizing the adopted vision and mission.

Performance Indicators on the Strategic Goals Level

Environmental Protection and Improvement and Sustainability Program

Waste Sector

Indicators	Baseline Values	Road Map		
		Cumulative target with the baseline value		
		2025	2027	2030
(%) Safe disposal of waste and reduction of pollution.	Baghdad municipality 30%	15%	40%	100%
	Municipalities 10%	15%	25%	40%
Percentage (%) of reduction in household waste generation per capita.	Baghdad municipality (0%)	1.20%	1.80%	3%
	Municipalities (1%)	2	4	6
Percentage (%) of increase in waste collection rate.	Baghdad municipality (85%)	87%	92%	95%
	Municipalities (55%)	65%	75%	85%
Number of sanitary landfills constructed	Baghdad municipality (0)	1	2	2
	Municipalities (2)	4	8	12
Number of recyclable material recovery facilities established	Baghdad municipality (2)	1	1	0
	Municipalities (2)	3	4	5
Percentage (%) of recyclable materials and recycled use	Baghdad municipality (0)	0	40%	40%
	Municipalities (0.5%)	1.5%	2.5%	4%
Number of waste treatment plants and energy recovery facilities	Baghdad municipality (0)	0	1	2
	Municipalities (0)	0	1	2

Ecosystems and Biodiversity Sectors

Indicators	Baseline Values	Road Map		
		cumulative target with the baseline value		
		2025	2027	2030
Percentage (%) of natural habitat included in Iraq's natural reserves network.	1.50%	-	-	5%
Number of natural reserves established and declared in Iraq	1	2	3	4
Number of investment opportunities implemented in the field of natural reserves	0	0	1	2
Percentage (%) of updated biodiversity database and ecosystems in Iraq	50%	--	---	100%
Establish a database for invasive and alien species in Iraq	0	0	0	1
Percentage (%) of decreased in hunting violations	0%	10%	15%	20%
Percentage (%) of locally endangered species for which protective measures have been implemented	15%	0	0	25%
Percentage (%) of monitoring and assessment of contaminants in Iraqi marsh waters	0	15%	30%	45%
Percentage (%) of development and readiness of the laboratories to conduct research on genetic mutation and its products	50%	0	75%	100%
Number of natural reserves nominated for declaration on World Heritage lists	0	0	1	2
Percentage (%) of utilization of natural resources by local communities in the Southern Iraqi marshlands	0	0	0	50%
Percentage (%) of gaps identified in the site-specific documentation for sites nominated for inclusion on the World Heritage list	50%	0	0	60%
Percentage (%) of issuance of National Register for natural heritage sites in Iraq	25%	0	0	60%
Preparation of Environmental Impact Assessment (EIA) for droughts and water scarcity on the marshes in southern Iraq	0	0	0	1

Water Resources and Water Security Sector

Indicators	Baseline Values	Roadmap		
		cumulative target with baseline value		
		2025	2027	2030
Increased proportion percentage (%) of people serviced with clean water supplies in urban, rural and marshes areas	Baghdad Municipality 100%	100%	100%	100%
	Municipalities (80%	90%	95%	100%
	Increase value is 20%			
Per capita consumption rate of clean water	Baghdad Municipality (350l/day)	300l/day	275l/day	275l/day
	Municipalities (300l/day)	200-250l/day	200-250l/day	200-250l/day
Percentage (%) of population in Greater Baghdad municipality connected to the sewage services	Baghdad Municipality	95%	96.5%	98.5%
	Increase value is (6.5%)			
Percentage (%) of the population in Iraqi municipalities connected to the sewage services	20%	30%	45%	61%
	Proposed increased value is 41%			
Percentage (%) of sewage systems constructed and developed in Greater Baghdad municipality	25%	42%	50%	59%
	Increase value is 34%			
Percentage (%) of sewage systems constructed and developed in Iraq's Governorates	0	10%	20%	30%
Percentage (%) of increase in treated wastewater returned to rivers compared to baseline value	Baghdad municipality (60%)	-	90%	90%
	Proposed increase value is 30%			
	The Municipalities amount of treated water is 2,078 billion m3	5%	12%	22%
Number of surface and groundwater quality monitoring programs	1	2	2	3
The annual rate of water quantity processed for the marshes	3.88 billion m3	30% of 5.3 billion m3	70% of 5.3 billion m3	100% of 5.3 billion m3
	Increased amount based on available water (5.3 billion m3)			
Provide an updated version of the strategic study of Iraq's water and land resources	1	-	1	-
Number of Implemented water harvesting projects	0	3	8	15
Percentage (%) of water stored in water harvesting projects Annual water savings rate	0	25% from 136 million m3	70% of 136 million m3	100% of 136 million m3
Enhancing the overall irrigation efficiency Systems	32%	35%	40%	50%
	The increased value is 18%			

Coastal and Marine Ecosystems Sector

Indicators	Baseline Values	Roadmap		
		Cumulative target with baseline value		
		2025	2027	2030
Percentage (%) of Spillage control preventing pollution of Coastal and Marine Environment	5%	10%	20%	30%
Reduction in the number of cases and fines related to marine and coastal ecosystems	8	6	4	2
Number of new legislation and regulations for sustainable management of marine fisheries	1	-	-	2
Develop a plan for sustainable management of marine fisheries.	-	-	-	1
Develop a marine reserve and develop a management plan.	-	--	---	1
	0	1	-	1
Percentage (%) of marine area declared as a marine reserve	0	0	0	50%
Percentage (%) of seawater contaminants reduction	12%	8%	6%	3%
Establishment of marine and coastal ecosystems database	-	-	-	1
Developing an integrated coastal area management action plan	0	0	0	1
Preparation of Iraq's marine habitat map	0	-	-	1
Number of removed drowned objects from objects the regional water, channels and Shatt Al-Arab	13	15	19	25

Agricultural Food Security Sector

Indicators	Baseline Values	Roadmap		
		Cumulative targets with baseline value		
		2025	2027	2030
The number of crops utilizing organic fertilizer	2 The increased value (3)	3	4	5
(%) increased investment in organic agriculture	0 The increased value (2%)	0	1%	2%
(%) decreased use of chemical fertilizer	1 The decreased value (10%)	3%	6%	11%
(%) increased use of environmentally friendly pesticides in agriculture.	2% The increased value (10%)	4%	7%	12%
Number of licenses granted for the establishment of organic farms	0)	0	0	1
Feasibility study on the use of organic fertilizer in agriculture	0	0	0	1
(%) Use of alternative energy in agricultural activities	5% The increase value is 60%	15%	35%	65%
(%) Use of non-conventional water sources in agricultural activities.	0 The Increased value of 20%	2%	10%	20%
Percentage (%) of farms using modern and efficient irrigation systems	20% The Increased value of 60%	30%	50%	80%
National strategy for land degradation reduction (land degradation neutrality).	1 The Increase 1	0	0	2
Number of pastoral stations in Iraq	23 Increase value 6	0	26	29
Percentage (%) of beneficiaries of livestock breeders from the self-sufficiency feed program	20% Increase value 45%	30%	45%	65%
Percentage (%) of pastoral land rehabilitated	10% Increase value 30%	15%	25%	40%
Preparation of the national program to combat desertification	1	2	2	2
Preparation of the National Sand and Dust Storm Control Program	1	2	2	2
Percentage (%) of land protected from desertification	20% Increase value 40%	25%	35%	60%
(%) Increased afforestation and forestry areas in Iraq	1.60% Increase value 2%	-	2.60%	3.60%
Number of oases recovered and protected	9 Increase value 10	11	14	19
Number of natural reserves (biodiversity)	3 Increase 4	4	5	7
Number of earth dams (water harvesting)	7 Increase value 8	9	11	15
Number of water traps (water harvesting)	5 Increase value 7	7	9	12

Environmental Health Sector

Indicators	Baseline Values	Road Map		
		Cumulative targets with baseline value		
		2025	2027	2030
Percentage of government expenditure on health programs from the total government expenditure	7% Increase value (3%)	8%	9%	10%
# of disease prevention programs implemented annually	0 Increase value 9	0	0	9
(%) increased use of environmentally friendly pesticides in agriculture.	2% The increased value (10%)	4%	7%	12%
Percentage of hospitals served by modern solid waste management projects	32% Increase value 38%	50%	60%	70%
Percentage of hospitals served by liquid waste treatment units	15% Increase value 11%	16%	21%	26%
Number of health and environmental awareness programs implemented	Ministry of Education 5 Increase value 5	7	9	10
Adoption of green buildings manual in all modern government buildings	1	-	-	2
Number of governmental buildings converted into green buildings	0	-	-	20
Manual building codes and thermal insulation	1	-	-	2
Number of projects that implement energy-efficient principles	1	1	2	3
Volume of annual investments in construction material manufacturing and sustainable technologies	0	2%	5%	10%

Industrial, Oil and Gas Production Sector

Indicators	Baseline Values	Road Map		
		Cumulative targets with baseline value		
		2025	2027	2030
Percentage (%) of treated wastewater used in industry sector	0% Increase value (2%)	0	1%	2%
Water quality reports from the industry sector	4 Increase value 3	5	6	7
Number of Environmental parameters reported in the industry wastewater quality reports	10 Increase value 6	12	14	16
Annual number of measures taken to mitigate violations	2 Increase value (5)	3	5	7
Number of environment-friendly projects	Industry 2 Increase value 10	4	7	12
	Oil 1 Increase value 1	1	1	2
Percentage of increased productivity in waste recycling facilities	5% Increase value 5%	6%	8%	10%
Increase the support to promote innovation and research related to green production and environment-friendly industries.	Industry sector: base value 2%, increase 5%	3%	5%	7%
	Number of cases in the oil sector Increase value 1000	1100	1300	1520
Number of green jobs generated in industrial and oil sectors	10 Increase value 50	20	35	60

Chemicals and Hazardous Waste Sector

Indicators	Baseline Values	Road Map		
		Cumulative targets with baseline value		
		2025	2027	2030
Survey reports of chemical pollution in environmental elements	150	170	190	210
Database for chemical inventory and disposal mechanisms	14 databases	19	24	29
Number of licenses associated with importing, exporting, and use of hazardous chemicals	1934 Increase value 25%	2034	2234	2417
Number of risk identification and specification guides	Ministry of Higher Education 3 Increase value 1	3	4	4
Number of awareness programs for chemical usage	4 Increase value 6	5	6	10
Number of environmental approvals concerning establishing waste management projects	35	39	43	47
Percentage of chemicals annually treated and handled in an environmentally friendly manner.	Higher Education 10% Increase value 30%	20%	30%	40%
Number of implemented programs in accounting and assessment of hazardous waste in the government sector	11	14	17	22
Number of capacity-building programs implemented related to pollutant assessment, analysis, and risk prevention measures	35	49	63	77
Percentage (%) of participants in capacity-building programs in this Sector	100%	100%	100%	100%
Annual worker assessment reports for chemical and biological prevention and inspection programs workers.	Higher Education 1 Continuous	1	1	1

Energy and Transportation Sector

Indicators	Baseline Values	Road Map		
		Cumulative targets with baseline value		
		2025	2027	2030
Percentage (%) of renewable energy (solar energy, wind energy, and Hydro energy) in the energy mix up to 6.8$ until 2030	2% Increase value (4.3%)	4.8%	5.6%	6.3%
Percentage of natural gas in the fuel mix in electricity production	69%	-	-	-
	Decrease value 10%	65%	56%	59%
Percentage of production in both public and private sectors using natural gas	59%	72%	65%	64%
	increase 5%			
Percentage (%) of energy production through electric power generation technologies with low carbon pollution	18%	-	-	-
	Increase value 15%	23%	33%	33%
Number of sustainable and environmentally friendly transportation projects	0	0	0	1
Monitoring gas emissions from electric power generation plant chimneys	0	5 Locations	10 Locations	20 locations

Climate Change Program

Indicators	Baseline Values	Road Map		
		Cumulative targets with baseline value		
		2025	2027	2030
Follow-up the implementation of technological needs Action Plan for Mitigation	0	1	1	1
Issuance and updating of Nationally Determined Contributions (NDCs)	1	2	--	3
Percentage (%) greenhouse gases emitted from the waste sector	0	1%	2%	3%
Percentage of achievement of conditional and unconditional NDCs	0	5%	10%	17%
Vulnerability Assessment for Climate Change Report	0	1	2	3
Issuance and update of the National Climate Change Communication Report	1	2	3	4
Preparing climate change Atlas for adapting to climate change	0	1	2	3
Number of projects implemented related to nature-based solutions and ecosystem-based adaptation principles	0	1	2	3
Number of projects implemented to Strengthen agricultural sector resilience towards climate changes and incorporate smart agriculture principles	0	1	2	3
Preparing a complete curriculum for research and development	0	1	2	3
Number of implemented projects in Strengthening rural communities' resilience towards climate change	0	1	2	3
Number of financed projects from Climate Funds	5	7	9	12
Developing and implementing the National Strategy for Disaster Risk Reduction	0	1	--	2
Preparing loss and damages reports resulting from natural disasters	4	7	9	12
Number of workshops related to climate action	0	3	5	8
Number of international participation cases in climate action	0	2	5	8
Number of training courses in climate action	0	5	10	16

Partnership Support Program

Indicators	Baseline Values	Road Map		
		Cumulative targets with baseline value		
		2025	2027	2030
Stakeholder analysis report	0 Increase value 3	1	2	3
Number of Participants in Environmental Protection and Climate Change Regional and International Seminars and Workshops	150	200	220	300
Number of formal and informal green jobs in different sectors				
Number of awareness programs and mandatory guidance for investors on green environmental investments	6	8	10	12
Number of approved mechanisms for promoting green jobs in the informal waste (waste pickers) sector	0	1	2	3

Environmental Education Dissemination Program

Indicators	Baseline Values	Road Map		
		Cumulative targets with baseline value		
		2025	2027	2030
Number of implemented awareness and educational programs to introduce the National Strategy goals for protecting and improving the environment	6	6	6	6
Percentage (%) of college and university curricula and vocational training curricula developed concerning environment protection issues	70%	80%	90%	100%

Environmental Governance Program

Indicators	Baseline Values	Road Map		
		Cumulative targets with baseline value		
		2025	2027	2030
Number of training programs for stakeholders involved in implementing the strategy	4 Increase value 9	7	10	13
Updating the Ministry of Environment's organizational structure document and job description	1 Increase value 3	2	3	4
Number of environmental regulations and laws issued or updated	0	1	2	-
Special database for environmental legislation and laws	1	1	1	1
Environmental Performance Indicator Report	2 Increase value 3	3	4	5
Percentage of coverage of economic effects of environmental degradation related to the annual study to estimate the cost of environmental degradation in Iraq	40% Increase value 60%	55%	75%	100%
Environmental Public Policy in Iraq	0	-	1	-
Percentage (%) of achievement according to monitoring and evaluation program report of achieved strategic goals of the Environment Protection and Improvement Strategy	0 Increase value 3	1	2	3
Number of implemented programs to Improve civil society inclusiveness	0 Increase value 100%	20%	40%	100%

Part Five: Action Plan

In this Part, the needed action plan for achieving the strategy and its ambitious goals will be clarified.

5

Environment Protection and Improvement and Sustainability Program

Waste Sector

Sustainable Development Goals			
Ambitious targets	Indicators	responsibility	Estimated Budget (USD)
Strategic Goal (1): Reducing the loss of natural resources and building sustainability programs through raising the waste collection and management capacity.			
Target (1): Safe disposal of waste and reduction of pollution by 60% at Baghdad Municipality level and by 20-30% at the municipal level in Iraqi governorates.	Percentage (%) of safe waste disposal and pollution reduction	Baghdad Municipality. Ministry of Construction, Housing, and Public Municipalities	Baghdad Municipality did not determine the budget. 50,000,000
Target (2): Reducing household waste generation rate by intensifying awareness programs and focusing on reducing the use of single-use packaging materials.	Percentage (%) of household waste generation rate reduction	Baghdad Municipality Ministry of Construction, Housing, and Public Municipalities	10,000,000 10,000,000
Target (3): Increasing the waste collection rate by up to 85% at the Governorate level and 95% at the Baghdad Municipality level.	Percentage (%) of achieved increase in average waste collection rate	Baghdad Municipality Ministry of Construction, Housing, and Public Municipalities	Baghdad Municipality did not determine the budget. 65,000,000
Target (4): Establishing two (2) sanitary landfill sites for waste disposal on the governorates level and two sites on Baghdad Municipality level.	Number of sanitary landfill sites implemented and approved.	Baghdad Municipality Ministry of Construction, Housing, and Public Municipalities	Baghdad Municipality did not determine the budget. 250,000,000
Strategic Goal (2): Increase the material recovery rate by increasing waste handling capacity and moving towards an effective circular economy.			
Target (1): Establishing two recycling facilities at Baghdad Municipality level to recycle and use recyclables to reach a recycling percentage of up to (20%) to convert waste into a resource that contributes to advancing the economy.	Number of recyclable material recovery facilities at Baghdad Municipality level	Baghdad Municipality	-
	Percentage (%) of recyclable and usable materials collected and recycled at Baghdad Municipality level.	Baghdad Municipality	-
	Number of waste screening, recycling, and power generation projects at Baghdad Municipality level	Baghdad Municipality	-
Target (2): Establish three sites in three governorates in Iraq to recover recyclable material to reach a recycling rate of up to (1-3%) of the total waste weight to convert waste into a resource contributing to the economy's enhancement.	Number of recyclable material recovery facilities at the level of Iraq's Governorates	Ministry of Construction, Housing and Municipalities	50,000,000
	Percentage (%) of recyclable materials recycled at the Governorate Level	Ministry of Construction, Housing and Municipalities	50,000,000

Ecosystems and Biodiversity Sector

Sustainable Development Goals

Ambitious targets	Indicators	responsibility	Estimated Budget (USD)
Strategic Goal (1): Reducing the loss of natural resources and building sustainability programs through raising the waste collection and management capacity.			
Target (1): Reach a minimum protection rate for natural environments of 5% of Iraq's total area within the network of nature reserves or through the use of other means with a focus on the Marsh areas and wetlands	Percentage (%) of natural environments included in Iraq's natural reserves	Ministry of Environment	100,000,000
	Number of reserves established and announced in Iraq	Ministry of Environment	100,000,000
Target (2): Creating reserves for a socio-economic development opportunity and encouraging investment through promoting public-private partnerships.	Number of investment opportunities implemented in the field of environmental reserves	Ministry of Environment	100,000,000
Target (3): To establish an inclusive database of Iraq's plant and animal species that would guarantee the provision of information on the status of species, endangered species, the associated opportunities, and popular uses	Percentage (%) of biodiversity and ecosystems database update in Iraq	Ministry of Environment	5,000,000
Target (4): Establish a database on invasive and exotic species in Iraq	Establishment of a database of invasive and exotic species in Iraq	Ministry of Environment	5,000,000
Target (5): Develop an inclusive hunting regulation plan that protects species and habitats.	Percentage (%) of hunting violation reduction	Ministry of Environment	5,000,000
	Percentage (%) of endangered species locally and that have had protective measures	Ministry of Environment	5,000,000
Target (6): Implementing a monitoring program for the quality of Iraq's marshland water to ensure the sustainability of biodiversity	Percentage (%) of monitoring and assessment of contaminants in Iraqi marsh waters	Ministry of Environment Ministry of Water Resources	50,000,000
Target (7): Enhancing the laboratory readiness working in genetic engineering	Percentage (%) of development and readiness of the laboratories Uued to conduct research on genetic mulation and its products.	Ministry of Environment	5,000,000
Target (8): Establish a database on the global values of Iraq's natural sites and issue the National Register of Natural Heritage Sites in Iraq	Number of natural reserves nominated for promotion on global heritage lists	Ministry of Environment	50,000,000
	Percentage (%) of filling gaps identified in the files of sites nominated for World Heritage lists	Ministry of Environment	10,000,000
	Percentage (%) of issuance of draft National Registry for Natural Heritage Sites in Iraq	Ministry of Environment	50,000,000
Target (9): Estimate the return to local communities of the world heritage sites (Central Marshes and Western Himar) in Thi-Qar Governorate to protect them from degradation	Percentage (%) of natural resources utilized by local communities in the southern Iraqi Marshland areas	Ministry of Environment	50,000,000
	Preparing a study to assess the environmental effects of droughts and water scarcity on the marshes in southern Iraq	Ministry of Higher Education, Ministry of Water Resources, Ministry of Environment, and Ministry of Science and Technology	1,000,000
Strategic Goal (2): To protect, restore and promote the sustainable use of terrestrial and marine ecosystems, forest management, combating desertification and halting and reversing land degradation			
Target (1): Restore (120 thousand hectares) of degraded natural land areas, including forests, pastoral areas, and others, through the implementation of rehabilitation and recovery programs	Percentage (%) of areas recovered from degraded wild natural areas	Ministry of Agriculture	20,000,000
Target (2): Preserve and restore degraded ecosystems associated with water availability, such as forests, water bodies, mountains, etc., when preparing water budget	(%) Protected areas within the network of nature reserves or other means	Ministry of Agriculture Ministry of Environment	15,000,000

Water and Water Security Sector

Sustainable Development Goals	

Ambitious targets	Indicators	responsibility	Estimated Budget (USD)
Strategic Goal (1): Reducing the loss of natural resources and building sustainability programs through raising the waste collection and management capacity.			
Target (1): Increase the supply of clean water in urban and rural areas at the Baghdad Municipality level and in Iraq's governorates	Percentage (%) of people served with clean water supply in urban, rural, and Marshes areas	Baghdad municipality, Ministry of Construction, Housing and Municipalities/ Directorate General of Water and Water Directorates operating in governorates	-
Target (2): Maintain a daily rate of supply and consumption of water fit for human consumption in different demographic locations between (200-240 liters per person per day)	Per capita consumption rate of water fit for human consumption	Baghdad Municipality, Ministry of Construction, Housing and Municipalities/ Directorate General of Water and Water Directorates operating in governorates	-
Target (3): Creating sewage systems to increase the population connected to sewage service at the Baghdad Municipality level and the Iraqi governorates	Percentage (%) of the population connected to the sewage service.	Ministry of Construction, Housing, and Municipalities / Baghdad Municipality	335,071,790
	Percentage (%) of sewage networks built	Ministry of Construction, Housing, and Municipalities / Baghdad Municipality	-
Target (4): Increase percentage of recycling and safe use of wastewater	Percentage (%) of monitoring and assessment of contaminants in Iraqi marsh waters	Ministry of Environment Ministry of Water Resources	-
Target (5): To improve the quality of surface and groundwater by reducing pollution and preventing the discharge and leakage of pollutants or liquid residues to water sources in all governorates of Iraq, with the need to implement groundwater recharge programs	Number of surface and groundwater quality control programs	Ministry of Environment in Coordination with Ministry of Water Resources	65,000,000
Target (6): Convert (5.3 billion m3) of water annually into marshland to cover (2851 square km) in good water revenue years. These indicators decrease in proportion to water scarcity.	Annual average of water quantity processed for the marshes.	**Ministry of Water Resources**	**10,000,000**
Strategic Goal (2): Reduce water loss and significantly increase water efficiency across all sectors, ensure sustainable withdrawal and supply of freshwater to address water scarcity, and greatly reduce the number of people who face water scarcity.			
Target (1): Apply the integrated water resource management approach across the Republic of Iraq by targeting watersheds and major water harvesting sites, including the establishment of water harvesting projects, which, upon establishment, are hoped to achieve an estimated water storage of 136 million m3.	Update the strategic study of Iraq's water and land resources	Ministry of Water Resources	2,000,000
	Number of water harvesting projects implemented	Ministry of Water Resources	15,000,000
	Percentage (%) of water stored on the level of Iraq's water harvesting projects	Ministry of Water Resources	20,000,000
Target (2): Increase investments to improve water collection and storage infrastructure, and attention to maintaining dams and operational systems, and providing all dams with seismic sensitization devices and controlling the quantity of water storage and the sustainability of the ecosystem.	Number of dams and operational systems developed and launched	Ministry of Water Resources	200,000,000
Strategic Goal (3): Water demand and supply management.			
Target (1): Apply ecosystem-based adaptation programs and nature-based solutions to ensure increased storage of surface and rainwater for multiple to secure water for domestic use, irrigation, livestock, aquaculture, industry and environmental sustainability by: development of water resources management through the implementation of plans to distribute water revenues to governorates and work to eliminate abuses of water quotas and to hold accountable those responsible	Rate of water saved annually.	Ministry of Water Resources	10,000,000
Target (2): Increase the overall irrigation efficiency to (60%) by using modern irrigation methods (pipe-closed irrigation, spray and drip irrigation) and lining the channels and irrigation streams.	Percentage (%) increase in the overall irrigation efficiency	Ministry of Water Resources\ Ministry of Agriculture	15,000,000
Strategic Goal (4): Provide new non-conventional water sources.			
Target (1): Creating storage to store approximately 200,000 - 400,000 m3 of water in suitable areas	Number of established dams and excavations and annual water storage rate	Ministry of Agriculture	30,000,000
Target (2): Excavations to book approximately 20,000 - 40,000 m3 of water.	Percentage (%) of storage in dams and traps	Ministry of Agriculture	40,000,000

The Ministry of Water Resources reserves reservations about the estimated budget in the water and water security sector for goals and indicators due to the variation in prices, and they can be estimated when preparing programs.

Coastal and Marine Ecosystem Sector

Sustainable Development Goals	

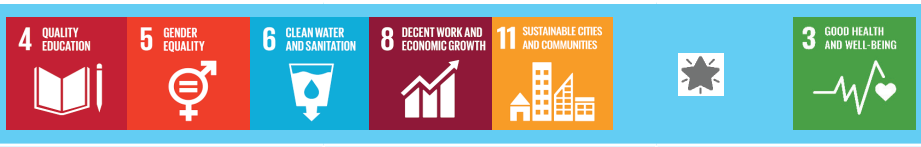
Ambitious targets	Indicators	responsibility	Estimated Budget
Strategic Goal (1): Protect the coastal and marine ecosystems and promote habitat and species recovery			
Target (1): To reduce oil pollution affecting the coastal and marine environment and implement efficient programs to address its different impacts, and work on facing and preventing the discharge of petroleum tailings, fuel residues, balance water for oil tailings, and cargo vessels to surface water or maritime fields, whether disposal from fixed or mobile waste or loading operations.	Percentage (%) control of spillages that led to pollution of the coastal and marine environment	Ministry of Environment, Ministry of Oil, and Ministry of Transportation	25,000,000
	Reduction in the number of cases and fines for polluting the marine and coastal environment	Ministry of Environment	10,000,000
Target (2): Apply the sustainable maritime fisheries management approach while protecting species, habitats, and environmental ecosystems.	Number of regulations for sustainable management of sea fishery wealth	Ministry of Agriculture	2,000,000
	Development of a strategy for sustainable management of marine fisheries	Ministry of Environment Ministry of Agriculture	1,000,000
Target (3): Establish a marine reserve to protect species, habitats, and ecosystems.	Establishment and declaration of a marine reserve and development of a management plan	Ministry of Environment	4,000,000
	Percentage (%) of Marine Area Declared as a Reserve	Ministry of Environment	2,000,000
Target (4): Implement the coastal and marine water quality control program, which would necessarily help implement rapid and effective response plans to reduce the impact of water quality emergencies.	Percentage (%) of seawater contaminants reduction	Ministry of Environment Ministry of Transportation Ministry of Oil	10,000,000
Target (5): Establish a database on Iraq's marine and coastal environment.	Establishment of marine and coastal environment database	Ministry of Environment	2,000,000
Target (6): Recover drowned objects from regional waters, channels, and Shatt Al-Arab to facilitate sailing and preserve the environment.	Number of drowned objects recovered from regional marine waters, channels, and Shatt Al-Arab	Ministry of Transportation	2,000,000
Strategic Goal (2): Develop an integrated coastal area management approach in a participative manner with all stakeholders.			
Target (1): Developing and Implementing the Integrated Management for Coastal Areas.	Developing Coastal Area Integrated Management Action Plan	Ministry of Environment	2,000,000
Target (2): Map marine ecosystem habitats and prepare an inclusive blueprint for coastal area uses.	Preparation of Iraq's marine habitat map	Ministry of Environment	2,000,000

Agricultural and Food Security Sector

Sustainable Development Goals	

Ambitious targets	Indicators	responsibility	Estimated Budget
Strategic Goal (1): Promote the pattern of environmentally friendly and climate-resistant agriculture to ensure reduced use of pesticides and chemical fertilizers to protect environmental components.			
Target (1): Promote agricultural practices that increase the number of organic substances in the soil (organic carbon sequestration) annually by (10%).	Number of crops targeted by the use of organic fertilizer	Ministry of Agriculture	10,000,000
	Percentage (%) increase in investments in organic agriculture	Ministry of Agriculture	5,000,000
Target (2): Reduce the use of chemical fertilizers, chemicals and insecticides in agriculture.	Percentage (%) of chemical fertilizer usage reduction	Ministry of Agriculture	10,000,000
	Percentage (%) increase in using environmentally friendly pesticides in agriculture.	Ministry of Agriculture	10,000,000
Target (3): Establish a marine protected area to ensure the protection of species, habitats and ecosystems	Declaring the marine protected area and developing the management plan	Ministry of Environment	4,000,000
	Percentage (%) of the marine area that has been declared as protected area	Ministry of Environment	2,000,000
Target (4): Increase the use of alternative energy in agricultural activities by (25)%.	Percentage (%) of using alternative energy in agricultural activities	Ministry of Agriculture	10,000,000
Target (5): Reduce the percentage of water used in agriculture from 85% to 75% and compensate for non-conventional water sources, additionally developing irrigation systems.	Percentage (%) of using non-conventional water sources in agricultural activities.	Ministry of Agriculture	10,000,000
	Percentage (%) of farms using efficient irrigation systems	Ministry of Agriculture	10,000,000
Target (6): Enhancing soil quality control programs and, establishing land quality information database and determine land suitability for different human uses.	The National Strategy for Land Degradation Reduction (Land Degradation Neutrality)	Ministry of Agriculture and the relevant ministries	2,000,000
Strategic Goal (2): Protect and restore pastoral spaces and increase green spaces to ensure sustainable use of biodiversity and achieve food security.			
Target (1): Increase the number of pastoral reserves to cover (125 Hectares) in (6) governorates.	Number of pastoral stations in Iraq.	Ministry of Agriculture	5,000,000
Target (2): Achieve self-sufficiency in feed for livestock farmer.	(%) of beneficiaries of livestock breeders from the self-sufficiency feed program	Ministry of Agriculture	6,000,000
Target (3): Multiplying the endangered native pastoral plants (e.g., food and other plants).	Percentage (%) of rehabilitated pastoral land	Ministry of Agriculture	10,000,000
Target (4): Reduce the areas of arable, desertified, or desertification-threatened agricultural land to (40%).	Percentage (%) of rehabilitated and protected agricultural land	Ministry of Agriculture	10,000,000
	Preparing the national program to combat desertification	Ministry of the Environment and	1,000,000
	Preparing the National Sand and Dust Storm Control Program	Ministry of Environment and relevant stakeholders	1,000,000
Target (5): Stabilize approximately (25%) of the total sand dune area and develop necessary plans to achieve a dune stabilization rate of approximately 55% by 2030.	Percentage (%) of land protected from desertification	Ministry of Agriculture	10,000,000
Target (6): Increase the area of the green spaces by increasing the number of forests with a total area of 3,750 hectares.	Percentage (%) of forestry areas in Iraq	Ministry of Agriculture	10,000,000
	Number of biodiversity reserves	Ministry of Agriculture	15,000,000
Target (7): Rehabilitate 6 oases (with 50-200 hectares area), keeping in mind covering different plant species of crops and trees.	Number of oases recovered and their protected	Ministry of Agriculture	20,000,000
Target (8): Sustainable farming (10 million) of palm trees and fruitless and local shrubs through the use of non-conventional water sources and non-conventional irrigation methods (spraying and drip) within a clear program of afforestation with promoting agriculture and preservation of species as the original habitat of Iraq, and the preservation of green spaces by stopping urbanization on agricultural land	Number of Seedlings Produced	Ministry of Agriculture	
	Number of dirt reimbursements (water harvest)	Ministry of Agriculture	
	Number of water harvesting projects	Ministry of Agriculture	

Health Environment Sector

Sustainable Development Goals	

Ambitious targets	Indicators	Responsibility	Estimated Budget
Strategic Goal (1): To protect the environment, preserve public health from pollution of all kinds, and prevent diseases affecting humans, animals and plants and food safety.			
Target (1): Combat climate change and environmental pollution-related diseases	Percentage (%) of government expenditure on health programs from the total government expenditure	Ministry of Health	120,000,000
Target (2): Prevent waterborne diseases, food, animal sources, pathological threats, and health risks.	Number of disease prevention programs implemented annually	Ministry of Health	4,000,000
Target (3): Strengthening environmental health programs to contribute to preventive health services and primary health care.	Number of health and environmental awareness programs implemented	Ministry of Health	500,000
Target (4): Treat wastewater from hospitals and determine the percentage of treated water within the environmental protection and improvement strategy.	Percentage (%) of hospitals served with wastewater treatment units	Ministry of Health	44,000,000
Target (5): Including (50%) of hospitals in modern solid medical waste management projects (shredding and autoclave)	Percentage (%) of hospitals served with modern solid waste management projects.	Ministry of Health	10,080,000
Target (6): Adopt the green buildings manual in all modern government buildings and work on expanding the transformation of existing government buildings into green ones, which promote energy efficiency, provided that the green space in new projects is (25%) or greater of the total area.	The adoption of the green buildings manual in all the new governmental buildings	All Ministries	1,000,000
	Number of government buildings converted into green buildings	All Ministries	10,000,000
Target (7): Adopt building codes and thermal insulation to implement new investment opportunities.	Preparing a manual of building codes and thermal insulation	Ministry of Housing Ministry of Planning Central Authority for Standardization and Qualitative Control	1,000,000
Target (8): Oblige new investment projects to consider a scientific foundation in the selection of air conditioning and water heating systems that enhance energy efficiency and the selection of thermal insulation-assisted building materials.	Number of investment projects that consider energy efficiency program principles	Investment Commission	50,000,000
Target (9): Encouraging investments in sustainable construction materials and technology manufacturing projects for use in new housing projects.	Volume of annual investments in construction materials manufacturing projects and sustainable technologies	Ministry of Industry	40,000,000

Industrial, Oil and Gas Production Sector

Sustainable Development Goals			
Ambitious targets	Indicators	Responsibility	Estimated Budget
Strategic Goal (1): Promote the efficient use of resources by integra environmentally friendly and modern technologies into production and promoting environmental consideration into the sector.			
Target (1): Increase the efficiency of treated wastewater in the industry sector by 2%.	Percentage (%) of treated wastewater used in industry sector	Ministry of Industry	10,000,000
Target (2): To improve the quality of the water discharge to comply with environmental limits and to prevent the discharge of any industrial water outside environmental limits, according to the environmental regulations and legislation.	Industry water quality reports	Ministry of Industry	1,000,000
	Number of environmental parameters of the discharged water quality reports	Ministry of Oil	-
	Number of mitigation actions to decrease violations (annually)	Ministry of Industry Ministry of Oil	2,000,000
Target (3): To increase the energy efficiency in the industrial sectors and work on the establishment of heat recycling projects in the state-owned company for iron and steel for the purpose of generating electric power and heating iron scrape, and to seek attention to the provision and introduction of heat recycling technology resulting from the furnaces of the cement industry.	Percentage (%) of energy efficiency programs in the industrial sectors	Ministry of Industry Ministry of Oil	60,000,000
Target (4): Increasing resource usage efficiency, recycled materials as alternative inputs to raw materials in different industries, and reach an advanced percentage in discarding with the use of freshwater in oil extraction	Percentage (%) of raw material efficient usage programs in the industrial and oil sectors	Ministry of Industry Ministry of Oil	50,000,000
Target (5): Rehabilitate production lines in the Ministry of Industry's configurations to be environmentally friendly, as well as adopt economic incentives that enhance production efficiency, environmental commitment, and sustainable development, and change consumption patterns, including the selection of more resource-efficient and less harmful products	Number of environmentally friendly projects	Ministry of Industry Ministry of Oil	200,000,000
Target (6): Increase the production capacity of the recycling activities of waste resulting from production processes and consumables such as aluminum scrape tailings, tyres, freon gas and vacuum distillation tower tailings	Percentage (%) increase in the recycling activities of waste from production processes and c	The Ministry of Industry	70,000,000
Strategic Goal (2): Enhance awareness and the capacity to improve the understanding, management, and enhance/promote reuse, recycling, protection and resource values.			
Target (1): Increase the employment rate in the green economy and introduce innovation and systems for productive processes through climate change initiatives. This is accomplished through the availability of resources and technical support through international environmental agreements.	Increased support to encourage creativity, innovation, and scientific research on green production and environmentally friendly industries	Ministry of Industry Ministry of Oil	25,000,000
	Number of green jobs generated	Ministry of Industry Ministry of Oil	20,000,000

All estimated costs for the goals in this table are exclusively for the Ministry of Industry, and the Ministry of Oil has reserved reservations about setting estimated amounts for its work within these goals.

Chemicals and Hazardous Waste Sector

Sustainable Development Goals				
Ambitious targets	Indicators	Responsibility	Estimated Budget
Strategic Goal (1): Implementing and activating integrated hazardous chemicals management plan.			
Target (1): Prepare comprehensive surveys of the chemical pollution in elements of the environment (soil, air, water).	Survey reports on the chemical pollution in environmental components	Ministry of Higher Education and Scientific Research Ministry of Environment, Ministry of Interior	1, 000, 000
Target (2): Inventory of chemicals disposed of in environmentally safe ways and consequent risk assessment.	A database of chemicals and mechanisms for their disposal	Ministry of Environment Ministry of Higher Education Ministry of Science & Technology Ministry of Industry	1,000,000
Target (3): To activate and update the legal and regulatory framework for licensing the import, export, storage, and use of hazardous chemicals and coordinating with the legal department.	Number of licenses associated with importing, exporting, storing, and using hazardous chemicals.	National Security Advisor Ministry of Interior Ministry of Environment Ministry of Commerce Intelligence Service	3,000,000
Target (4): Issue hazard identification guides and specifications of chemicals to avoid risks arising from dealing with different chemicals	Number of risk and specifications identification guides	Ministry of Environment, National Security Advisor, Central Authority for Qualitative Control and Measurement, Ministry of Higher Education and Scientific Research	1,000,000
Target (5): To cooperate with international organizations specializing in environmental issues and related to chemicals and their waste (international conventions).	Number of awareness programs for chemicals' uses	Ministry of Environment, National Security Advisor, Central Authority for Standardization and Qualitative Measurement Ministry of Higher Education and Scientific Research Ministry of Industry Ministry of Agriculture	1,000,000
Strategic Goal (2): Implement and operationalize integrated hazardous waste management plans.			
Target (1): Safe disposal and treatment of hazardous wastes through environmental licensing of hazardous waste treatment projects.	Number of environmental licenses and audit reports for waste treatment projects	Ministry of Environment, Ministry of Science and Technology, National Security Apparatus, Ministry of Higher Education and Scientific Research	30,000,000
	Quantity of chemicals and hazardous wastes treated environmentally yearly	Ministry of Environment, Ministry of Science and Technology, National Security Apparatus, Ministry of Higher Education and Scientific Research	30,000,000
Target (2): Inventory and assessment of hazardous wastes in the government sector.	Number of programs implemented in accounting and evaluation of hazardous wastes in the government sector	All Ministries	3,000,000
Target (3): Build capacity in pollutant assessment, analysis, and risk prevention measures, as well as continue to conduct training courses in chemical safety and security in the handling of hazardous chemicals.	Number of capacity-building programs implemented in pollutant assessment, analysis, and risk prevention measures	All Ministries	3,000,000
	Percentage (%) of participants in capacity-building programs in this sector	All Ministries	3,000,000
Target (4): Develop the performance of environmental prevention and inspection in the field of hazardous wastes.	Annual evaluation reports of workers in chemical and biological prevention and inspection programs	Ministry of Labor and Social Affairs, Ministry of Health Ministry of Higher Education	1,000,000

Energy and Transportation Sector

Sustainable Development Goals			
Ambitious targets	Indicators	Responsibility	Estimated Budget
Strategic Goal (1): Invest in infrastructure and innovation in a way that ensures the application, improvement, and innovation of clean technologies to mitigate the impacts of climate change			
Target (1): Increase the renewable energy share in the total energy mix to (6.8%)	Percentage of renewable energy (solar energy, wind energy, and hydro-energy) in the total energy mix	Ministry of Electricity	700,000,000
Target (2): Increase the reliance on natural gas from the fuel mix in the electric power sector by 2030, with the completion of Iraq's gas sector licensing projects and securing financial allocation.	Percentage (%) of natural gas dependency in the fuel mix in the electrical energy sector	Ministry of Oil Ministry of Electricity	8,848,750,000
Target (3): To implement program to develop increased use of natural gas, energy production and transportation, and to increase public and private sector investment projects in this field.	Percentage (%) of the number of public and private sector investment projects associated with the use of natural gas	Ministry of Electricity	11,265,143,302
Target (4): Reducing total energy consumption from fossil fuel sources by relying on natural gas fuel.	Percentage of electrical energy production using low-carbon technologies.	Ministry of Electricity	1,926,694,000
Target (5): Increase the percentage of passengers using public transport to (10-20%) including buses and trains.	Number of passengers and travelers utilizing public transportation	Ministry of Transportation	15,000,000
	Number of sustainable and environmentally friendly transportation projects	Ministry of Transportation	4,375,290,400
Target (6): Monitor gas and precision emissions within the chimneys of electric power plants	Number of sites where monitoring programs are functioning.	Ministry of Electricity Ministry of Environment	10,000,000

The estimated cost is either from international funding, such as grants or investment and not from the operating budget of the Ministry of Electricity.

Climate Change Program

Sustainable Development Goals			

Ambitious targets	Indicators	Responsibility	Estimated Budget
Strategic Goal (1): Mitigate greenhouse gas emissions from the different sectors, achieving low-carbon economic development and transformation towards sustainable technologies.			
Target (1): Shifting towards sustainable techniques in different fields and sectors.	Tracking the technology development needs a document and a technology action plan for mitigation and implementation.	Ministry of Environment	1,000,000
Target (2): To implement Iraq's commitments to the United Nations Climate Change Convention and the Paris Agreement	Issuance and update of the NDC report	Ministry of Environment and Relevant Ministries	1,000,000
	Issuance of the national communication reports	Ministry of Environment and relevant Ministries	
Target (3): Reduction of greenhouse gas emissions from waste (CH4, CO2) by (3–5%).	Percentage (%) of Greenhouse Gases emanating from the waste sector	Baghdad municipality and Ministry of Municipalities	10,000,000
Target (4): Meet the NDC requirement to reduce GHGs by (17%) distributed between 2% of unconditional contributions and 15% of conditional contributions.	Achievement rate of NDCs' conditional and unconditional contributions	Ministry of Environment and relevant Ministries	150,000,000
Strategic Goal (2): Assess vulnerabilities and vulnerable areas and identify needed national and international adaptation actions.			
Target (1): Identify the areas most vulnerable to climate change in Iraq and promote its sustainability	Preparing Climate Change Atlas for adapting to climate change	Ministry of Environment and relevant ministries	1,000,000
	Preparing climate change vulnerability report	Ministry of Environment	1,000,000
Target (2): Apply nature-based solutions techniques and Ecosystem-based adaptation principles in the agricultural, water, forest, and other sectors.	Number of implemented projects for the nature-based solutions and Ecosystems-based Adaptation concepts	Ministry of Environment and relevant ministries	100,000,000
Target (3): To improve and develop agricultural practices to achieve the principles of adaptation and transition to possible agricultural production systems and to increase investments in climate-smart agriculture.	Number of implemented projects to promote the agricultural sector's resilience to climate changes and introduce smart agriculture concepts	Ministry of Agriculture	100,000,000
Target (4): Implement the climate change assessment program at the national level and promote education, training, scientific research and development and innovation to mitigate and adapt to the potential impacts of climate change.	Develop an integrated curriculum with the ministries of Education, Higher Education and Scientific Research, and Science and Technology for innovation and development	Ministry of Education	10,000,000
Target (5): Strengthen the resilience of rural communities affected by desertification against climate change.	Number of implemented projects to enhance rural communities' resilience against climate change	Ministry of Agriculture	10,000,000
Strategic Goal (3): Provide funding for implementing mitigation and adaptation programs that support Iraq's ambition to reduce emissions, address climate change's negative impacts, and achieve Nationally Determined Contributions.			
Target (1): Enhancing climate funding opportunities, including but not limited to Green Climate Fund and Adaptation Fund	Number of projects funded by Climate Funds	Ministry of Environment	250,000,000
Strategic Goal (4): Capacity building related to the Framework Convention on Climate Change, associated conferences, climate negotiations, Paris Convention, and carbon markets.			
Target (1): Capacity-building related to Climate change negotiation	Number of workshops related to climate change	Ministry of Environment	1,000,000
Target (2): International partnerships in climate change	Number of international participation cases in the climate change	Ministry of Environment	1,000,000
Target (3): Capacity-building in climate action.	Number of climate action training courses	Ministry of Environment	500,000
Strategic Goal (5): Reduce the risk of natural disasters resulting from the climate change and establish monitoring and early warning systems for natural disasters			
Target (1): Assess disaster management related to climate change at the national level and promote education, training, scientific research and development, and innovation in mitigation and adaptation to the potential impacts of climate change.	Preparing and implementing the national strategy to mitigate disaster (disaster risk reduction)	Ministry of Environment	1,000,000
	Preparation of the losses and damage report resulting from natural disasters	Ministry of Environment	1,000,000

Partnership Strengthening Program

Sustainable Development Goals			
Ambitious targets	**Indicators**	**Responsibility**	**Estimated Budget**
Strategic Goal (1): Develop partnership opportunities at the national, regional, and international levels to achieve Iraq's Vision 2030.			
Target (1): Develop a comprehensive analysis of stakeholders to ensure effective communication plans	Stakeholder's analysis report	Ministry of Environment	2,000,000
Target (2): To strengthen Iraq's presence in regional and international environmental protection and climate change platforms.	Number of participants in seminars and regional and international workshops related to environmental protection and climate change	All the ministries	4,000,000
Strategic Goal (2): Promote green job opportunities suitable for informal sector in waste management through multiple legislative and technical tools.			
Target (1): Promote the principle of employment in green formal and informal jobs.	Number of green formal and informal jobs in the different sectors	All ministries	100,000,000
	Number of awareness programs and mandatory guidance for investors and investment bodies on green environmental investments	Investment Authority Ministry of Industry	2,000,000
Target (2): Develop appropriate mechanisms to promote green jobs in the informal waste sector and strengthen its role in providing decentralized waste collection services.	Number of approved mechanisms to promote green jobs in the informal waste (collectors) sector	Baghdad Municipality Ministry of Municipalities	2,000,000

Environmental Education Dissemination Program

Sustainable Development Goals			
Ambitious targets	**Indicators**	**Responsibility**	**Estimated Budget**
Strategic Goal (1): Develop partnership opportunities at the national, regional, and international levels to achieve Iraq's Vision 2030.			
Target (1): The Ministry of Environment coordinates with media organizations to implement awareness and educational programs to introduce goals and the objectives of the National Strategy for the Protection and Improvement of the Environment, acknowledging the importance of using available visual, audio, and written media tools, as well as social media sites.	Number of awareness and educational programs implemented to introduce the objectives of the National Strategy for Environmental Protection and Improvement	Ministry of Environment, Ministry of Education, Ministry of Higher Education and Scientific Research	3,000,000
Target (2): Promote and devise school and university curricula and vocational training curricula related to environmental protection in order to form a future young adult nucleus able to support environmental protection and improvement.	Percentage (%) Number of school and university curricula and vocational training curricula devised on issues related to environmental protection.	Ministry of Education, Ministry of Higher Education and Scientific Research, and Ministry of Labor and Social Affairs	5,000,000

Environmental Governance Program

Sustainable Development Goals			
Ambitious targets	**Indicators**	**Responsibility**	**Estimated Budget**
Strategic Goal (1): Develop partnership opportunities at the national, regional, and international levels to achieve Iraq's Vision 2030.			
Targe (1): Strengthen the technical and managerial capacities of relevant staff and key stakeholders to ensure effective strategy implementation.	Number of stakeholders' training programs to implement the strategy	Ministry of Environment	5,000,000
Target (2): Develop the institutional structure and job description for the Ministry of Environment	Update of institutional structure document and job description in the Ministry of Environment	Ministry of Environment	2,000,000
Target (3): Establish an environmental database containing environmental laws, legislation, and regulations.	Database for environmental legislation and laws	Ministry of Environment	2,000,000
Target (4): To launch a program for issuing and modifying environmental determinants in the field of quality of different environmental components, with the importance that this program includes issuing Iraq's national environmental guides in different fields such as air quality manual, water, soil, etc.	Environmental Performance Index Report	Ministry of Environment	1,000,000
Target (5): To promote and prepare the annual study to estimate the cost of environmental degradation in Iraq, covering most of the economic effects of environmental degradation, to observe a monetary indicator that contributes to enhancing decision-making mechanisms in the field of environmental protection and improvement	Percentage (%) of coverage of economic effects of environmental degradation in the annual study	Ministry of Environment Ministry of Planning International Organizations	2,000,000
Strategic Goal (2): Participate actively in formulating environmental policies and legal frameworks to ensure rational governance and transparent management.			
Target (1): Review and develop existing legislation and laws to meet the strategy's ambitious objectives/goals and enhance the informal sector's participation in the strategy's implementation.	Number of environmental legislation and laws issued or updated	Ministry of Environment	1,000,000
Target (2): To develop and disseminate Iraq's environmental policy at the level of Iraq and at all segments.	Environmental Public Policy in Iraq	Ministry of Environment	2,000,000
Target (3): Ministry of Environment implements a program to assess the achievement of the strategic objectives for protecting and improving the environment, with stakeholders and different sectors promoting this program with data.	Percentage (%) of achievement according to monitoring and evaluation program to assess the verification of strategic objectives for environmental protection and improvement	Ministry of Environment	1,000,000
Target (4): Propose programs to improve the inclusiveness of civil society and different social groups, such as women, youth, minorities, etc., in policy, decision and implementation of the proposed environmental strategy.	Several programs have been implemented to improve the inclusivity of civil society and different social groups.	All Ministries	4,000,000

Baseline Report

2024-2030

TABLE OF CONTENTS

PREFACE

The Iraqi Ministry of Environment is implementing a project to formulate a new strategy for environmental action in Iraq to guide environmental efforts for all stakeholders, whether working in the public or private sectors and civil society organizations. Furthermore, the strategy aims to address the fundamental challenges facing the environment in Iraq during the next five years. The strategy for protecting and improving the environment in Iraq (2024-2030) adopts the achievement of two basic and interrelated objectives:

- Preparing a comprehensive baseline report on the state of the environment in Iraq based on official data from all related sectors. The report adopted the available data for the last five years (2017-2022) to give the possibility to diagnose the current environmental situation and map out its trends during the mentioned period. The baseline report is supported by analyses including pressures, responses, gaps and priorities.

- Based on the analyses presented in this report, the national strategy will be formulated to identify priorities and mechanisms for action in the environmental sector for the next five years, while identifying implementation tools and methods for follow-up and evaluation.

The entities involved in the formulation of the National Environment Strategy in Iraq included the following:

a. Iraqi Ministry of Environment (MoEnv): the national focal point and direct supervisory entity for the formulation, preparation and implementation of the strategy.

b. Stakeholders from sectoral ministries, public and private sector institutions and civil society organizations are involved in the discussion and formulation of the strategy and in its implementation.

c. The United States Agency for International Development (USAID) as it is funding the process.

d. United Nations Development Programme (UNDP) as a technical support body.

The timeframe for the methodological steps adopted for the strategy formulation is presented below:

- The UNDP initiated the project's activities in coordination with the Iraqi Ministry of Environment in January 2022.
- Nominating the advisory experts, which included an international and national team members by the UNDP in July 2022.
- Revision of the previous National Environmental Strategy and Action Plan (2013-2017).
- The first workshop involving different stakeholders was held in Erbil in October 2022 (Appendix 1).
- Collecting data and information and writing a baseline report on the state of the environment in Iraq, which was completed in December 2022.
- Conducting the second workshop in December 2022 to approve the baseline report and the strategy's table of contents (Appendix 2).
- Completing the writing of the strategy on June 2023 and summiting it to the Ministry of Environment and other stakeholders.
- Endorsement of the strategy in 2024.

INTRODUCTION

OBJECTIVES

The report aims to:

- Prepare the Baseline Report on the State of the Environment which is the first product of the draft National Strategy for the Protection and Improvement of the Environment in Iraq (2024-2030) and will contribute to paving the way for the preparation of the strategy.
- Present the state of the environment in Iraq and future expectations in order to assist the project team and relevant authorities in formulating and preparing the national strategic dimensions for the environment.
- Raise the level of environmental awareness by informing all relevant authorities about the state of the environment in order to enhance their participation in environmental decision-making and enhance the role of the concerned sectors in protecting and improving the environment.
- Build a database to follow up on environmental changes at the level of all sectors related to the environment.

METHODOLOGY FOR PREPARING THE BASELINE REPORT

For the preparation of this report, an approved methodology to identify sources of information and collect these data was followed. The sources of information were identified in cooperation with the MoEnv and UNDP, where it was agreed to adopt a number of national reports and strategies and the main official sources of information. There were four sources of information as follows:

- **Statistical data issued by the Central Bureau of Statistics at the Ministry of Planning:** These data were obtained from the official website of the Bureau where statistical reports and raw data were obtained for each of the targeted sectors. Statistical data for the last five years were adopted f, noting that the latest data for most sectors related to the environment were from 2017-2020 and in some sectors, data were available for the year 2021.
- **Official data, studies, reports, and strategies:** The official studies prepared by the relevant ministries were obtained from three sources: MoEnv website and the UNDP and through the local consultant. Many studies and reports have been obtained, the most important of which are the National Communications Report, the Fifth National Report of the Convention on Biological Diversity, the National Biodiversity Strategy, the Action Plan, and other official reports.
- **Informal data and studies:** Research studies from the academic and research sector have been relied upon in the event that data cannot be obtained from the sources described above. Where scientific research published in accredited international journals was relied upon to obtain some information such as the state of biodiversity.
- **Data provided directly by ministries and other sectors:** A national workshop was held with stakeholders in Erbil in October 2022, where the project For the preparation of this report, an approved methodology to identify sources of information and collect these data was followed. The sources of information were identified in cooperation with the MoEnv and UNDP, where it was agreed to adopt a number of national reports and strategies and the main official sources of information. There were four sources of information as follows:

STRUCTURE AND CONTENT OF THE REPORT

The Baseline Report consists of main five sections as follows:

Axis One
The environmental and natural feature of Iraq

Iraq location
Terrain and geograohical areas
Topography

Axis Three: The extent of pressures on the environment in Iraq

Pressures arising from population
Pressures arising from the municipal services sector
Pressures arising from industrial sector
Pressures arising from the agricultural sector
Pressures arising from the health sector
Pressures arising from the water sector
Pressures arising from the transportation sector
Pressures arising from the energy sector
Pressures arising from the oil production sector

Axis Two: The state of the environment in Iraq

Water
Vegetation
Desertification
Population
Climate
Natural systems and biodiversity
Threats to ecosystems and biodiversity
Coastal and marine habitats
Interface systems services
Fisheries
Agriculture

Axis Four
The response of the Iraqi environment to pressures

Environmental legislation in force
Multilateral environmental agreements
Policies and strategies
Environmental components
Climate change
Reducing air pollution
Reducing water pollution
Reducing soil pollution
Reducing pollution resulting from solid waste
management Reducing pollution resulting from the industrial sector
Reducing pollution resulting from the energy
sector
Strengthening the legal and institutional
framework
Institutional response

Axis Five: Gap analysis and recommendations

CHAPTER ONE:

ENVIRONMENTAL AND NATURAL FEATURES OF IRAQ

1

LOCATION OF IRAQ

Iraq is located in the Middle East and is geographically considered within the West Asia region, sharing borders with Iran, Kuwait, Saudi Arabia, Jordan, Syria and Turkey (Figure 1.1).

TOPOGRAPHY AND GEOGRAPHICAL AREAS

Table 1.1: General information about the geography of Iraq

Item	Description
Coordinates	N, 44 00 E 00 33
Total Area	435.052 km^2
Land Area	434100 km^2
Water bodies	950 km^2
Total land borders Length of border with border states	3650 km
Iran	1,458 km
Jordan	181 km
Kuwait	240 km
Saudi Arabia	814 km
Syria	605 km
Turkey	352 km
Coast	58 km

Table 1.2: Geographical Characteristics of Iraq

Geographical Area	%	Location	Features
Desert Plateau	40	West and south of the Euphrates River	A wide rocky plain with scattered stretches of sand, sparsely populated by nomadic pastoralists. The network of seasonal waterways (or valleys) extends from the border to the Euphra tes River.
Northeastern Highlands	20	South of the Mosul-Kirkuk border line towards the borders with Turkey and Iran	The height of mountain ranges reaches 3600 meters
Highland Area	10	Transition zone between the highlands and the desert plateau	Much of this area can be classified as desert because water ways flow into deep valleys.
Sedimentary plain	30	Formed by the combined delta of the Tigris and Euphrates rivers	The region's once-extensive wetlands were devastated by the construction of dams, the diversion of the Euphrates River in Turkey and Syria, and large-scale drainage work carried out by the Iraqi regime in the aftermath of the 1991 Gulf War.

Source: UNEP Abstract (2007) "UNEP Iraq"

Iraq is characterized as one of the arid and semi-arid geographical areas, which led to the fragility of its environment and ecosystems and the elements of biodiversity contained which are more vulnerable to of climate change effects. This is evidenced by climatic phenomena that it has never experienced before, such as low rainfall rates, low water levels of lakes and rivers, high temperatures at unprecedented rates, the occurrence of fires, the increase in intensity and frequency of dust storms, and the changing time periods for their occurrence, and the increasing phenomenon of desertification, which caused pressure on the balance of the ecosystem. Despite these pressures, large areas of Iraq are still of global and local importance, for example, marsh areas, which were included on the World Heritage List, as well as the declaration of many protected areas as naturally rich and the environmental services they provide as an important economic return.

On the other hand, surface water is the main resource in Iraq (Tigris and Euphrates rivers and their tributaries and the Shatt al-Arab), and there has been a significant decrease in water resources due to dams and irrigation and development projects that were established on these rivers in neighboring countries to secure their water shares and use them to generate hydropower, which affected Iraq's water share and quality, and the effects of climate change have caused a decrease in the quantities of water received into its rivers, as the water sector is one of the most fragile sectors in the face of climate change.

It is worth noting that the natural environmental features are distributed over most of the area of Iraq, where it is characterized by the diversity of terrain, from mountains, valleys and forests in northern Iraq, especially in the Kurdistan region, to the hills as in the Hamrin ridge, and from sedimentary plain between the Tigris and Euphrates rivers to arid deserts. Iraq contains the western desert plateau in the west, as well as the natural marshes area in the south, which is one of its natural environmental elements, including the Hawizeh Marsh and the Hammar Marsh, as well as the presence of several natural and artificial lakes such as Sawa Lake Tharthar, Razzaza and others. Figure 2.1 highlights the natural environmental features of Iraq.

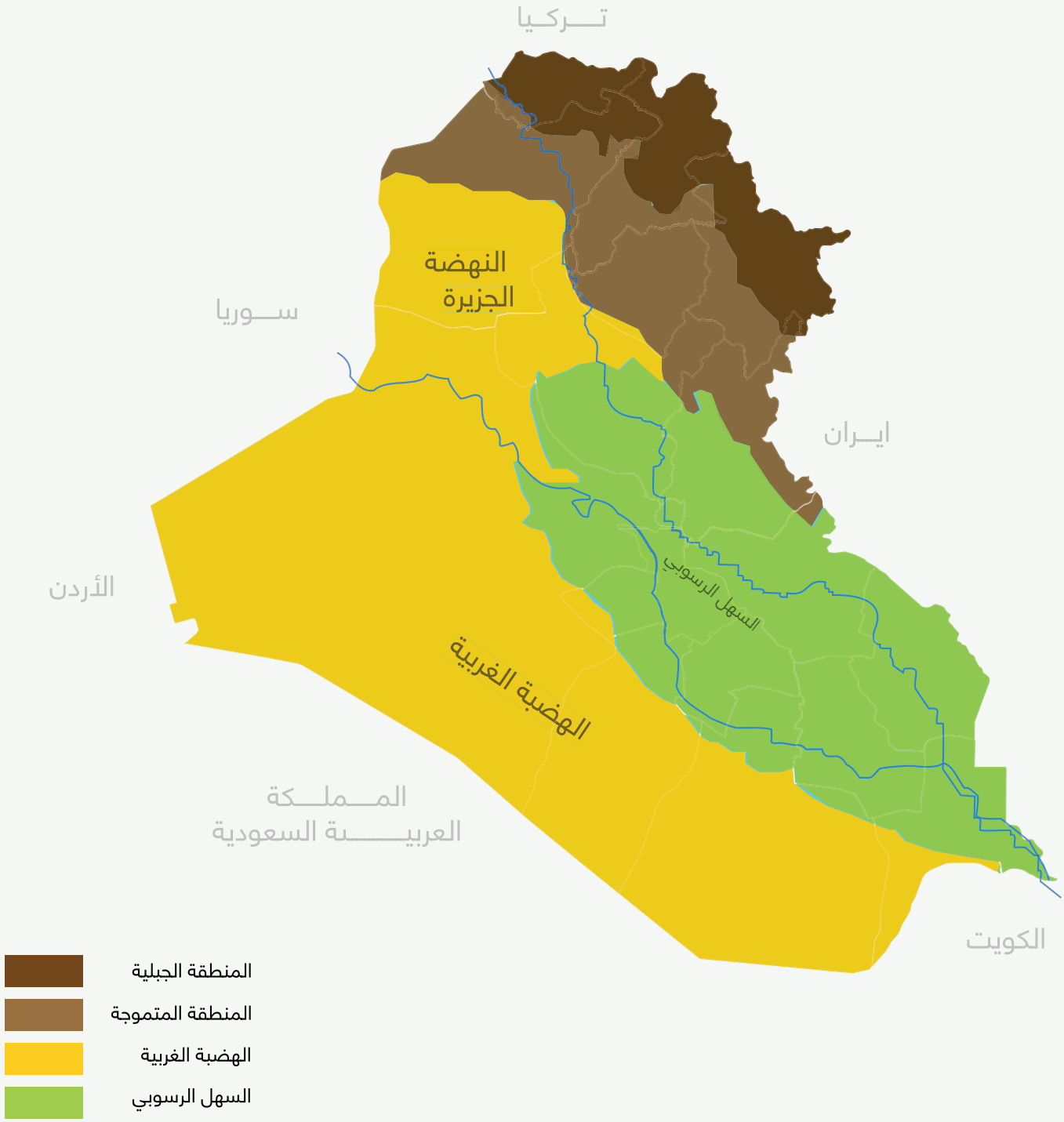
TOPOGRAPHY

Iraq is characterized by its geographical diversity and is divided into four main regions: the desert plateau (west of the Euphrates), the island (between the upper Tigris and the Euphrates), the northern highlands of the Kurdistan region of Iraq, and the sedimentary plain that extends from central Iraq to the Arabian Gulf (Table 1.3) and (Figure 1.3).

Table 1.3: Geographical regions of Iraq (Source: Ministry of Planning, Central Bureau of Statistics, Environment Statistics Section, 2017 and 2020)

Details	Area in km-	Percentage
The plains including the marshes and lakes	132500	30.5
Semi-mountainous Lands	42000	9.7
Mountains	92000	21.1
Deserts	168552	38.7
Total	435052	100

Figure 1.1: Topographic Map of Iraq (Source: General Authority for Survey)



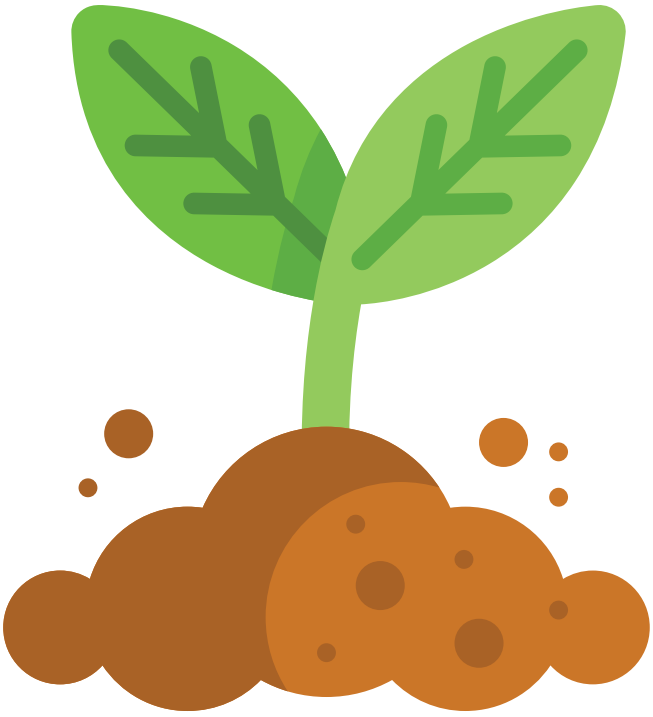
The desert plateau extends along the area west of the Euphrates River towards the desert of Syria, Jordan and Saudi Arabia, which is a dry area in most seasons of the year and is inhabited by Bedouins and has many valleys, some of which reach a length of 400 km and the rain fall in winter sometimes forms floods that threaten the Bedouins living in it. The desert covers the western and southwestern parts of Iraq, and it consists of limestone hills and sand dunes that extend into the desert of Syria, Jordan and the desert of the Kingdom of Saudi Arabia. In this desert spreads dry valleys that are filled with water after rainfall.

The island (semi-mountainous zone) is an area between the sedimentary plain and the mountainous area where the ground level begins to rise gradually. This area begins between the Tigris River north of the city of Samarra and the Euphrates River north of the city of Hit and extends to Syria and Turkey and was called the island because it is located between the Tigris and Euphrates rivers.

The mountainous area is mostly located in the Kurdistan region and covers an area of 92,000 km2 and begins south of the city of Kirkuk with Jabal Hamrin and extends east to Iran, west to Syria and north to Turkey. It is formed in the shape of a mountain arc that starts in the northwest of Iraq and heads towards the east, then bends towards the southeast, occupying about one fifth of the total area of Iraq. The first is part of the Zagros Mountains extending between Iran and Iraq, and the Taurus Mountains in Turkey, and the altitude here is more than 3000 m, where the highest peak in the mountains of Iraq is located is the Hasarost Peak (3607 m). The second region is a transitional zone between the low plains in the south and the high mountains in the north, occupying about 75% of the area of the highland region, and its altitude ranges between 400-1000 meters above sea level, and is of great economic importance. The Highland region is interrupted by narrow longitudinal plains cut through narrow rugged rivers, such as the Little Zab, the Great Zab and Diyala.

The sedimentary plain area begins south of Baghdad and extends to the Arabian Gulf, which is the area where the Tigris and Euphrates rivers pass, where these two rivers are linked by a group of channels and this area includes a group of marshes, some of which are permanent and others seasonal. The area was called the sedimentary plain due to the large quantities of sediments of the Tigris and Euphrates rivers, such as sand and mud in the region, as well as salt deposits, where there is a lake in southwest Baghdad such as Bahr al-Salt, a reference to the density of salt deposits, which reaches a thickness of 20 centimeters, and there are also two lakes north of Bahr al-Salt, namely the Habbaniyah and Tharthar lakes.

Iraq is characterized by its wide plains and swamps, and the plains consist of a flat central area known as the island in the north and the blackness of Iraq in the south. This area is penetrated by the Tigris and Euphrates rivers, and it rises gradually towards the west towards the Levant desert, and towards the southwest towards the Najd plateau. The Iraqi planes occupy about 20% of the entire country, and they extend in a rectangular shape 650 km from northwest to southeast between the city of Samarra on the Tigris River and the city of Ramadi on the Euphrates River in the north, the head of the Arabian Gulf in the south, and the slopes of Zagros in the east and the Badia al-Sham in the west. These plains are characterized by levelness, and their altitude does not exceed 100 m above sea level in most areas. The northern part is characterized by drought and lack of fertility, while the southern section is characterized by fertility, because it includes the fertile delta plain between the Tigris and Euphrates rivers.



CHAPTER TWO:

STATE OF THE ENVIRONMENT IN IRAQ

2

CHAPTER TWO: STATE OF THE ENVIRONMENT IN IRAQ

WATER Resources

Iraq is famous for its large river system, which consists of the Tigris and Euphrates rivers; the Tigris River, which originates in Turkey and enters Iraq at the town of Fishkhabour, is connected to it after entering the Iraqi border from its left bank by five tributaries that supply it with (65.77%) of its total annual waters, namely: T Rehe Khabur, the Great Zab, the Little Zab, the Azim and Diyala, and continues its course towards the Arabian Gulf, cutting a distance of 1418 km inside Iraqi territory. The Euphrates River, which also originates from Turkey, and enters Iraqi territory after passing through Syria, extends within Iraq for a distance of 1213 km approaching the Tigris at the city of Baghdad, and branches at the city of Musayyib into two large branches, Hilla and Hindi, and they meet at the city of Shinafiya, and it is divided again into two branches, Samawa and Suwayer, and unites again near the city of Al-Khader. The river loses 63% of its water in the summer between Hit and Nasiriyah due to branches, streams and swamps. The two rivers meet at the city of Qurna. They form a single stream known as the Shatt al-Arab, which traverses 204 km before emptying into the Arabian Gulf at the city of Faw. In addition, there are lakes, marshes and swamps in Iraq, which occupy about 15.5 thousand km2, the largest of which is the Hawizeh Marsh, which extends between Iraq and Iran. Table (1.2) shows the water imports of the Tigris River and its tributaries and the Euphrates River for the water year (2019-2020) by months.

Table 1.2: Water imports of the Tigris River and its tributaries and the Euphrates River for the water year (2019-2020) by months

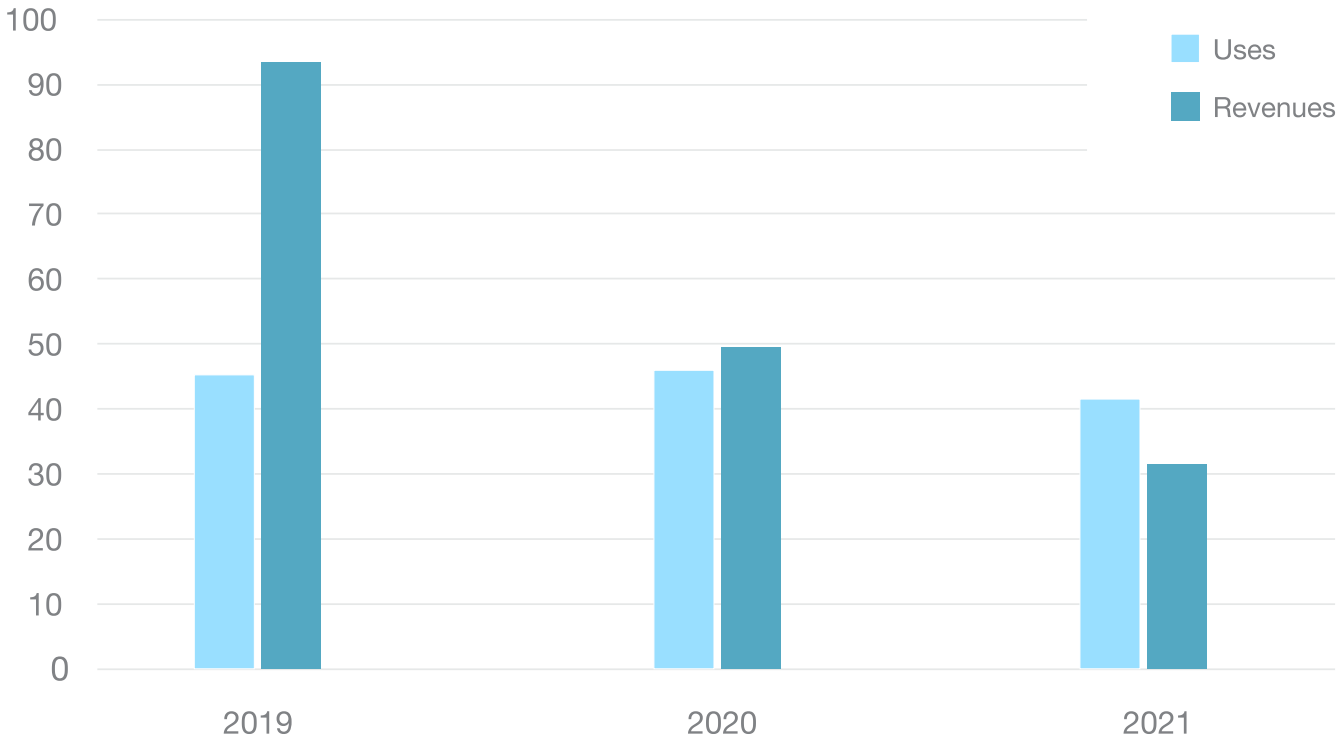
River	Monthly Rate (m^3/s)												Annual Rate	Annual Import
	T1	T2	K1	K2	February	March	April	May	June	July	August	September	(m^3/s)	(billion m^3)
Main Tigris River	111	95	119	160	278	673	522	397	231	480	585	608	362.42	11.44
Upper Zab tributary	200	100	117	175	300	700	900	700	382	175	75	70	324.50	10.23
Lower Zab tributary	41	45	79	129	273	358	339	232	98	48	1	2	137.08	29.4
Tributary of the Adhaim River	32	39	57	36	63	76	36	15	2	1	1	3	30.08	40.9
Tributary of the Diyala River	64	72	56	63	116	154	157	72	56	77	36	28	79.25	49.2
Revenue of the Euphrates River in Husaybah	779	720	800	866	854	913	725	492	346	280	3987	527	641.67	81.92
Total	1,227	1,071	1,228	1,429	1,884	2,874	2,679	1,908	1,205	1,061	1,096	1,238	1,575	10.95

Source: Ministry of Water Resources / Planning and Follow-up Department / Environmental Policies Section

Surface water:

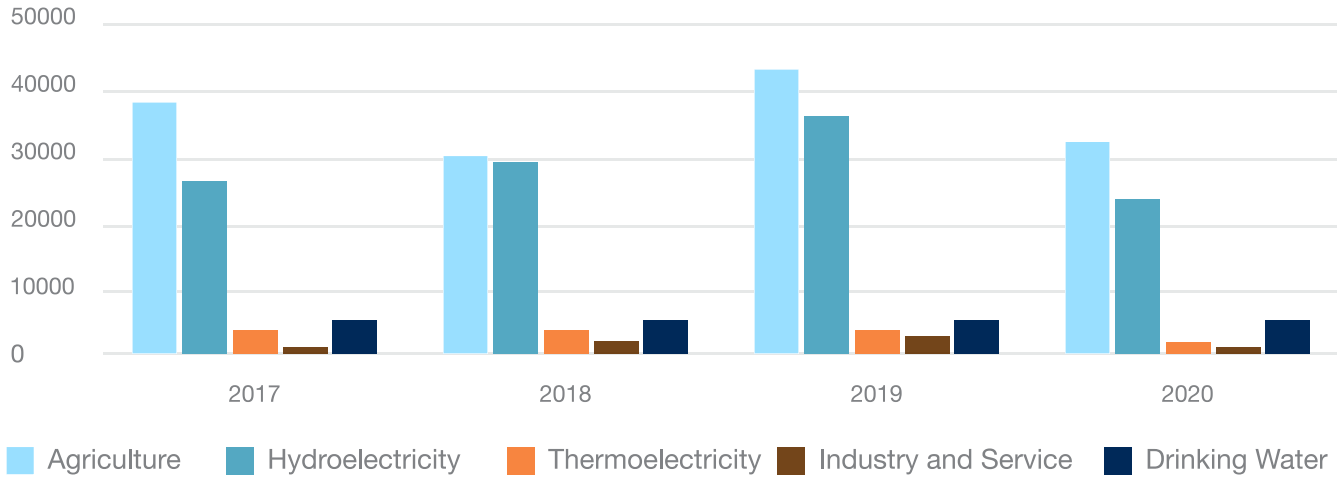
It is one of the main water resources in Iraq and consists of the Tigris and Euphrates rivers and their tributaries and the Shatt al-Arab. Before the construction of dams in the upper two rivers, the amount of surface water changed from season to season throughout the year, increasing during the spring (rainy season or flood) and decreasing in the summer and autumn seasons (dry season) and varying in its quantities from year to year depending on the variation in the amount of rain and snow sources. However, after the neighboring countries built a number of dams several years ago on the course of the Tigris and Euphrates rivers and their tributaries, the water resources to Iraq decreased significantly, which threatens to affect the water and food security of Iraq, because it caused the drying up of large areas of agricultural land that extend along the banks of the two rivers, especially the Tigris River. This calls for the need to sign agreements with neighboring countries (Turkey - Syria - Iran) on shared waters to determine the water shares entering Iraq, quantitatively and qualitatively, in line with the principles of partnership and equity to cover the current and future needs of Iraq and the establishment of joint water projects.

Figure 1.2: Surface water quantities (billion cubic meters) Annual revenues and uses in Iraq



This water is used for multiple economic uses, namely: agriculture, industry and services, hydroelectric and thermal electricity and drinking water. The following table shows the distribution of surface water uses to economic activities. The largest use of surface water is by the agricultural uses and hydroelectricity.

Figure 2.2: Distribution of Surface Water Use (Million Cubic Meters) by Economic Sectors in Iraq



Looking at the distribution of water uses by governorate, the data indicate that the share of Nineveh governorate is the lowest, reaching 1.7% of the total water used in Iraq. Wasit governorate was the highest at 15.6%. Figure 2.3 shows the percentage of distribution of water use for (agricultural, domestic, and industrial uses) for the water year 2019-2020 by governorate.

Figure 2.3: Percentage (%) Distribution of Water Use by Governorate

Also, Table (2.2) shows the storage levels achieved in dams and lakes (reservoirs).

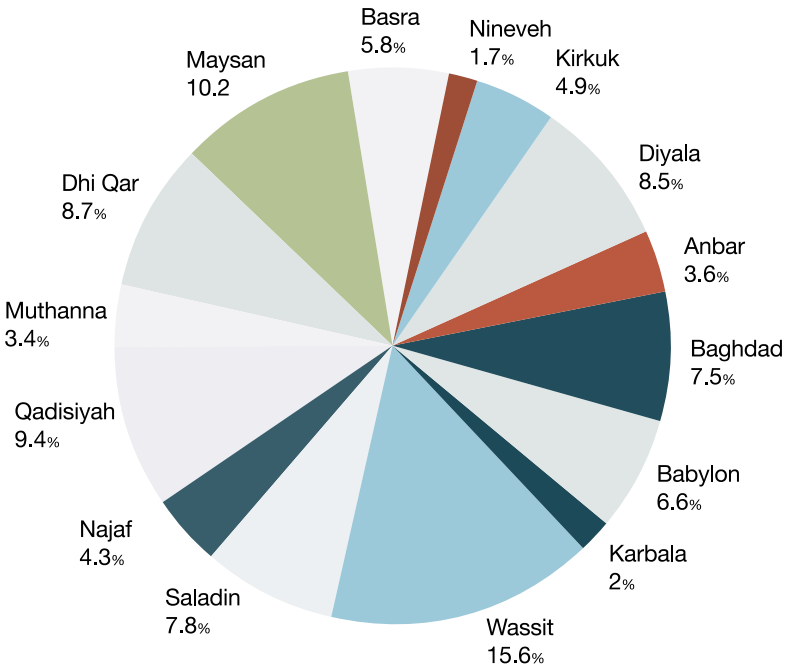


Table (2.2) Storage levels achieved in dams and lakes (reservoirs) on 1/10/2020 compared to the same date of 2019

Source: Ministry of Water Resources / Planning and Follow-up Department / Environmental Policies Section

Basin	Dam or lake	Achieved on 1/10/2019		Achieved on 1/10/2020	
		Water level (m)	Live storage (billion m³)	Water level (m)	Live storage (billion m³)
Tigris and Euphrates basins	Mosul Dam	316.55	5.98	320.78	7.23
	Haditha Dam	145.68	7.61	145.15	7.34
	Tharthar Lake	56.56	25.43	54.66	21.57
	Habbaniyah Lake	49.61	2.01	49.88	2.12
	Total		41.03		38.26
Lower Zab	Dukan Dam	503.12	4.78	497.16	3.42
Basin of the Adhaim River	Dam on the Adhaim River	128.4	1.25	124.38	0.87
Diyala	Darbandikhan Dam	471.51	1.45	468.50	1.29
	Hamrin Dam	102.57	1.97	96.90	0.76
	Total		3.41		2.05
Live storage up to lower ports (billion m³)			50.47		44.60

Table 2.3: Amount of Water Released in Lakes and Reservoirs by Months for the Water Year (2019-2020)

Source: Ministry of Water Resources / Planning and Follow-up Department / Environmental Policies Section

Loc-ation	Water Year	Months (m³/s)												
		Oct	Nov	Dec	Jan	Feb	Mar	Aprl	May	June	July	Aug	Sep	Annual Total (billion m³)
Tharthar Lake	2018 - 2019	0	43	822	602	1430	1775	4215	3652	1025	152	0	0	36.03
	2019 - 2020	0	0	46	43	203	616	821	663	51	0	0	0	6.3
Habbaniyah Lake	2018 - 2019	0	5	10	16	14	29	17	14	188	182	301	283	2.8
	2019 - 2020	92	78	169	282	112	348	178	69	47	69	108	103	4.37
Razzaza Lake	2018 - 2019	0	0	0	0	0	0	0	0	0	0	0	0	0.0
	2019 - 2020	0	0	94	83	34	0	0	0	0	0	0	0	0.6

Groundwater:

The amount of renewable groundwater annually is (4.3-5.234 billion m³) and increases or decreases according to the amount of rainfall.

Water from other sources:

- **Agriculture channels:** It is the water returned from agricultural projects, between the Tigris and Euphrates rivers mainly, and comes annually at about 3.8 billion m³ of poor quality due to agricultural use on regular agricultural crops with salinity exceeding 3000 parts per million. This water is used to feed the marshes provided that its salinity does not exceed (4000 mg/liter) and is also used by the Ministry of Petroleum in oil extraction facilities. Part of this water is desalinated by the Ministry of Agriculture; however, desalination is performed at small scale. Moreover, this water is also used to irrigate the green belts.

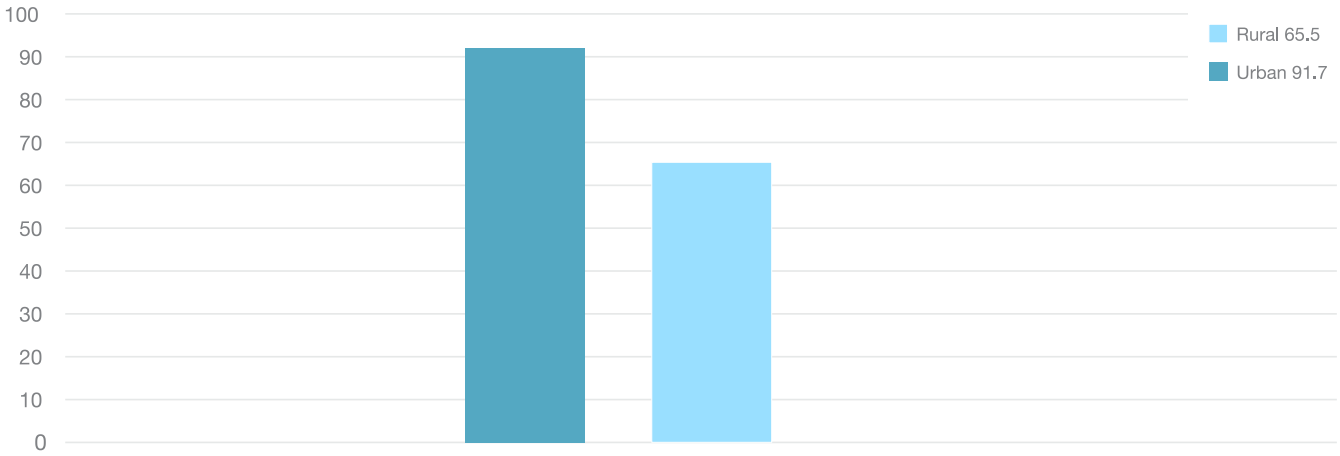
- **Treated wastewater:** The amount of wastewater increases with the increase in the population, and despite its relatively large quantities, the treated wastewater reaching about 580 million m³ in recent years, its use as a source of water is still in its early stages, as it was used in Baghdad and some provinces in a very limited way to irrigate some areas of the green belt.

Data from 2020 shows that water loss is 20%. Table 2.4 indicates the total and produced raw water quantity, the percentage and average of the quantities of water lost during water distribution network, and the amount of water distributed free of charge and sold for the year 2020. Figure 4.2 shows the percentage of population served by potable water distribution networks by environment for the year 2020.

Table 2.4: The total amount of raw water produced, the percentage and average of the quantities of water lost during transportation in the water distribution network, and the amount of water distributed free of charge and sold for the year 2020.

Average quantities of raw water withdrawn to water production plants * (m³/day)	Average quantities of water produced from water production plants (m³/day)	Percentage of average water losses during transportation in the water distribution network	Average amount of water loss during transportation in the water distribution network (m³/day)	Average amount of water distributed free of charge (m³/day)	Average quantity of potable water supplied (sold water) (m³/day)
18,662,038	15,795,940	20.1	3,174,901	305,619	12,315,419

Figure 2.4: Percentage of Population Served by Potable Water Distribution Networks by Environment for the Year 2020



LAND AND VEGETATION COVER

The land makes up the vast majority of Iraq's area of 435,052 km² while Iraq has approximately 105 km of coastline and 716 km² of territorial seas. The geography of Iraq varies and can be divided into five main regions: the desert in the west and southwest of the Euphrates River, Upper Mesopotamia (between the Tigris and Euphrates rivers), the northern highlands of Iraq, the lower Mesopotamian regions and the Mudmashat extending from Tikrit to the Arabian Gulf.

The mountains in the northeast are an extension of the Alpine system that stretches east from the Balkans through southern Turkey, northern Iraq, Iran and Afghanistan and eventually to the Himalayas in Pakistan. The desert is located in the southwestern provinces along the borders with Saudi Arabia and Jordan and geographically belongs to the Arabian Peninsula. The following describes these areas in more detail:

- **Upper Mesopotamia:**

The highlands between the Tigris rivers north of the Hamrin Mountains and the Euphrates north of Hit are known as the island and are part of an area extending west to Syria and Turkey. Water flows in the area in deep valleys. The southwestern regions of this area are classified as desert or semi-desert. The northern parts that include places like the Nineveh Plains, Dohuk, and Zakho are mainly made up of Mediterranean vegetation.

- **Lower Mesopotamia:**

It starts from the north of Baghdad and extends to the Arabian Gulf, where the Tigris and Euphrates rivers are located above the level of the plain in

many places and the whole region is a river delta intertwined with rivers and irrigation channels. The Tigris and Euphrates rivers also carry large amounts of salt, as high groundwater levels and poor subsurface drainage lead to a concentration of salts near the soil surface. In general, soil salinity increases from Baghdad in the south to the Persian Gulf and severely limits productivity.

- **Highlands:**

The northeastern highlands start south from Mosul to Kirkuk and extend to the borders with Turkey and Iran. The mountains of this highland area is ranging from 1,000 to 3,611 meters near the Iranian and Turkish borders. With the exception of a few valleys, the mountainous area is only suitable for grazing in the foothills and plains, however, sufficient soil and rainfall make farming possible. There are also large oil fields near Mosul and Kirkuk.

- **Deserts:**

The deserts are located to the west and southwest of the Euphrates River and are part of the Syrian desert and the Arabian Desert covering parts of Syria, Jordan, Saudi Arabia and most of the Arabian Peninsula. The sparsely populated lower areas of nomadic peoples consist of a vast rocky plain interspersed with sandy expanses. A forked pattern of valleys – watercourses that dry up most of the year – stretches from the border to the Euphrates. Some valleys are more than 400 kilometers long and face short but heavy flooding during winter rainfall. Western and southern Iraq covers a vast desert area of about 168,000 square kilometers, nearly two-fifths of the country's area. The Western Desert rises as an extension of the Syrian desert to heights of more than 490 meters. The elevation in the southern desert varies from 300 to 800 meters. It reaches a height of 951 meters at Mount Unaizah at the intersection of the borders of Jordan, Iraq and Saudi Arabia

- **Tigris and Euphrates River System:**

The Euphrates River originates in Turkey and enters Iraq in the northwest and the Tigris River rises in Turkey but enlarges through several rivers (valleys) in Iraq, all of which join the Tigris River over Baghdad and Diyala, which are joined at about thirty-six kilometers below the city. Both the Tigris and Euphrates rivers overlap a number of canals in the marshes region. Moreover, the marshes act as silt traps and the Shatt al-Arab is relatively silt free as it flows south. Syria built a dam on the Euphrates River which led to a significant decrease in the flow of water and floods no longer represented any problem in the mid-eighties as it had previously been, and in 1988, Turkey also built a dam on the Euphrates River that would further restrict the flow of water. It is worth noting that there was no change in the land-use map (Table 2.5) between 2017 and 2020.

Table 2.5: Land Use by Area and Percentage in Iraq

Source: Ministry of Planning, Central Bureau of Statistics, Environment Statistics Section, 2017 and 2020

Type of use	Area (Million Dunum)		Percentage	
	2017	2020	2017	2020
Desert and nomadic areas	54.0	54.0	31	31
Total arable land	23.4	13.5	27.4	27.4
Water surfaces and residential lands	47.7	47.7	27.4	27.4
Natural pastures	16.0	16.0	9.2	9.2
Natural forests	7.0	7.0	4.0	4.0
Barren mountains	1.7	1.7	1.0	1.0
Total in Iraq	149.8	139.9	100	100

As for soils in Iraq, soil surveys and classification began before 1950. At this time, the number and type of soil units in Iraq were not complete due to the lack of semi-detailed or detailed surveys covering all parts of Iraq. Only 35% of Iraq is covered by semi-detailed surveys with soil maps ranging from a scale of 1 to 50,000 to 1:25,000. There is no general soil map (soil classification or any other system) covering the whole of Iraq yet The excavation carried out in 1960 using the 1938 system is the common work carried out on Iraqi territory and has classified 17 large groups of known soil groups. So, the need for a semi-detailed survey to develop a large-scale soil map is absolutely necessary. In order to develop a general map of soil in Iraq following the USDA soil classification, 300 samples representing all Iraqi soil types expected from previous work were collected. Data collected using the 2012 soil classification key has been reclassified. The digital soil map is developed on a scale of 1: 500,000. The results indicated that there are five soil ranks, each one showing some differences with common characteristics that reflect the influence of the prevailing soil formation factors, and their order was arranged according to their dominance as follows (Aridisoils 62.5%), (Entisoils 16.2%), (Inceptisoils 12.6%), (Mollisoils 3.8%) and (Vertisoils 1.2%). Twelve branches belonging to the dominant groups were identified. Therefore, the land was divided according to its productive capacity into eight varieties:

- **Class I:**

Suitable for the cultivation of all field crops, vegetables and orchards and is free of any specific problems.

- **Class II:**

Suitable for all field crops, but it is characterized by a lower density than the first variety due to the presence of some determinants such as salinity and degree of slope.

- **Class III:**

Average production due to the presence of some determinants such as poor puncture.

- **Class IV:**

It is used for crops to a limited degree due to the presence of soil and climate determinants.

- **Class V:**

It is suitable for pastures and forests and is not suitable for growing field crops due to severe erosion and is exposed to floods and harsh weather conditions.

- **Class VI:**

More determinants than the fifth variety and is suitable for pastures to a lesser degree.

- **Class VII:**

Suitable for grazing, forests and wildlife.

- **Class VIII:**

It is not suitable for cultivation and is used as reserves.

Soil is an important natural resource and is a natural body consisting of mineral and organic substances, water and air in which the plant fixes its roots and from which it derives its nutritional needs. The soil of Iraq is characterized by other general characteristics, namely:

- Poor in organic matter, due to the lack of natural vegetation and high temperatures, especially during the summer months, which leads to oxidation of organic matter and reduces its accumulation in the soil.

- Rich in salts and other nutrients, due to the nature of the rocks from which they are derived, as well as the lack of rain and the increase in the amount of evaporation in most parts of Iraq, which leads to the accumulation of salts in the soil.

The characteristics of the soil in Iraq vary from one region to another depending on the variation of the terrain, climate and natural vegetation, so soils in Iraq can be classified as follows:

- **First:**

Sedimentary plain soil: Movable soil from the fragments of the original rocks that are located in places far from the sedimentary plain, where the water of rivers and valleys transported those fragments and deposited them in the sedimentary plain area, and its soil is characterized by a high percentage of clay and silt and a lack of sand, so its

fabric ranges from soft to medium, and in general it is a deep soil up to several meters deep and contains a high percentage of lime and a low percentage of gypsum and a low percentage of organic matter and high salinity, and can be divided as follows:

- **Soil for river terraces:** It extends within the area between the mouth of the Adhaim River and Balad in the south and the Fatha area in the north and is one of the oldest types of sedimentary soil, as it was formed during the rainy era, which was characterized by the washing away of large quantities of sediments by running rainwater from the mountainous region and deposited in those geographical locations, so the bulk of these sediments consists of gravel and coarse fragments as well as silt and the percentage of lime rises and reaches about 40% and therefore it is a poor soil in terms of agricultural production.

- **Floodplain soil:** Occupies the area extending from the south of the soil of the river terraces to the marshes area in southern Iraq and was formed by the sediments of the Tigris and Euphrates rivers during repeated floods and due to the irregular distribution of the amount of sediment between nearby places and places far from riverbeds, as the soil of the terraces and the basins has been formed. The soil of the rivers terraces is characterized by its medium weaving and good drainage, and the low level of ground water in it because it is higher than the neighboring lands, and the low percentage of salts compared to the soil of the basins, which is suitable for the cultivation of various crops, noting that the soil of river basins increases the proportion of clay, forming soft or medium tissue, poor drainage, high ground water level, and the percentage of salts, and most of them have turned into arable land, especially in the southern section of the floodplain.

- **Marshes and Marsh Soil:** The boundary between the permanent marshes and the soil of river basins is formed within the geographical area extending between the cities of Nasiriyah, Amara and Qurna, which is a newly formed soil that is subject to inundation with the waters of the Tigris and Euphrates rivers, which leads to the addition of a percentage of clay and silt annually. It is characterized by a high ground water level due to the low land level as well as the high percentage of organic matter, as it reaches in some locations more than 10% due to the density of vegetation cover that spreads in them.

- The soil of the Shatt al-Arab region and the coastal flats: It extends in the form of a narrow longitudinal range along the Shatt al-Arab from the south of the city of Qurna to the northern coast of the Arabian Gulf and is affected by the phenomenon of tides, which have a major role in washing salts from the soil near the course of the Shatt al-Arab and thus are good for agricultural production, especially palm trees and vegetables.

- Saline land also spreads away from the course of the Shatt al-Arab and occupies the coastal area on the Arabian Gulf and Khor Al-Zubair and is affected by the tide due to the low land level and this soil consists of clay sediments and has high salinity.

- The soil of the coastal edges extends between the Iraqi-Iranian border and the eastern edges of the Tigris flood plain within the spatial space that starts from the southeast of Khanaqin to the northeast of Maysan province and was formed by the sediments brought by waterways descending from the Iranian highlands and consists of coarse sediments in locations near the border and gradually decreases roughness until it becomes of soft fabric in which the proportion of clay rises in the eastern section of the Tigris flood plain and its salinity is medium.

Second:

The soil of the desert plateau consists of rock fragments that date back to different geological eras under the influence of erosion and weathering factors due to rain, wind and temperature variation, as the soil minutes in some locations were subjected to the process of erosion by running water or wind, so its thickness is shallow does not exceed a few centimeters and its thickness ranges in other places such as the valleys of the depressions between 3-7 m. In general, it consists of clay, alluvial and sandy deposits, in addition to some calcareous components, so agriculture is concentrated in those valleys and depressions, as in the Zubair district in Basra province, the areas of Al-Haidariya and Al-Khan in Karbala province, as well as some sites in the provinces of Najaf and Anbar.

Third:

Soil of the mountainous and semi-mountainous region: Its characteristics differ from the soil characteristics of the sedimentary plain and the

western plateau due to the different terrain and the quality of the rocks from which it is derived, as well as the different climatic conditions and natural vegetation, and can be classified as follows:

- Dark chestnut soil: It covers the valleys and plains that exist between mountain ranges, such as the plain of Shahr Zour and Rania and Sindhi and is rich in mineral and organic materials and may reach a depth of several meters as well as being well drained, so it is one of the types of fertile soil in which the productivity of agricultural crops is high.

- Deep and medium brown soil and spread in the south and southwest of the mountainous region, and covers the plains, valleys and foothills and may increase in depth in the depressions and decrease above the highlands and is fertile and rich in mineral and organic materials and this helps to spread demi-agriculture in it as in the province of Kirkuk and the Erbil plain.

- Red brown soil: It spreads to the south of the previous soil (deep and medium structure) and is characterized by a reddish-brown color containing calcareous or gypsum materials.

- High mountain soil: It covers high mountain peaks and steep slopes and is shallow due to continuous erosion and is therefore unsuitable for agriculture.

- In summary, it can be deduced that the soil in Iraq is exposed to two main problems:

1. The problem of erosion and washout due to running water or wind

2. Salinity problem.

- Forests are one of the indicators of vegetation abundance, as the total area of forests in 2017 and 2020 is estimated at 5.4 and 2.8 million dunums, respectively, a decrease of 48%. As for the vegetation cover, it symbolizes the growth of plants in a certain area, including all the plant forms inside it. As a general term, it refers to forests, grasses, gardens, algae, and every vegetation cover found on the planet. The term vegetation has emerged for its importance in maintaining the ecological balance.

- The problem of drought and desertification is among the most important challenges that negatively affect the abundance of vegetation cover, and it can be said that the deterioration of vegetation cover in arid and semi-arid areas represents the most serious factors of desertification. In Iraq, most of the desert and semi-desert (or valley) areas are classified as pastures of arid and semi-arid areas, with an area of more than 200,000 km2 (about half of Iraq's total area), which is an extension of the Syrian and Saudi deserts and includes the desert of the island and the northern (western) and southern Badia. As a result of the absence of sound scientific management and mis-exploitation represented by overgrazing and early and cutting trees and shrubs for the purpose of fuel, as well as the secretions of wars, military activities and other factors that led to disruption in this ecosystem and created an imbalance between natural plants on the one hand and humans and their animals on the other, and one of the most prominent results was the deterioration of vegetation cover and the exposure of some species to the risk of extinction, or the disappearance of some species in their natural habitats and the emergence of other undesirable species.

DESERTIFICATION

The threat of desertification is a global problem that occurs in many environments around the world, where large areas of land are transformed over time into desert or semi-desert lands, causing economic and health risks. By taking a simple look at the natural map of the region, you can estimate the extent of the desertification problem by observing signs and evidence. Among these signs and evidence of desertification are the following:

- The presence of barren sandy areas in the middle of agricultural land.

- Immersion of irrigation channels, trocars, trees, buildings and external roads with dust.

- Lack of natural plants and wild animals.

- The increasing phenomenon of dust storms and their health hazards, air pollution and dust accumulation in cities.

- The presence of a clay and alluvial layer under the sand dunes, which indicates that this sand has recently encroached on it.

The continued overuse of land, water and natural resources without taking appropriate measures has resulted in a decrease in plants, which constitute an important element of the biological cycle of the soil, which in turn maintains and improves the physical properties of the soil against erosion and desertification factors, which was helped by the prevailing hot and dry weather conditions accompanied by dry winds in the summer and the absence of rain, in addition to the presence of sandy desert on the edges of the sedimentary plain.

The failure to take the necessary measures, enact regulations and legislation, reorganize the use of land, water and natural resources, and prevent harmful practices such as overgrazing, logging, hunting wildlife and rationing irrigation to stop this deadly encroachment of millions of tons of quicksand, which in turn has led to an increase in the area of land desertification or threatened by desertification.

In general, Iraq has been facing serious desertification problem, represented by the increase in land areas affected by salinity and waterlogging, the significant deterioration that has occurred in vegetation cover, and the increase in areas covered by moving sand dunes as a result of land degradation and wind erosion. In general, the factors described below are among the most important natural and human factors that have contributed to the exacerbation of desertification:

1. **Wind and water erosion.**

2. **Creeping sand dunes.**

3. **Salinization and waterlogging.**

4. **Human mismanagement of land, water and natural resources.**

The factors mentioned above have contributed in turn to the deterioration of vegetation cover in Iraq as a result of the formation of sand dunes and the occurrence of sand and dust storms, and the paths of the dunes are formed in the form of three sand belts as shown in Figure (5.2):

- **1. Northern Sand Belt**
- **2. Eastern Sand Belt**
- **3. Central Sand Belt**

Although Iraq is known for its water resources, the desert covers a large percentage of its area, while the phenomenon of desertification is now besieging non-desert lands, as it eliminates the fertility of the land and reduces its productivity, and creeps rapidly towards the green line west of the Euphrates and puts great pressure on the rural population and forces them to leave their villages and places of original residence. Figure (6.2) shows a map with the distribution of the main land covers in Iraq, where it is found that barren and arid lands occupy large areas, especially in the western plateau, while there are important areas of the land covered with bushes and shrubs. As for the covers that include agricultural areas, it is noted that they have small areas and that they are located around the irrigated areas, except for the northern regions. The map (Fig. 6.2) also shows the distributions of water bodies and wetlands in Iraq.

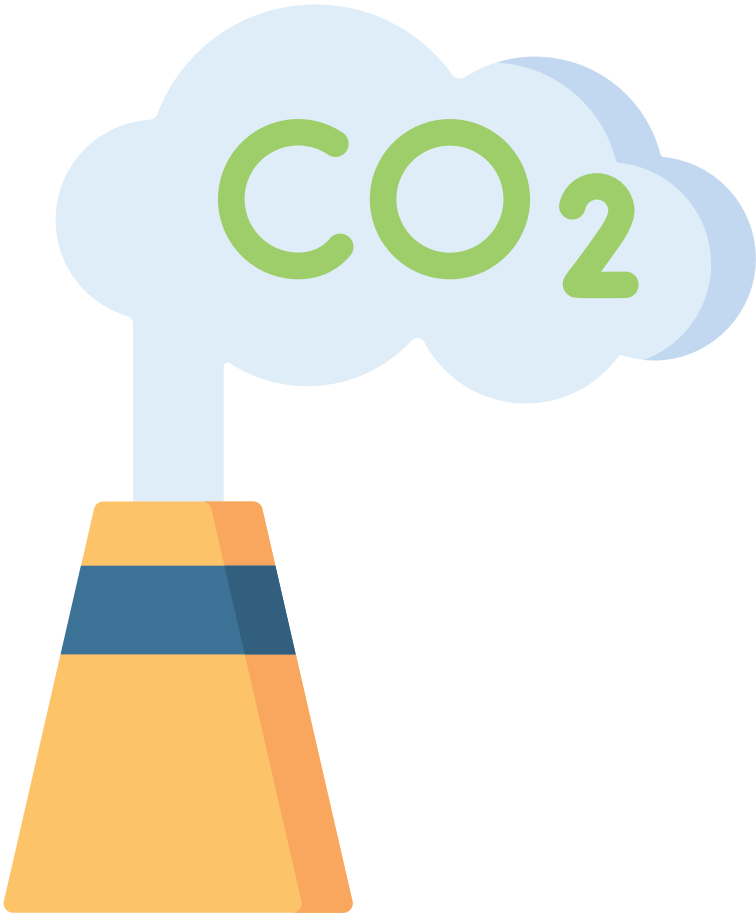
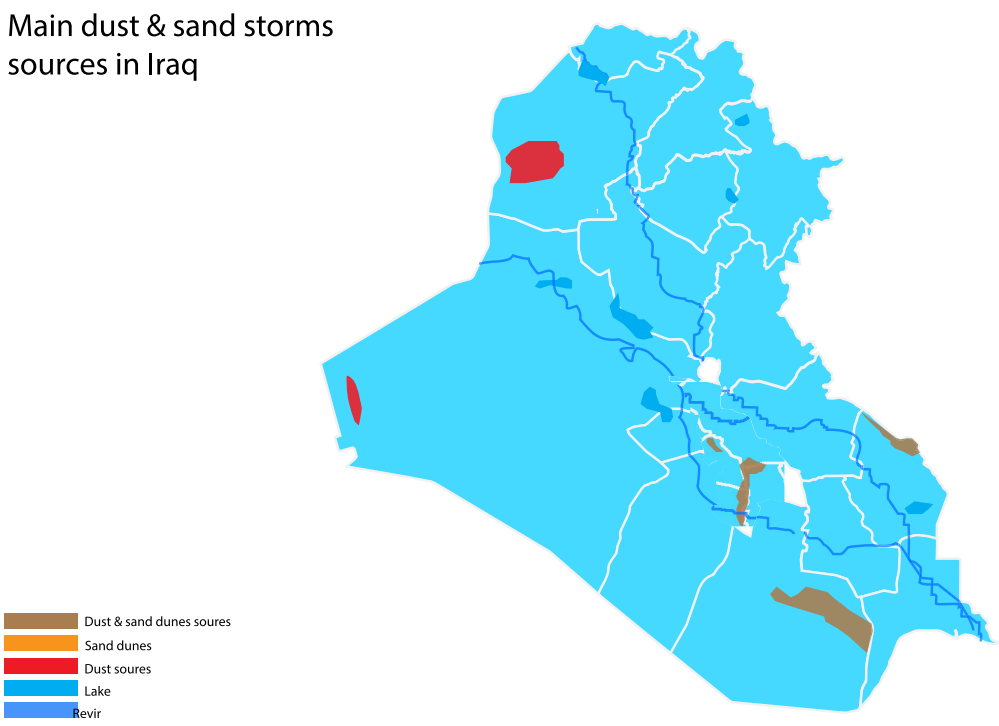


Figure 2.5: Active sand dune areas in Iraq (Source: Ministry of Environment: National Action Programme to Combat Desertification in Iraq)



It is noted from Table (2.6) that the total land affected by soil erosion or desertification for the year 2016 was about (160,588,000 dunums), which indicates the exacerbation of desertification in Iraq. It is noted from Table (2.7) that there is a continuous increase in the area of land threatened by desertification.

Table 2.6: Area affected by soil erosion and desertification in Iraq (Source: Ministry of Planning, Central Bureau of Statistics, Environment Statistics Section, 2017 and 2020)

Type of desertification	Intensity	Affected area (dunums)		Percentage	
		2016	2021	2016	2021
Wind erosion	Light-medium	5724000	No updated data	3.56	-
	Severe-very severe	2612000		1.63	
Water erosion	Light-medium	18764000		11.68	
	Severe-very severe				
Soil salinization	Light-medium	5288000		3.29	
	Severe-very severe	26716000		16.63	
Soil hardening	Calcification	67084000		41.77	
	Gypsum	34400000		21.42	
Total in Iraq		**160588000**		100	

Table 2.7: The most important indicators of desertification in Iraq (source: Ministry of Planning, Central Bureau of Statistics, Department of Environmental Statistics, 2017-2020)

Indicators	2018	2019	2020
Area of desert and desertified land (million dunums)	26.8	27.3	27.3
Area of land threatened by desertification (million dunums)	93.7	94.3	94.3

According to the National Action Programme to Combat Desertification in Iraq, which constitutes a comprehensive framework and the action plan of the Iraqi government, taking into account the set of relevant national policies, strategies and programs and in line with the requirements of international conventions, in particular the International Convention to Combat Desertification, the plan of the National Action Programme to Combat Desertification and its proposed procedures and projects aim to achieve the following strategic objectives:

1. **Rehabilitate ecosystems, conserve natural resources and limit their degradation.**

2. **Develop and strengthen institutions, human resources and legislative frameworks.**

3. **Improve awareness, education and education at all levels.**

POPULATION

The estimates of the Central Bureau of Statistics at the Ministry of Planning indicate that the population of Iraq for the year 2020 has reached (40,150,174) million people compared to 2021, where it reached (41,190,658) million people, with a growth rate of 2.59%, and the population of Iraq for the year 2021 is distributed by (20,810,479) million males, constituting (51%) of the total population, while the number of females was estimated at (20,380,179) million people, constituting (49%) of the total population. It is estimated that the urban population of Iraq reached (28,779,201) people for the year 2021, representing (69.9%) of the total population of Iraq, while the population of rural areas reached (12,411,457) people, or (30.1%) of the total population of Iraq. These estimates showed that the capital, Baghdad, is the highest governorate in population for the year 2021, with an estimated population of (8,780,422) million people, constituting (21.3%) of the total population of Iraq, while Muthanna Governorate came as the least populous governorate with about (880) thousand people, constituting (2.1%).

Population is closely linked to nature as they determine the pattern of their settlement on the land and the pattern of their economic activity. The population lives on resources, especially land and water provided by the natural environment for them, and often determine the resources, quantity and quality, pattern of stability. The majority of the population is concentrated near rivers and water sources. Besides land quality and climate, other factors such as trade, management systems, services and capital investments affect the geographical distribution of the population and the population density of that distribution. In turn, the disparity in geographical distribution was reflected in the difference in the social structures of regions and cities among themselves on the basis of differences in their historical functions or in their natural conditions, despite their possession of common interests. It is easy to see that the characteristics of an commercial river city such as Mosul differ from a tribal town on the edge of the desert, such as Souq al-Shuyoukh, from a holy religious city such as Najaf or from Baghdad, the center and the capital. The primary factors influencing the population can be summarized as follows:

First: Natural Factors

- **Water resources:**

Since the dawn of history, Iraq's civilization has been associated with the presence of water, and the population has been concentrated in huge numbers in Mesopotamia and the narrow strip along the Tigris and Euphrates rivers.

- **Environment:**

Iraq is characterized by the diversity of its geographical environments. There are four environments, the first is the sedimentary plain area, which is a low plain area and constitutes a spacious plain cut by huge rivers that leave their heavy load and lead to the emergence of sedimentary land interspersed with water areas, as is the case in the southern regions of Iraq. The plain area constitutes one third of the area of Iraq (500,132 km2) and this sedimentary plain extends between the city of Balad on the Tigris River and the city of Ramadi on the Euphrates River from the north and the Iranian border from the east and the desert plateau from the west and includes the marshes and lakes area. Due to the scarcity of rain in these environments and the high temperatures, dry climates suitable for certain types of plants and animals have been formed, and with the abundance of food they have attracted populations who have adapted to these environments, creating adaptive and associated communities, and forming distinct social and economic patterns. The population in this area is concentrated near the rivers, constituting two thirds of Iraq's population. The second region is the plateau, which is located in western Iraq and occupies about 39% of the country's area (168,552 km2) and ranges in altitude between (100-1000 m)

and includes the island region. It is characterized by the scarcity of rainfall and the dry climate, all of which impose a life of movement and living a Bedouin lifestyle. The third mountainous region is located in the northern and northeastern part of the country and extends to its common borders with Syria, Turkey and Iran in the west, north and east, and this area occupies 21% of the area of Iraq (92,000 km^2) and includes the governorates of: Sulaymaniyah, Erbil and Dohuk. With high mountains, the population, the cold environment and the abundance of water created different patterns. Between the low plains in the south and the high mountains in the far north and northeast, there is an undulating transition zone that occupies half of the mountainous area (67,000 km^2), of which (42,000 km^2) is outside the mountainous environment and ranges in altitude from (100-200 m) and (25,000 km^2) within the mountainous area and ranges in altitude between (200-450 m).

- **Climate:**

Climate is one of the important natural factors affecting the geographical distribution of the population, because of its effects on human organic functions, as well as its impact on the quality of soil and natural and agricultural plants. Iraq is dominated by a subtropical continental climate, characterized by mild cold winters and very hot dry summers, while the Mediterranean climate prevails in northern Iraq with mild winters and summers. The first rain line crosses the Euphrates passing through southern Harran, then crosses the Khabur on the road with Mount Sinjar and bends to the southeast to cross the Tigris River south of Mosul and continues the mountain line in eastern Iraq. This line marks the boundary of the steppe and is the meeting point of the worlds of agriculture and nomadism. The 100 mm rain line crosses the Euphrates south of Deir ez-Zor, then runs southeasterly to the Tigris between the small Zab and Diyala rivers, then runs south, passing west of Baghdad, crossing the middle of As-Sawad to the Arabian Gulf, marking the beginning of the desert. The fact that rainfall is limited to the winter season between October and March, its scarcity, has forced the population to rely on surface water resources for agriculture within the plain area and on groundwater resources within the plateau region.

- **Second: Administrative Factors**

Administrative centers attract the population, as the administrative factor have a an impact on the establishment of cities and with the change and development of the state and the management system in it and over the course of the twentieth century, the importance of the administrative factor has increased regarding the prosperity of governorate centers, and their rise as administrative centers where government institutions are located. These centers expanded at the expense of the rest of the cities that have declined in their administrative role.

The development of administration mechanisms and local governance and its impact on the distribution of the population, as the emergence of local government institutions in Iraq was linked to the implementation of governance policies in terms of classifying the city according to its importance and population and spatial size. Currently Iraq consists of 18 governorates that differ in terms of area and population size, and the governorates of the Kurdistan region have an administrative status (federal region) different from the rest of the provinces of Iraq. Anbar province is the largest and least populated province in Iraq, while the holy province of Karbala is the smallest province, and Baghdad has the largest population. Administratively, the governorates, in turn, are divided into a group of districts, where there are 118 districts belonging to the governorates of Iraq, while the neighborhoods are the smallest units. The administrative standard is adopted to differentiate between administrative units, where there are 393 districts administratively affiliated to these provinces. The concentration of public services and institutions of government, which encouraged the population in the neighboring rural areas to either work in the urban center or enjoy existing services, made the administratively classified urban settlements attractive areas for the population coming from the nearby countryside where there are health centers, hospitals, doctors' clinics, schools and libraries, as well as police stations and army units.

Economic Factors: The past four decades of development in Iraq, through its development plans, programs and policies, have witnessed the adoption of distorted central mechanisms in the field of allocation and distribution of investments at the sectoral and geographical level, which led to the deepening of structural imbalances and the concentration of the results of development in specific governorates without others and increasing the disparity in the levels of economic, social and urban development and thus rooting the phenomenon of (spatial duality) in Iraq.

The effect of the population distribution pattern on population density: The relationship between the diversity of natural environments and the distribution and density of the population in Iraq is clear, as the phenomenon of population density is associated with the governorates located in the plain region, such as in Baghdad, Babylon, Qadisiyah and Diyala, and decreases in the plateau provinces such as Anbar. The impact of the environment also extends to the governorate itself, in the governorates located on the banks of the rivers, the plain extends along it and we find it a suitable place to encourage human settlement, so that rivers and their branches and fertile plains suitable for agriculture are preferred for the population. The population density in Iraq is estimated at about 73 people per square kilometer, which is a moderate percentage compared to international standards, but this percentage does not constitute the reality of population density, as cities are concentrated in the cities of Mesopotamia, as the population density rises if we exclude the wide deserts to about 119 people per square kilometer.

CLIMATE

The impact of climate conditions varies in terms of temperature, amount of rainfall, atmospheric pressure and winds between parts of Iraq as a result of the variation of natural conditions such as terrain, natural vegetation, the impact of water bodies and the abundance of water from one season to another, and the impact of climate elements is clearly shown during the summer and winter, which are the two main seasons in Iraq, while during the spring and autumn seasons, they are transitional seasons that do not exceed two months throughout Iraq, in which the climate elements are moderate. The most important elements of the climate in Iraq will be addressed as follows:

- **Temperature**

Temperature is one of the most important climate elements, due to its direct impact on other climate elements such as atmospheric pressure, wind and rain. Temperatures in Iraq vary during the night and day and between summer and winter, which determines the characteristics of the prevailing climate in Iraq, which is a continental climate. Perhaps the greatest impact of climate change as a result of unprecedented high temperatures is its threat to food security as a result of the decline in water resources and agricultural production, the deterioration of vegetation cover and the loss of biodiversity, as climate change poses a threat to vital economic investments, as well as social, economic and health repercussions, the spread of diseases and the exacerbation of epidemics.

Statistical analyzes indicate increasing trends in the average temperature in all stations belonging to the General Authority for Meteorology and Seismic Monitoring, for example, the monthly average of the minimum and maximum temperature for the year 2020 in the city of Baghdad was 16.9 and 32.3 degrees Celsius, respectively, and the data indicate that the general average for the previous 40 years in temperature in the city of Baghdad has reached 22.7 degrees Celsius, while the general average in the city of Baghdad for the year 2020 has reached 24.5° C with an average increase of 1.8° C. While the monthly average of the minimum and maximum temperature for the year 2020 in the city of Mosul was 14.2 and 29.1 degrees Celsius, respectively, the data indicate that the general average for the previous 40 years in temperature in the city of Mosul has reached 20.2 degrees Celsius, while the general average in the city of Mosul for the year 2020 reached 21.4 degrees Celsius, with an increase rate of 1.2 degrees Celsius.

The monthly average minimum and maximum temperature for the year 2020 in southern Iraq in the city of Basra was 18.4 and 32.1 degrees Celsius, respectively, and the data indicate that the general average for the previous 60 years in the city of Basra reached 24.9 degrees Celsius, while the general average for the year 2020 reached 30.1 degrees Celsius, with an increase rate of 5.2 degrees Celsius. It is noted from the indicator of the highest daily maximum temperature that the average daily temperature in Iraq has reached (47 degrees Celsius) and the highest daily average was recorded in the city of Nasiriyah in southern Iraq (49.9 degrees Celsius).

Based on temperature data in Baghdad, Mosul and Basra, shows that the general average temperature in previous years was about 22.6 degrees Celsius, while the general average in the three cities referred to above for 2020 reached 25.3 degrees Celsius, with an increase rate of 2.7 degrees Celsius.

- **Relative Humidity**

The distribution of relative humidity on the surface of the earth varied according to the variation rates of evaporation and the distribution of the amount

of water vapor in the air. Statistical analyzes indicate different trends in the average relative humidity in all stations belonging to the General Authority for Meteorology and Seismic Monitoring, for example, the general average for the previous 40 years in relative humidity in the city of Baghdad was 44.3%, while the general average in the city of Baghdad for the year 2020 was 42%, with a decrease rate of 2.3%.

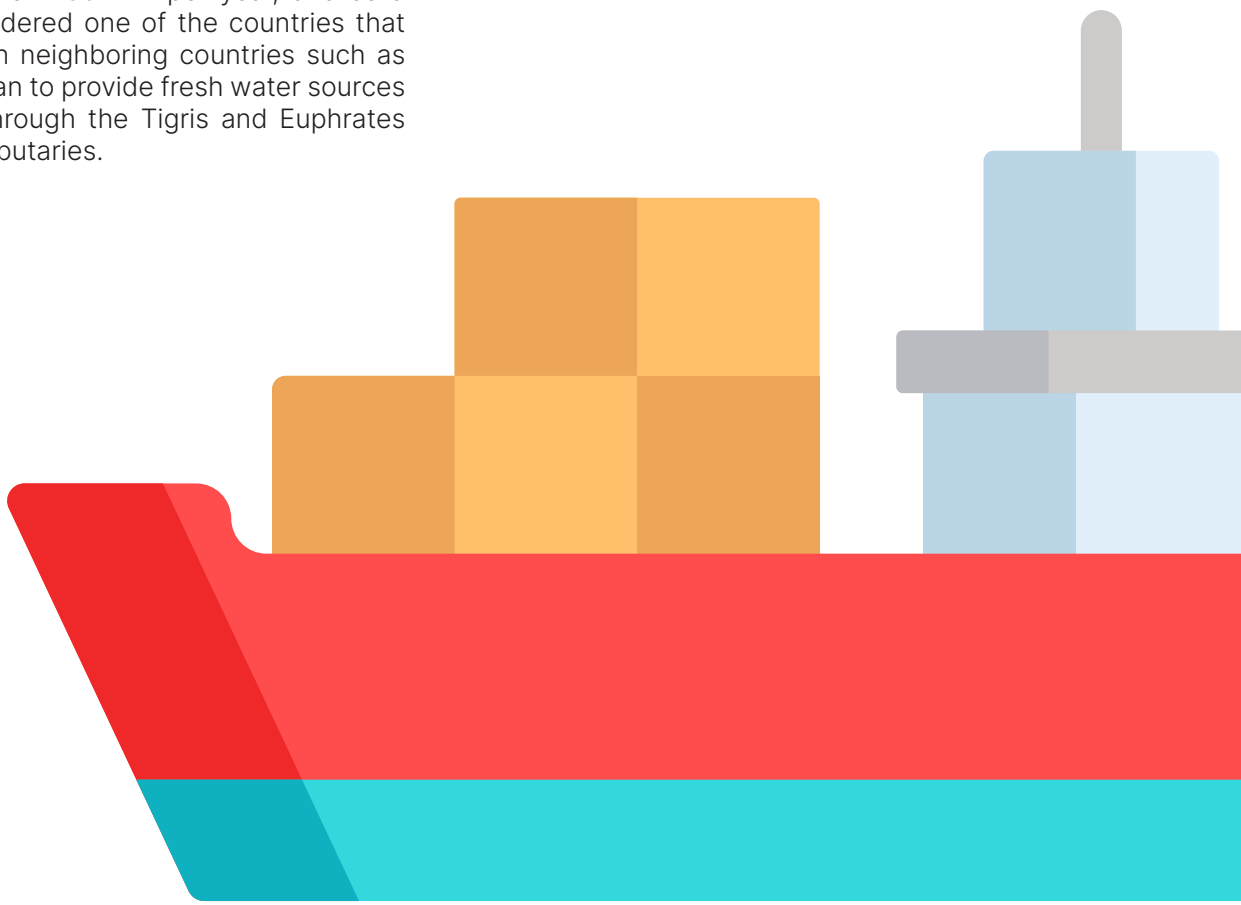
The general average for the previous 40 years in relative humidity in the city of Mosul was 53%, and the same percentage was recorded in the city of for the year 2020. As for the general average for the previous 60 years in relative humidity in the city of Basra, it reached 43%, while the general rate in the city for the year 2020 reached 42%, with a decrease rate of 1%.

- **Rain**

The depressions coming from the Mediterranean Sea are the main reason behind the rainfall in Iraq and the amount of rain varies throughout Iraq, it usually decreases in the central regions and the southwestern regions, and statistical analyzes indicate decreasing trends in the number of rainy days, most of the area of Iraq is within the desert and there are lands located within its area that receive rainwater of less than 150 mm per year, and as a result, Iraq is considered one of the countries that rely very heavily on neighboring countries such as Turkey, Syria and Iran to provide fresh water sources flowing into Iraq through the Tigris and Euphrates rivers and their tributaries.

The continued decrease in the amount of precipitation as a result of climate change, in addition to the increase in consumption rates in Iraq and neighboring countries that are considered upstream countries for incoming water sources will exacerbate the scarcity of fresh water in our country in the future, which will create clear challenges in the water sector in Iraq in the coming decades. Statistical analyzes indicate a sharp variation in the amount of rain in all stations belonging to the General Authority for Meteorology and Seismic Monitoring. For example, the monthly average amount of rain for 2020 in the city of Baghdad was 155.6 mm, while the general average for the previous 30 years in the amount of rain in the city was about 124.5 mm.

In the city of Mosul, the monthly average of rainfall in 2020 was 353.7 mm, while the general average for the previous 30 years in the amount of rain in the city was about 396.2 mm. In the city of Basra and during 2020, the monthly average amount of rain was about 84 mm, while the general average for the previous 30 years in the amount of rain in the city was about 127.5 mm, a sharp decrease by 34%. The following table shows the amount of rainfall from 2019-2020 (Table 2.8).



Dust storms

Dust and sandstorms have increased for several reasons, including climate change in Iraq because Iraq is one of the country's most vulnerable to climate change and desertification due to increasing drought, with high temperatures that exceed fifty degrees Celsius in summer. The decrease in the amount of water and the scarcity of water resources led to a strong drought that caused a sharp decline in vegetation cover, which led to increased wind erosion as a result of wind gusts. Experts attribute the occurrence of frequent dust storms at an escalating pace in the Middle East, especially in Iraq, to climate changes accompanied by high temperatures, lack of rain and desertification that affects agricultural and pastoral lands. Statistical analyses in all stations belonging to the General Authority for Meteorology and Seismic Monitoring indicate increasing trends in the number of dust storms that occurred in Iraq during previous years, where 4 storms were recorded in Baghdad in 2017, compared to one in 2020. Table (2.9) shows the measurements of falling dust by governorates.

Data is not available due to the interruption of stations or the malfunction of measuring devices in each of the governorates (Nineveh, Saladin, Diyala, Baghdad and Dhi Qar), while in the governorates (Kirkuk, Babylon, Wasit, Qadisiyah, Maysan and Basra) no readings were available for some months.

Table 2.8: Rainfall (mm) for selected sites and comparing it with the general average during the water year (2019-2020) by months

T	Location	Monthly total amount of rainfall during the water year 2019-2020								Annual Total	General rate	Percentage
		T1	T2	K1	K2	February	March	April	May			
1	Sulaymaniyah	43	14	105	56	92	146	54	8	518	641	80.8
2	Erbil	3	3	32	61	62	113	38	3	315	388	81.2
3	Mosul Dam	25	1	76	66	51	197	29	6	451	351	128.5
4	Dukan Dam	57	28	63	92	127	129	38	16	550	662	83.1
5	Dabs	72	9	46	52	41	113	28	1	362	315	114.9
6	Baghdad	12	1	26	19	10	23	3	0	94	109	86.2
7	Samarra dam	6	5	105	19	45	24	2	0	206	137	150.4
8	Darbandikhan	44	6	87	93	129	134	70	4	567	620	91.5
9	Najaf	31	4	12	5	11	5	13	0	81	96	84.4
10	Badra	9	1	7	5	0	0	1	0	23	117	19.7
11	Samawah	0	7	0	0	26	2	0	0	35	140	25.0
12	Haditha	3	1	9	4	0	31	1	0	49	152	32.2
13	Saddat Al-Hindiyah	2	1	14	20	23	4	2	0	66	103	64.1
14	Kut dam	6	4	47	16	46	2	1	0	122	210	58.1
15	Nasserite	3	15	0	0	0	1	0	0	19	77	24.7
16	Ali Al Gharbi	1	0	25	41	13	37	0	0	117	109	107.3

The general average was adopted instead of the arithmetic mean because there are missing years in the timeline

Table 2.9: Annual average amount of falling dust (g/m²) by governorate for the year 2021

Region	Governorate	Months												Annual Rate	Maximum	Minimum
		K2	Feb	Mar	Apr	May	June	July	Aug	Sept	T1	T2	K1			
Northern Governorate	Nineveh	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	Kirkuk	..	6	9	10	6	8	8	6	8	..	..	..	7.6	10	6
	Saladin	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Central Governorate	Diyala	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	Anbar	27	28	28	28	29	28	27	30	29	31	30	26	28.4	31	26
	Baghdad	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	Babylon	5	7	16	10	15	11	7	16	9	..	..	..	10.7	16	5
	Wasit	10	12	24	..	..	11	..	..	..	14	8	15	13.4	24	8
	Karbala	10	12	17	10	21	19	53	13	9	6	11	13	16.2	53	6
Southern Governorate	Qadisiyah	13	15	14	21	10	3	12	14	12	7	..	10	11.9	21	3
	Najaf	46	10	12	13	25	14	14	19	11	15	8	16	16.9	46	8
	Muthanna	18	19	16	21	18	20	17	14	11	13	13	12	16.0	21	11
	Maysan	..	..	14	..	..	17	17	17	15	..	14	..	15.7	17	14
	Dhi Qar	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	Basra	10	10	..	..	..	10	..	..	..	..	..	..	10.0	10	10

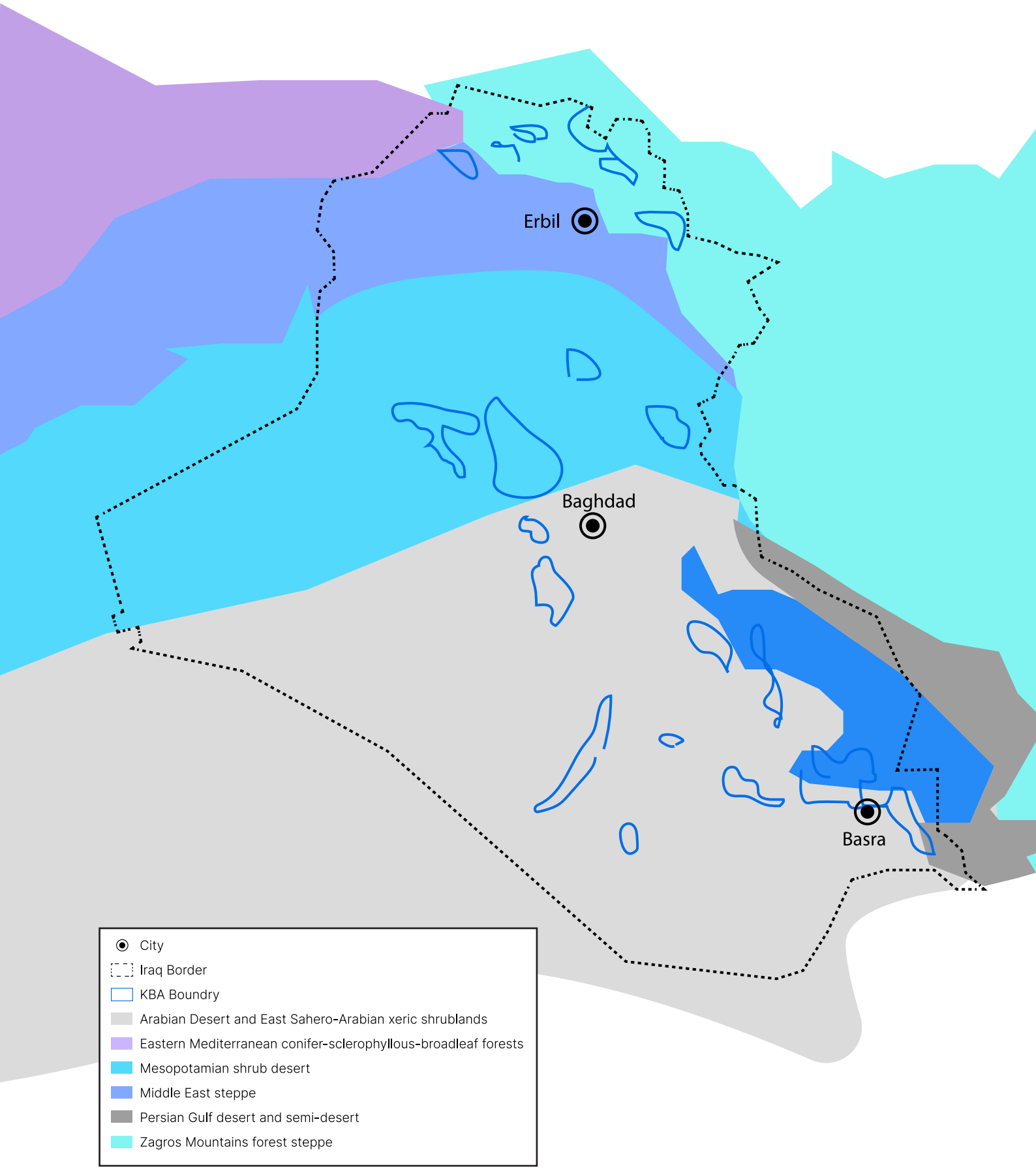
NATURAL SYSTEMS AND BIODIVERSITY

STATUS

10 ecoregions have been identified in Iraq, some of which are considered environmentally important areas (Figure 7.2) and include the following:

1. Arabian desert, desert areas and dry shrubs
2. Broadleaf pine forests of the Eastern Mediterranean
3. Mesopotamian shrubs
4. Middle East steppes
5. Semi-desert Gulf regions
6. Tropical and semi-desert deserts of the Red Sea
7. Tropical and semi-desert deserts of southern Iran
8. Alluvial salt marshes of the Tigris and Euphrates
9. The forest steppes of the Zagros Mountains
10. Marine environment

Figure 2.7: Ecozones in the State of Iraq (Source: World Animal Facility and Nature Iraq (WWF and Nature Iraq)



The variation of environments and ecosystems in Iraq has contributed to the provision of biodiversity as summarized below:

First: Plants

4500 plant species have been recorded in Iraq, including 195 endemic species, according to studies carried out by the Ministry of Agriculture, the Ministry of Environment, Kew Park in England, Nature of Iraq, the Middle East Botanical Center at the Royal Botanic Garden in Edinburgh, the Missouri Botanical Garden in the United States of America and Old Dominion University in the United States of America. The vegetation cover of the marsh areas in Iraq is dominated by Phragmites australis plants that reach 8 meters in height due to the availability of nutrients and herbs of the type (Typha angustifolia) with the presence of a large number of other plant species seasonally submerged in water. Ether and Tarfa plants (Tamarix spp.) are found on the wet banks of the swamps with extensions of weeds of various species such as Juncus arabicus, grass (Paspulum distichum), Saadi (Carex divisa) and others.

Three main groups of plants have been identified in the marsh area (Al-Hilli, 1977), each of them is associated with specific topographic, formative and climatic conditions:

Dry Plants: Dry plant communities live on the semi-desert high plateau around the actual marshes and most of them are found in non-saline to slightly saline soil. They are divided into eight main communities named after their distinctive plant species: round-winged silhouette (Bienertia cycloptera), Aslih (Malcolmia grandiflora), Jordanian Salsola (Salsola jordanicola), Salsola (Salsola incanescens) and simple pyramid plant (Zygophyllum propinquum), Ajram (Anabasis setifera), Acidosis (Hammada elegans) and Arfaj (Rhanterium epapposum) respectively.

Halophytes: Halophytic communities are limited to lowlands below shallow water levels around flood-prone areas. Six plant communities have been identified, all located within highly saline layers (high chloride and sodium ions). These communities are dominated by bacillus (Polygonum salicifolium), Ludwigia adscendens, white water-crowfoot (Ranunculus aquatilis), Typha domingensis, Phragmites australis, and Brahmi (Bacopa monnieri) respectively. An additional 38 plant communities were identified in well-drained riparian habitat. These plant communities are dominated by Alhagi mannifera, Prosopis farcta, Populus euphratica, and Cynodon dactylon.

Aquatic Plants: They were divided into three main categories: permanently submerged, partially submerged and floating plant communities. Three communities of permanently submerged plants have been identified, dominated by herbaceous plants of theVallisneria spiralis Najas armada and Ceratophyllum demersum. Partially submerged plant communities included plants such as Potamogeton crisps (Potamogetonaceae), longleaf pondweed (Potamogeton nodosus), and water grass (Myriophyllum verticillatum). Finally, plant species such as the Diriyah marsh flower (Nymphoides peltata) or the ciliary lily (Nymphoides indica) dominated floating plant communities.

Al-Hilli (1977) introduced a simplified classification system for plants in the marshes where vegetation cover was classified into six categories based on the growth of the dominant species and their position relative to the average seasonal depth of water, where tall grassy plants formed the main vegetation type in most of the marsh areas and consisted of three main communities:

Scirpus litoralis community mixed with a number of other plants, namely the white water-crowfoot (Ranunculus aquatilis), the Nymphoides (Nymphoides indica) and the (Cressa cretica).

The community of plants of the Southern cattail (Typha domingensis) is mixed with a number of other plants, namely the reed (Phragmites australis), the submerged champlain (Ceratophyllum demersum) and the plant (Jussiaea repens).

Additionally, the community of reed plants (Phragmites australis) is mixed with a number of other plants, namely the Polygonum (Polygonum salicifolium) and the sabkha halfa (Cladium mariscus), and the height of the reed plants exceeded six meters during the summer.

In 2009 study was carried out with the aim of establishing the Central Marshes National Park which was proposed in June 2008 and six categories of main habitats have been identified namely inland, running water, river or canal water, inland stagnant water, swamp vegetation, desert, forests and herbaceous plants. The dominant habitat subcategories in the central marshes have been identified as follows: (1) Rooted submerged vegetation (2) Upper vegetation (3) Floating vegetation (4) Ground shrubs (5) Non-vegetative river or canal (6) Non-vegetative desert and (7) Sunken vegetative communities.

The ecosystems in Iraq vary, including forests, as the data in Table 2.10 show the distribution of forests by governorates.

Table 2.10: Distribution of forests in the Iraqi governorates according to statistics for the year 2016

Governorate	Area of natural forests (dunums)	Area of artificial forests (dunums)	Types of cultivated plants
Najaf	None	910	Olive, Eucalyptus, Sidr, Palm, Quinoa and Carpus
Babylon	None	4626	Eucalyptus, Casuarina and Olive
Dhi Qar	None	None	None
Basra		1000	Eucalyptus, Athel, Quinoa and Carpus
Kirkuk	2799	2026	Eucalyptus, olive, cypress, pine, raspberry, acacia, chinaberry, cazulina, janar, brushe, challic, willow, gough, sesame, casuarina, athel
Baghdad		7514	Eucalyptus, Casuarina, Cypress, Sesame, Athel, and Gough
Muthanna	100	None	Athel, olives and eucalyptus
Wasit	None	50512	Eucalyptus, athel, olive, dudonia, acacia, casuarina, lusita and quinocarpus
Qadisiyah	None	14752	Olives, athel, eucalyptus and white lands
Holy Karbala	None	240	Olive, eucalyptus and palm
Diyala	None	10716	Eucalyptus and Gough
Maysan	238	170	Eucalyptus, athel, casealina, sidr, sea thistle and the bottle-brush crimson

Second: Animals

Fish

Freshwater fish

The Tigris and Euphrates Basin are the main areas for fish species, including 52 species belonging to seven families dominated by fish from the family Cyprinidaewith. 34 species have been recorded, 22 of which are endemic to the Tigris and Euphrates Basin (Coad, 1996). At the bottom of this basin, 44 native species, 13 exotic species of freshwater fish and 14 endemic species have been recorded in the Tigris and Euphrates basin, where most of these species belong to the family of Cyprinidae, especially the genus Barbus, and some of these species are economically important. The status of most of these marsh species is still unknown but it is clear that the large number of endemic fish species may contribute significantly to the potentially exceptional universal value of the marshes. Three species endemic to the marsh areas have been recorded: catfish (Silurus triostegus), Binni (Barbus Mesopotamichtys sharpeyi) and the common carp (Barbus Luciobarbus xanthopterus).

In addition, three endemic species have been recorded for the Tigris and Euphrates river basin, namely (Glyptothorax steindachneri) and blind fish of the type (Caecocypris basim) and (Typhlogarra widdowsoni), where they are considered the last two endangered species according to the Red List of Endangered Species of the International Union for Conservation of Nature, both of which are cave-dwelling species and are not found in Marshes. A new type of Avanius (Aphanius mesopotamicus) has also been described to reside in the Karmat Ali area of Basra on the Shatt al-Arab. Protection priorities for freshwater fish species in northern Iraq have been assessed as shown in Table 2.11 (Abd et al., 2009).

Table 2.11: Freshwater Fish Species in Northern Iraq

Scientific Name	Arabic Name	Priority protection
Tenualosa ilisha	Ilish fish	High
Alburnoides bipunctatus	Schneider fish	Likely to be high
Barbus barbulus	Binni	Likely to be high
Barbus esocinus	Mangar fish	Likely to be high
Barbus grypus	Carp	High at the regional level
Barbus subquincunciatus	Binni	Likely to be high
Barbus xanthopterus	Gattan	High
Caecocypris basimi	Blind fish	None
Cyprinion kais	None	Medium
Typhlogarra widdowssoni	Blind fish	High
Cobitis taenia	None	Unknown
Glyptothorax kurdistanicus	None	None
Glyptothorax steindachneri	None	None
Liza Abu	Liza	Medium
Liza klunzingeri	Liza	Medium
Acanthopagrus latus	Porgies	Medium

Marine water fish

Several species of marine fish regularly enter the Shatt al-Arab River and have been recorded in the interior up to the Hamar Swamp, some of which used to travel across the Tigris and Euphrates rivers to varying degrees, but dams and diversion plans have now prevented their movement (Coad, 2010). 25 marine fish species have been recorded in the marsh area as shown in Table 2.12.

Invasive fish

Thirteen exotic species introduced in the Tigris and Euphrates basin (Coad, 1996) were recorded, six exotic species from the Hammar Marshes (Hussain et al., 2008) and four exotic species were found in both the Hammarr and Hawizeh Marshes: Carp (Ctenopharyngodon idella), Carp (Cyprinus carpio) and Golden Carp (Carassius carassius), and Catfish (Heteropneustus fossilis) (Hussain et al., 2008).

1. **Mammals**

Eighty species of mammals have been recorded in Iraq, including two species considered endemic to the Arabian Peninsula, the (Gerbillus mesopotamiae) and the (Gerbillus cheesmani). The list of mammals includes six species of insectivorous, 20 species of bats, 19 species of predators, eight species of hoofed creatures and 26 species of rodents. The water dog (Lutrogale perspicillata) is an important species that lives in marsh areas.

2. **Amphibians**

Ten species of amphibians have been recorded in Iraq, such as the yellow spotted salamander (Neurergus crocatus) and the Kurdish water salamander (Neurergus microspilotus), the latter of which is endemic to the Kurdistan region of Iraq.

3. **Reptiles**

97 species of reptiles have been recorded in Iraq, the most important of which is the Euphrates softshell turtle (Rafetus euphraticus) endemic to Iraq. Many species endangered and threatened sea turtles have been reported in Iraqi marine waters, such as: Loggerhead sea turtle (Caretta caretta); green turtle (Chelonia mydas); subspecies of hawksbill turtle (Eretmochelys imbricata bissa); Olive ridley sea turtle (Lepidochelys

Table 2.12 : Types of marine fish in the marshes

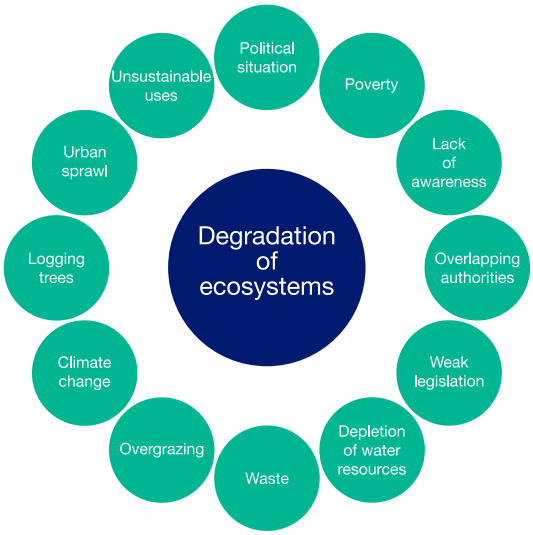
Family	Scientific Name	Arabic Name
Carcharhinidae	Carcharhinus leucas	Bull shark
Engraulidae	Thryssa Hamiltoni Thryssa whiteheadi	None None
Clupeidae	Tenualosa ilisha	Ilish fish
Ariidae	Netuma bilineatus Plicofollis layardi	Unknown Unknown
Mugilidae	Liza klunzingeri Liza subviridis	Liza Liza
Hemiramphidae	Hemiramphus marginatus Rhynchorhamphus georgii	Hemirhamphus Rhynchorhamphus
Belonidae	Strongylura strongylurus	Unknown
Platycephalidae	Platycephalus indicus	Bartail flathead
Sillaginidae	Sillago sihama	Sillago sihama
Sparidae	Acanthopagrus berda Acanthopagrus latus Sparidentex hasta	Unknown Unknown Sparidentex hasta
Sciaenidae	Johnius belangerii Otolithes ruber	Unknown Otolithes ruber
Gobiidae	Bathygobius fuscus	Unknown
Scatophagidae	Scatophagus argus	Unknown
Stromateidae	Pampus argenteus Pampus chinensis	Silver pomfret Pomfret
Soleidae	Brachirus orientalis	Sole

THREATS TO ECOSYSTEMS AND BIODIVERSITY

Habitat and Ecosystem Degradation

The value of ecosystems and their services is affected by one or more human practices (Figure 8.2), resulting in losing their ability to regenerate and carry out their vital functions, affecting biodiversity and habitats negatively. Unregulated hunting, harvesting of threatened species, species trade, unsustainable development and lack of protection in many of Iraq's most important biodiversity sites are among the causes of degradation of species, habitats and ecosystems. The use of poisons, electric shocks, explosives used in fishing and wastewater, as well as the high salinity of lakes and rivers, have also affected biodiversity.

Figure 2.8: Causes of degradation of species, habitats and ecosystems



A real-life example that has caused the degradation of ecosystems and negatively impacted species is the increased salinity of water and pollution is also expected to play a role in reducing fish diversity. Wars, fragmentation of agricultural land, and industrial and urban activities have also caused the degradation of Iraq's biodiversity in terms of type and density (World Bank, 2017). In general, biodiversity is particularly low in the central plain and the Baghdad region due to the region's history of sustainable agricultural activity and population density (UNEP, 2007).

Another challenge is the pollution of Iraq's marine waters, where Iraq's coastal water belt is characterized by a high fertility rate that attracts Gulf fish during mating seasons and is a corridor for migratory fish. Pollution from oil activities in Iraqi ports has caused severe water damage, damaged biodiversity and negatively impacting fish stocks (World Bank, 2017). The UNEP report to the UN General Assembly concluded that mining activities negatively affect environmental processes by altering soil properties, destroying vegetation and killing flora and fauna. Landmines and unexploded ordnance also introduce toxic substances into the environment when their envelope is eroded and decomposed, making them water-soluble, carcinogenic, and highly toxic to mammalian species, aquatic microorganisms and fish, even in small quantities.

As for hunting, it has caused the loss of many species, as the mountain ibex (Capra aegagrus) has been assessed as an endangered species according to the red lists of the International Union for Conservation of Nature, and the water dog (Lutra

lutra) is hunted in the humid areas of northern Iraq, and large numbers of waterbirds were affected by hunting such as Abu Hashish ducks, Houbara bustards and others.

Soil quality is an important factor as it supports food security and provides a suitable environment for obtaining supportive vegetation cover for many species. Therefore, poor soil quality and pollution will cause the transfer of dangerous pollutants to plant tissues, which in turn will be transmitted to humans, and contaminated soil will cause the transfer of these pollutants, especially in rainy seasons, to rivers, surface water bodies or groundwater. Healthy ecosystems and healthy vegetation cover help preserve and prevent soil contamination. People in the marshes depend on natural resources in their daily lives, where fish are food sources, and the availability of the reed plants can be used as fodder for buffaloes. Therefore, the degradation of these natural resources will have a significant impact on the sources of income and livelihood of many residents.

Invasive Alien Species

Those species that have been introduced intentionally or unintentionally and have been able to adapt to the surrounding conditions to spread over large areas and in large numbers, which affects the natural environment and affects communities. In Iraq, 30 species of invasive exotic plants were recorded as shown in Table 2.13.

For example, two types of catfish considered as invasive exotic species were recorded in the Shatt al-Arab region in the eighties, namely (Heteropneustes fossilis) and (Heteropneustes holbrook) and the number of exotic species rose to nine since then until 2015 and it is expected that the number is increasing, but needs more studies. The presence of these invasive alien species negatively affects the original species as they compete with them for food and breeding places, and invasive species transmit diseases, and currently alien species dominate the fish community in the Shatt al-Arab.

Table 2.13: Invasive plant species registered in Iraq

Scientific Name	Common English name	Arabic Name
Ceratophyllum demersum	Coontail	شمبلان مغمور
Acacia saligna	Coojong	سنط
Aegilops triuncialis	Barbed goatgrass	دوسر ثلاثي البوصات
Agrostis gigantean	Black bent	أغروستيس عملاق
Arundo donax	Giant reed	غاب عملاق
Brassica tournefortii	Mustard	حرشاء
Bromus rubens	Brome grass	عشب
Butomus umbellatus	Flowering rush	عناز خيمي
Cenchrus ciliaris	Buffel-grass	سبط مهدب
Centaurea solstitialis	Yellow star-thistle	قنطريون صيفي
Coronilla varia	Crown vetch	سكورجيرة متغيرة
Cyperus rotundus	Nutsedge (nutgrass)	سعد مستدير
Dalbergia sissoo	Indian rosewood	ساسم
Erodium cicutarium	Common stork's-bill	رقمة شوكرانية
Eupatorium cannabinum	Hemp-agrimony	القنب
Frangula Nous	Alder buckthorn	عوسج أسود
Hypericum perforatum	Perforated St. John's Wort	حشيشة القلب
Imperata cylindrical	Cogongrass	حلف
Lepidium latifolium	Tall whitetop	رشاد عريض الأوراق
Lotus corniculatus	Common bird's-foot trefoil	لوطس ياباني
Melilotus Alba	Sweet clover	حندقوق أبيض
Onopordum acanthium	Thistle	أقسون شوكي
Panicum repens	Torpedograss	ثمام زاحف
Phalaris arundinacea	Reed canary grass	خرفار قصبي
Poa pratensis	Blue grass	قبأ المروج
.Prosopis spp	Mesquite	سلم
Rumex crispus	Curly dock	حماض أصفر
Salsola tragus	Windwitch	روثّ
Tamarix ramosissima	Salt cedar	الطرفاء
Trifolium repens	White clover	نفل زاحف

Depletion of Natural Resources

Exploitation or depletion of vital resources as a result of practices such as unregulated hunting that eliminate species or reduce their numbers to a degree that does not enable them to sustain their populations. Depletion of natural resources can deplete biodiversity and expose a number of threatened and endangered species.

One of the clear examples caused by the depletion of natural resources is the decline in the number of Zubaidi fish (Pampus argenteus), which is considered one of the most important commercial fish in the Arabian Gulf region and in Iraq in particular. According to (Ali et al., 2000), Iraq has accounted for about 22% of the total of this species, but it is currently considered endangered and suffers from a sharp decline in numbers due to overfishing and poor management of fish stocks, but the effects of environmental pollution and changing water quality, particularly salinity, is one of the reasons for its low numbers. Other important marine fish species facing extinction is the Ilish fish (Tenualosa ilisha), which faces overfishing at sea, the mouth of the Shatt al-Arab and the Shatt al-Arab River. River pollution, increased salinity and lack of fresh water also affected the population.

CLIMATE CHANGE

Climate change negatively affects species, for example, high temperatures and low rainfall rates may cause changing breeding seasons or migration, which negatively affects the species and exposes it to more pressure. Currently, desert areas in Iraq constitute up to 31% of the total area and unsustainable agricultural practices over the years have exacerbated the effects of dry climates contributing to increased desertification rates. Low fertility, high soil salinity, erosion and sand dune stretches are pervasive problems as well.

COASTAL AND MARINE HABITATS

The Arabian Gulf is the only seaport for Iraq to the world, as the length of the seacoast of Iraq is about 58 kilometers, and the port of Um Qasr in Basra is one of the most important Iraqi ports overlooking the Gulf. The Tigris and Euphrates rivers run from northern to southern Iraq, which were the basis for the emergence of the world's first cultural centers on Mesopotamia, which were established in Iraq throughout history for 8,000 years, by the Akkadians, Sumerians, Assyrians, and Babylonians.

Coral reefs are available in Iraqi coastal waters covering an area of 28 square kilometers in the Arabian Gulf at the mouth of the Shatt al-Arab River and the presence of coral reefs is important and indicative of adaptation to one of the harsh coral reef environments in the world with sea water temperature in this area ranging between 14 and 34 degrees Celsius. Coral reefs include many living stone corals, octagonal corals, avioroids and bivalves.

ECOSYSTEM SERVICES

Ecosystems are defined as dynamic complexes of plants, animals, and microorganisms (or what is known as biodiversity) that interact with their environment and ecosystems generate services known as ecosystem services or nature's contribution to people's lives. Ecosystem services are classified into four categories:

1. **Supply Services:** They are the services that ecosystems provide to humans such as raw materials, food, shelter, energy, medical resources and other resources necessary in order to promote well-being and improve diversified economic activities.

2. **Regulatory Services:** They are the services that ecosystems provide to humans by regulating the ecological balance and include air, water, soil, floods and diseases.

3. **Supportive Services (Assistance):** They are the services provided by ecosystems in terms of supporting the existence of the necessities of life such as providing shelter and housing for a myriad of plants and animals in addition to preserving their diversity. Providing water and food, which are the most important elements that sustain and keep people alive.

4. **Cultural Services:** They are non-material services such as providing green spaces for hiking, walking, tourism, beaches and seascapes

that contribute to entertainment and tourism activities, and what many natural components provide for the spiritual and religious side of peoples of different cultures.

Therefore, the preservation and sustainable management of natural capital is essential because any deterioration or loss of it or one of its elements will cause environmental, societal and economic problems, and the planet will become vulnerable to risks and severe events such as floods and droughts, and will lead to more wars and conflicts to achieve food and water security and others, which will cause the displacement and migration of many people.

One study focused on the Central Marshes region and aimed to evaluate a series of ecosystem services where a Toolkit for Ecosystem Service Site-Based Assessment (TESSA) was adopted to determine biophysical and economic values. Data on key ecosystem services included fish trade, plant collection, buffalo milking and fodder collected over a six-month period in 2014. The study estimated ecosystem services within the Central Marsh area of nearly 40,000 hectares over 6 months with a total of $860,078.23 distributed between $86,637.25 from plant collection, $551,334.80 from fish trade and $167,303.70 from buffalo milk trade and $54,804.00 from feed trade. The average income per capita in Iraq in 2014 is $6720.

FISHERIES

Fisheries information from the Food and Agriculture Foundation (FAO) was monitored where fish production caught from inland waters in 2017 was around 28,900 tonnes, down sharply from 53,460 tonnes in 2013. Catches in offshore waters reached about 6,300 tonnes in 2017. The main fishing gear used in sea fishing are gill nets, traps and shrimp trawls that work with 332 estimated fishing vessels in 2017 as well as 6,500 small inland boats. The total employment in 2017 for the sector was 1,521 people in the inland sector with an additional 832 people reported for coastal fishing.

As for aquaculture, it has started in Iraq since the seventies in fresh water, but on a limited scale, despite the availability of water resources, and extensive and semi-intensive carp culture prevails in ponds. Other cultured species include carp (grass carp and silver carp), mullet, and native fish (local barbs). The aquaculture sector operates at the public and private levels and is mostly active in the central and southern regions of the country. Annual production reached about 5,000 tons in the late eighties. Aquaculture production declined mainly during the economic sanctions imposed on Iraq due to the limited production of fish fingerlings in hatcheries. According to recent statistics released by the Public Authority for Fish Resources Development, aquaculture production has increased in recent years, from 14,000 tons in 2004 to a record 31,800 tons in 2017.

Apparent fish consumption was estimated at 2.6 kg/capita in 2016 and in 2017 imports of fish and fishery products were estimated at $148 million and exports at $80,000.

AGRICULTURE

The agricultural sector is one of the most water-consuming sectors in Iraq, as it consumes about 30 billion m^3/year. The percentage of water consumption in this sector ranges between 75-80% and the decrease in water resources will greatly affect the agricultural aspect in Iraq and will lead to the loss of farming land, causing heavy financial losses due to Iraq's dependence on foreign imports of agricultural crops, as well as other losses represented in the increasing percentage of unemployed after the cessation of work in many agricultural projects, leading to high poverty rates, which are closely associated with the establishment of projects, especially agricultural and industrial, which will leave its clear effects on the economic situation. Moreover, what increases the waste in the quantities of water used in agriculture is the use of unlined, open and old irrigation channels and the lack of modernization of infrastructure and the use of old irrigation techniques and traditional farming patterns, which led to high ground water levels used and increased waterlogging and soil salinization.

The agricultural sector employs approximately 18.7% of the country's workforce, women constitute 23.3%, and is the second largest contributor of 5% of GDP after the oil sector (World Bank, 2019). Agricultural development is critical to achieving its vision of a more diversified economy with job creation and private sector participation.

Table 2.14: Distribution of Arable Land by Governorates

Governorate	Arable Land/ dunum	Exploited Land Currently/Dunam	Irrigated /Lands Dunam	Fertile Lands /Dunam	Land that uses well water/ Dunum
Najaf	10998168	358022	255596	None	72192
Babylon	1254474	1015840	1135642		11508
Dhi Qar	2530879	525345	831863	None	300
Basra	5196114	114867	85203		29664
Kirkuk	2051435	1232437	555119	1496334	191609
Baghdad	1281378	707856	983866	None	214588
Muthanna	1453453	271152	271152		122960
Wasit	4643292	2040377	2662000	626688	
Qadisiyah	1872490	928836	928836	None	3100
Holy Karbala	1028619	220456	197194	69467	29130
Diyala	3265043	786351	1524604	1740237	265088
Maysan	2547273	643669	1281888	1265385	3300

Land suitable for agricultural production constitutes approximately (23.4 million dunums), but the area of cultivated land currently constitutes only about (13 million dunums), and crop production is the main source of income for the majority of farmers (about 75%) while the rest depends on livestock or mixed crop and livestock production systems. Small farming systems dominate the sector and are usually characterized by traditional methods and meagre capital investments resulting in low productivity. There is also limited social capital that causes poor integration along the supply chain. Table 14.2 shows arable land by governorates for 2016 and no information is available about the governorates of Nineveh, Saladin and Anbar due to the security situation.

Najaf Governorate, which covers an area of 31,191 dunums, is characterized by a number of citrus crops and palm groves, but it suffers from dredging, erosion and urbanization, while the province of Babylon, which has an area of 133,663 dunums, is famous for the cultivation of palm and fruits, and the province of Dhi Qar is characterized by an area of 45,409.5 dunums with palm plantings, and the scarcity of water, high salinity in the soil, insects and lack of irrigation channels are among the most key challenges it faces. In addition, the area of Basra province is about 23,551 and is characterized by palm cultivation, but it suffers from a number of challenges, the most important of which are neglect, wars, water salinity, dredging, reduced farmland, previous wars and land salinization. Kirkuk governorate covers an area of 11,165 dunums and is famous for the cultivation of palms, citrus fruits and olives, but it suffers from water scarcity and constant power cuts, which affect agriculture. As for the province of Baghdad, it has an area of 136,463 dunums and is famous for citrus and palm cultivation, but it suffers from a large number of threats, the most important of which are encroachment on agricultural land, razing farmland and converting them into residential lands, the deteriorating security situation, especially in the outskirts of Baghdad, which led to the farmer's abandonment of their farms, water scarcity, salinization of agricultural land, lack of reclamation projects, lack of support provided by the Ministry of Agriculture, flooding the local market with imported products, and the emergence of insect or fungal infections. Muthanna Governorate, which covers an area of 33,042 dunums, is characterized by palm cultivation, but it suffers from water scarcity and the spread of agricultural pests, while Wasit Governorate has an area of 86,938 dunums and is famous for citrus cultivation, as well as the Qadisiyah Governorate, which has an area of 35,374.98 dunums, and is famous in addition to citrus cultivation for the cultivation of palms, olives and fruits. The area of the holy city of Karbala is 117,576 dunams and is characterized by the cultivation of citrus, palms and deciduous fruits, and the area of Diyala province is 46,351 dunums and Maysan province is 12,316 dunums and are characterized by palm and citrus planting. It should be noted that there is no information about the provinces of Nineveh, Saladin and Anbar due to the security situation.

Iraq has gone from being a smallholder-driven, food-producing country that can cover its needs to becoming a major food importer, driven by decades of sanctions, conflict, wars, inefficient government policies, extreme weather events resulting from climate change, water scarcity, disruption of value chains, and distortion of linkages between producers and markets. Moreover, Daesh (ISIS), which began in 2014, has displaced entire communities, limited access to inputs and markets, and destroyed agricultural infrastructure. The Ministry of Agriculture has estimated that Iraq has lost nearly 40 percent of its agricultural production in the after the ISIS crisis and the sector has not yet fully recovered.

The wheat value chain is characterized by high participation from the ministries of Agriculture and Trade to ensure that the needs for local wheat are met, as this product is one of the main ones, especially in the northern governorates, and it is classified as a strategic crop for the state's food security, where local production is mainly fed into the public distribution system, which is a food basket that is distributed to all Iraqis. Most of the wheat production (70% of the cultivated area) is carried out on irrigated land and generates 75% of the total national production, while 25% is grown in rainfed areas (30% of the cultivated area). Despite efforts to support local production, wheat flour is Iraq's second-highest import and because of its higher quality than local wheat, it is usually destined for private bakeries and other processors.

As for pastoral lands, Table 2.15 shows the area of land that constitutes natural pastures according to 2016 statistics, with the exception of the governorates of Diyala, which did not send their data, and the governorates of Nineveh, Saladin and Anbar due to the security situation.

Table 2.15: Distribution of pastoral land by governorate

Index	Index value for 2020
Quantity of imported chemicals	Industrial 366 tons, laboratory 535 materials,) (compressed gases 61 tons
Quantity of pesticides inventoried in the government and private sectors throughout Iraq	Solid pesticides 24934 kg, liquid pesticides 195405 liters
Damaged pesticides in Essaouira warehouses	Damaged liquid pesticides 75,000 liters, damaged solid pesticides 2956 kg
Hazardous waste in government institutions	Solid 1,672,168 kg and liquid 618,125 liters
Electronic and Electrical Waste	pcs 13430
Permit for the transport of hazardous waste inside Iraq	certified companies 6
Licenses for companies specialized in the treatment of hazardous waste	certified companies 8

Agricultural practices in Iraq are dominated by the excessive use of fertilizers and pesticides due to the lack of farmers awareness, so agricultural land contains large amounts of chemical fertilizers and salts that are discharged into rivers through irrigation or rainwater. Drainage of agricultural drainage into rivers with salts, fertilizers and pesticide residues increases the concentration of nitrates, phosphates and heavy metals. Therefore, a full-fledged system of agricultural drainage networks will preserve the freshwater environment from pollution. Agricultural drainage that carries highly toxic pollutants resulting from the overuse of pesticides and fertilizers is discharged into rivers with the agricultural drainage networks not fully connected to the main drainage system.

Pesticides are chemical compounds used to protect plants from diseases and damage caused by agricultural pests, such as insects, fungi, viruses and bacteria. They are a double-edged sword, in addition to their importance in pest control, their excessive and wrong use might cause significant damage to the environment and humans as a result of toxicity and slow and partial decomposition, as they need a long period of time to decompose and according to the type of pesticide and its solubility, spread, washing and filtration in addition to other factors, the pollution of soil and water with these toxic chemicals has negative effects on plant and animal organisms, and if these pesticides reach water sources, especially phosphorus, chlorine and zinc, they cause water pollution and death.

There are many challenges facing the environment of Iraq due to the use of pesticides and the reasons for these challenges stem from the lack of commitment of farmers to the special safety period and scientifically recommended concentrations for each pesticide because some of them are not proficient in reading and writing or do not follow the instructions of the agricultural experts in the region and do not rely on specialists in diagnosing the infection and determining the appropriate type of pesticide and farmers carry out manual spraying operations without the use of prevention and health safety tools such as masks and gloves and use the containers and mixing tools for household purposes and then wash them on the riverside. Pesticides are also used in overfishing operations in addition to the use of these dead fish after drying as poultry feed.

The number of pesticides used during 2016 amounted to (133,437,482 liters) of liquid materials and (14,792,3755 kg) of solids, while fungicides amounted to (8,252,945 liters) for liquid materials and (1,584,121.46 kg) for solids, and the amount of bush pesticides reached (4,872,29065 liters) for

liquid materials and (186,156 kg for solids), excluding the governorates of Nineveh, Saladin and Anbar due to the lack of data due to poor security conditions.

As for fertilizers, which are essential nutrients for plant growth, they may be organic such as animal manure, sewage waste, decaying plants, or mineral produced in factories. Organic fertilizers are one of the solutions to get rid of the problem of waste and prevent environmental pollution and make the concentration of nutrients appropriate in the fruits without having harmful effects on human health in the long term. The quantities of fertilizers used in the governorates for the year 2016 amounted to (35,830,6996 tons of urea fertilizer) and (2,181,575.66 tons of compound fertilizer), excluding the governorates of Nineveh, Saladin and Anbar did not send their annual reports due to the poor security situation.

CHEMICALS AND HAZARDOUS WASTE MANAGEMENT

The issue of chemicals and waste management has become one of the important topics that have won global attention because their impact threatens human health and the environment directly and indirectly due to the widespread use of chemicals in various areas of life and chemicals and hazardous waste are important challenges facing the environment in Iraq, especially in terms of comprehensive management of (import, internal transport, cross-border transport, storage, destruction ... etc.). Among the most important indicators related to chemicals and hazardous waste, which were indicated by the Technical Department at the Ministry of Environment, are shown in Table 2.16.

Table 2.16: Index of the quantity of chemicals and hazardous waste by the Ministry of Environment for the year 2020

Governorate	Natural pasture area
Najaf	4100
Babylon	None
Dhi Qar	None
Basra	2140
Kirkuk	114108
Baghdad	None
Muthanna	
Wasit	2800
Qadisiyah	None
Holy Karbala	2
Maysan	120000

CHAPTER THREE:

THE MAGNITUDE OF THE PRESSURE ON THE ENVIRONMENT IN IRAQ

3

CHAPTER THREE:

THE MAGNITUDE OF THE PRESSURE ON THE ENVIRONMENT IN IRAQ

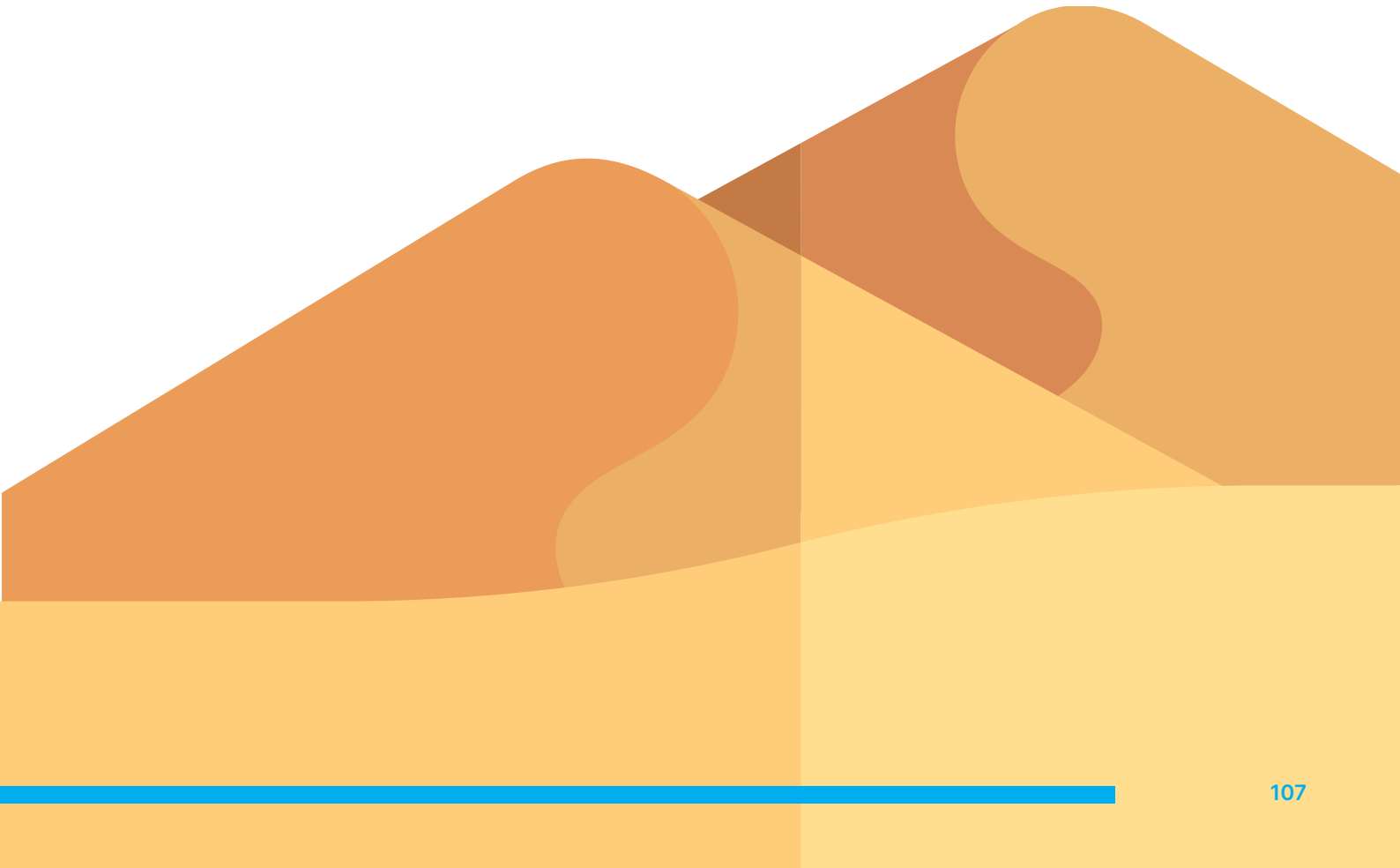
INTRODUCTION

The natural environment is currently facing enormous challenges, due to rapid development, and the effects of climate change and global warming, which are a clear reflection of human activities. Environmental protection and sustainable development are key topics of great interest at the local and international levels.

In Iraq, the environment and its natural resources face many pressures due to the irrational use of these resources as a result of the abnormal conditions experienced in Iraq, as well as the implementation of development plans in all sectors with absence of environmental considerations. In general, environmental pressures are associated with a set of driving factors, which are formed by a set of natural or human influences that directly or indirectly cause a change in the ecosystem, and direct driving factors affect environmental processes, including: on climate change, pollution, land changes and overexploitation of resources, while indirect factors include demographic, economic, social, political, technical and cultural factors.

Understanding the factors or drivers that generate pressures on the environment will generate important information to guide the development of appropriate policies and strategies, including the strategy for protecting and improving the environment in Iraq.

This section focuses on those driving factors and pressures common to many of the environmental topics addressed in the State of the Environment report in Iraq, and these factors are usually man-made, in the sense that they are the result of various human activities, independent or overlapping with each other.



PRESSURES INFLICTED BY THE POPULATION

INTRODUCTION

In Iraq, the environment and its natural resources face many pressures due to the irrational use of these resources as a result of the abnormal conditions experienced in Iraq, as well as the implementation of development plans in all sectors with absence of environmental considerations. In general, environmental pressures are associated with a set of driving factors, which are formed by a set of natural or human influences that directly or indirectly cause a change in the ecosystem, and direct driving factors affect environmental processes, including: on climate change, pollution, land changes and overexploitation of resources, while indirect factors include demographic, economic, social, political, technical and cultural factors

This chapter summarizes the population growth in Iraq, which is information through which we can develop a picture of the magnitude of the pressures on the country's environment as a result of the volume of activities practiced by the population and the volume of services provided to them by the state. This chapter also provides details on spatial and age population divisions that can be used to classify the country's regions according to levels of pressures on the environment and its natural resources such as rivers. Population inflation is one of the most difficult challenges that may face any country in the world, especially developing countries, which often suffer from political, security, and economic problems accompanied by institutional inability to formulate public policies, development and economic strategies that would accommodate the requirements and pressures of growing population inflation, and Iraq is one of the countries facing a challenge in this area resulting from high fertility rates among its population, as the rapid population growth in Iraq puts pressure on the aging infrastructure, and dwindling natural resources.

According to the estimates of the Ministry of Planning for the year (2020), the population of Iraq is currently approximately (40,150,174) people, and it is estimated that it may reach (51,211,700) people by the year 2030, where the annual growth rate in Iraq will be (2.55) as in Table (3.1).

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Table 3.1: Iraq Population Estimates for the Year (2020-2030) (Source: Ministry of Planning, Central Bureau of Statistics)

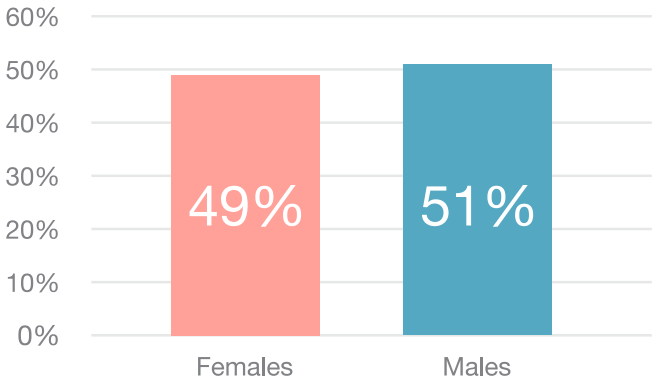
Year	Population
2020	40,150,174
2021	41,190,658
2022	42,248,900
2023	43,324,000
2024	44,414,800
2025	45,520,500
2026	46,639,900
2027	47,771,600
2028	48,914,100
2029	50,061,500
2030	51,211,700

MAIN INDICATORS

Based on the statistical report issued by the Central Bureau of Statistics at the Ministry of Planning for the year (2021), the most important population indicators and the pressures arising from them can be summarized as follows:

The population of Iraq for the year 2021 is distributed by (20,810,479) million males, constituting (51%) of the total population, while the number of females was estimated at (20,380,179), constituting (49%) the total population (Figure 3.1).

Figure 3.1: Population distribution by gender in Iraq



It is estimated that the urban population of Iraq reached (28,779,201) inhabitants for the year 2021, with a percentage of (69.9%) of the total population of Iraq, while the population of rural areas reached (12,411,457) inhabitants, or (30.1%) - Figure (3.2).

These estimates showed that the capital, Baghdad, constituted the largest governorate in terms of population on 2021, with an estimated population of (8,780,422) inhabitants, constituting (21.3%) of the total population of Iraq, while Muthanna Governorate came as the least populated governorate with about (880) thousand inhabitants, and by (2.1%) - Figure (3.3) (3.4).

The urban population in the city of Baghdad reached (7,488,087) inhabitants, or (87.5%) of the total population of the province, while the population of rural areas reached (1,070,538) inhabitants, or (12.5%) of the total population of the province while in Muthanna Governorate, the number of urban areas population reached (398,334) people, or (46.4%) of the total population, while the population of rural areas was (459,318) inhabitants, or (53.6%) of the total population (Figures 3.5 and 3.6).

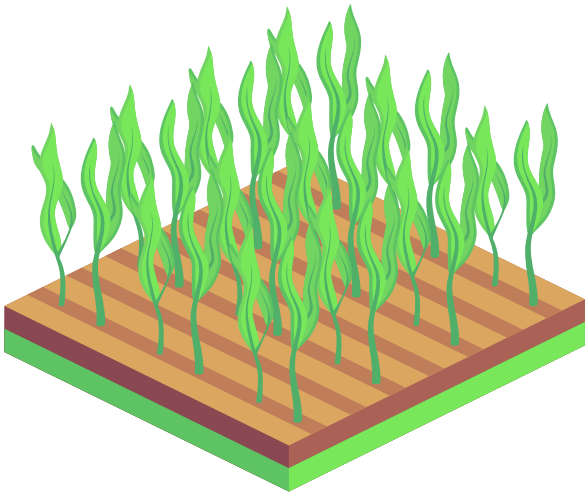


Figure 3.2: Percentage distribution of the population by environment

Figure 3.3: Population Distribution by Governorate

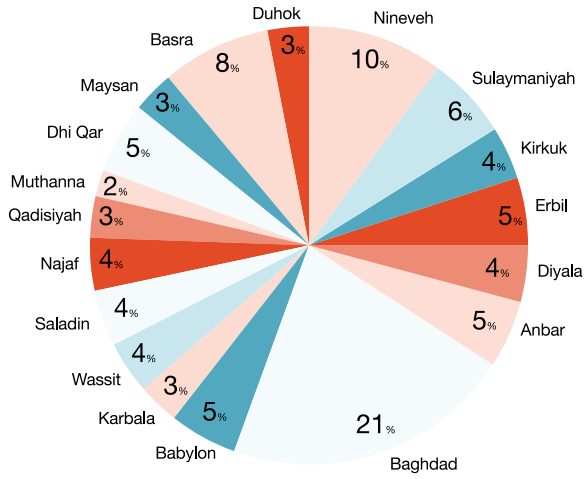
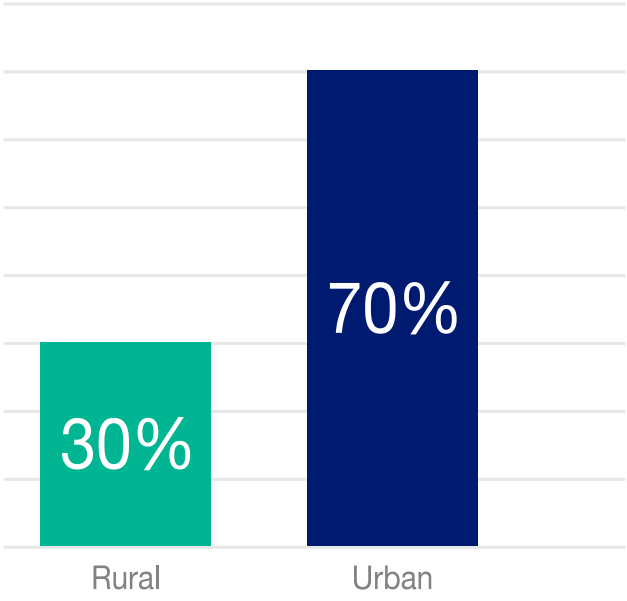


Figure 3.4: Population Distribution by Governorate



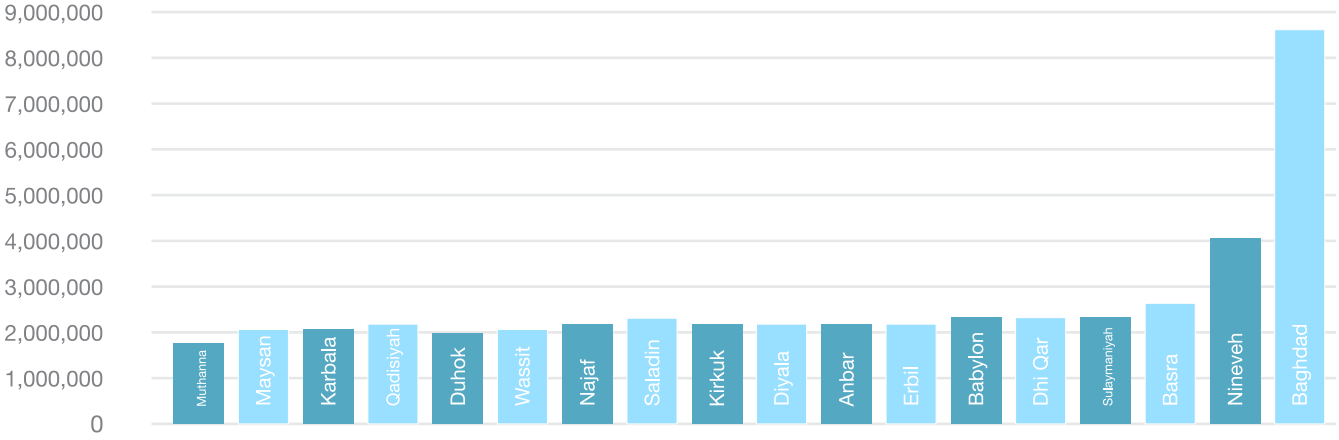


Figure 3.5: Percentage of Population Distribution by Governorate and Environment

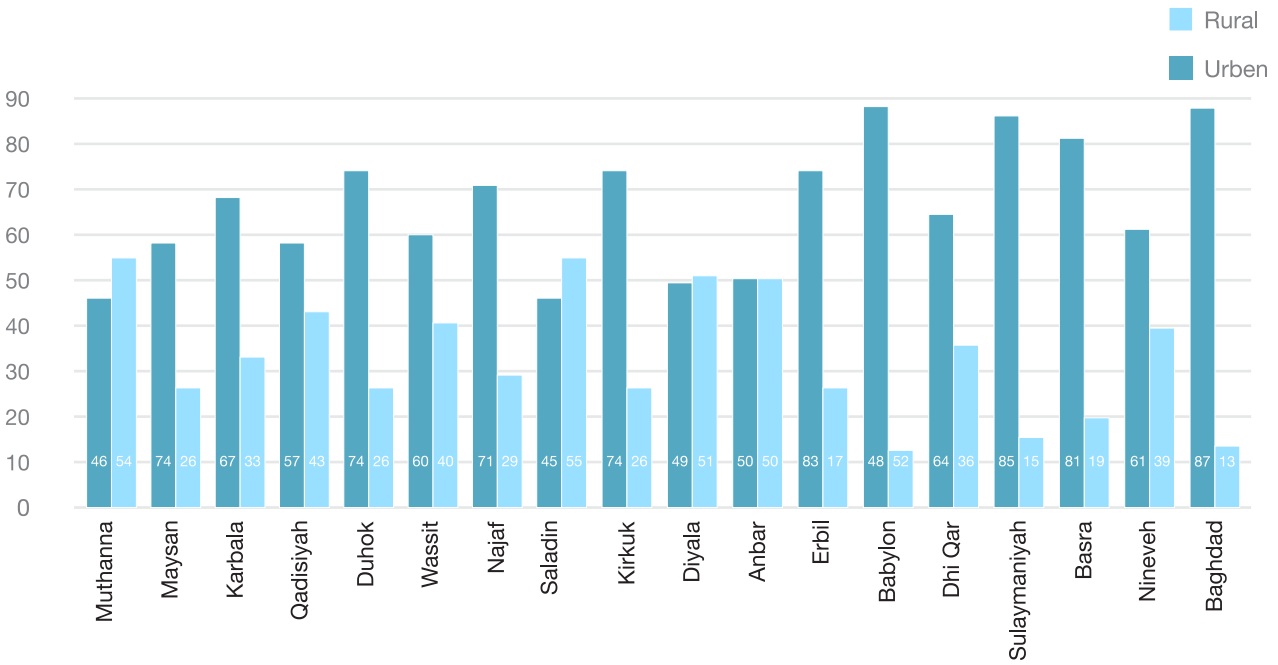
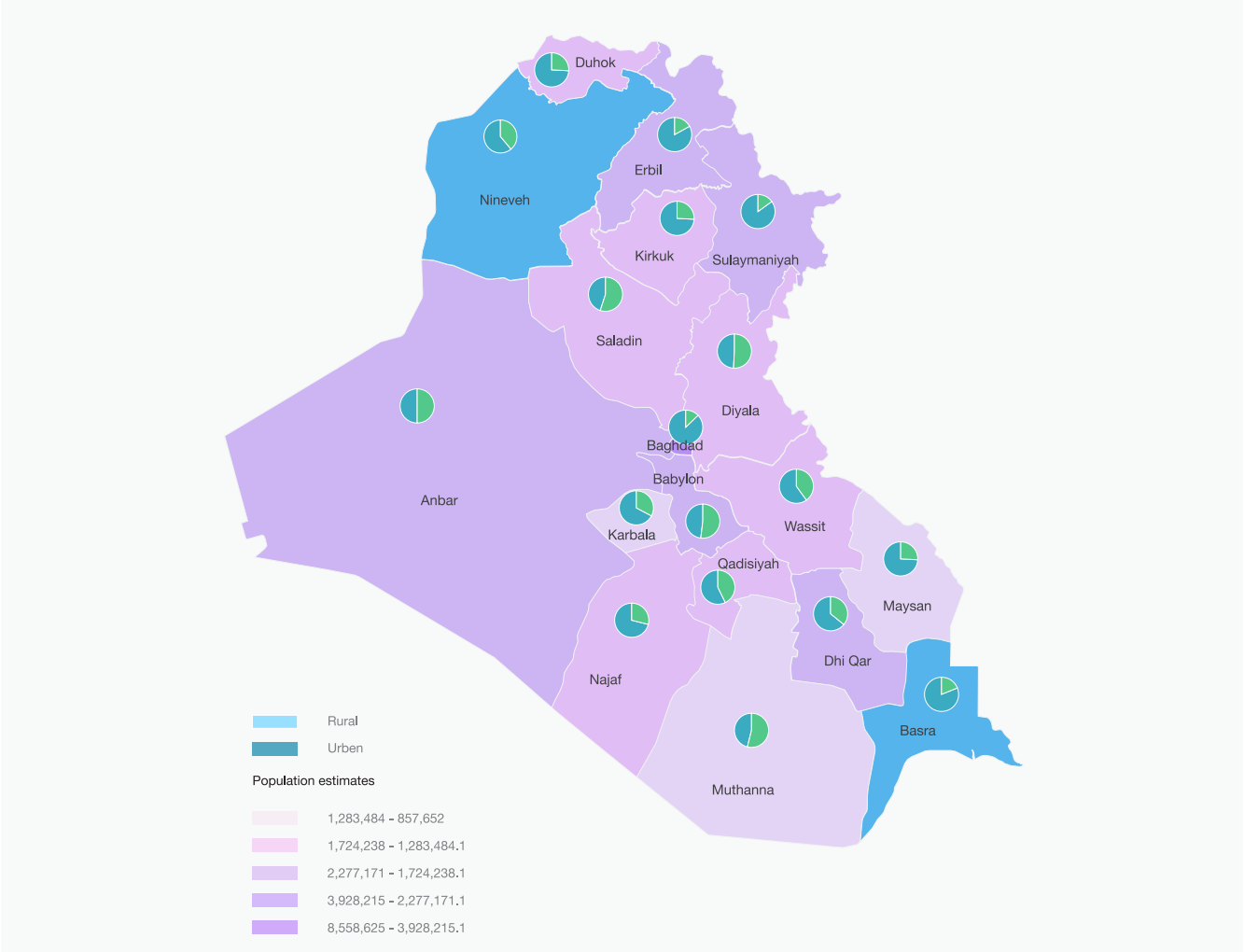


Figure 3.6: The most important statistics of the indicators of the municipal services sector



Source: These maps were drafted in the GIS Center and are not official documents of administrative borders but are for the purpose of displaying population data only.

The population of Iraq under the age of 15 years has reached 16,247,342 people, accounting for 40.5% of the total population. Among them, the number of males is 8,368,978 people, making up 51.5%, while the number of females totals 7,878,369 people, comprising 48.5% of the total population of this age group. Furthermore, the urban population in this age group stands at 10,794,818 people, composing 66.4%, whereas the rural population comprises 5,454,524 people, representing 33.6% of the total population of this age group (see Figure 3.7).

Regarding the population of Iraq between the ages of 15 and 64 it amounts to 22,668,103 people, making up 56.5% of the total population. Among this age group, the number of males is 11,335,526 people, accounting for 50.0%, while the number of females stands at 11,334,577 people, also comprising 50.0% of the total population in this age range. Additionally, the urban population within this age group totals 116,321,666 people, representing 72%, while the rural population comprises 6,346,437 people, making up 28% of the total population in this age group (see Figure 3.8).

The number of young populations aged between 15 and 24 years in Iraq amounts for 8,021,531 individuals, making up 20% of the total population, Among this age group, those aged 15-19 years constitute 10.7% of the total population, while those aged 20-24 years make up 9.3% of the total population (see Figure 3.7).

Figure 3.7: Distribution Percentage of the Young Population in Iraq

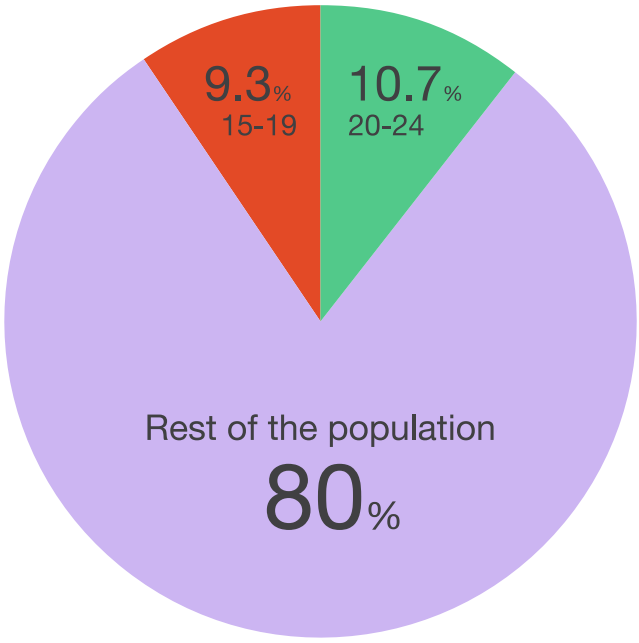
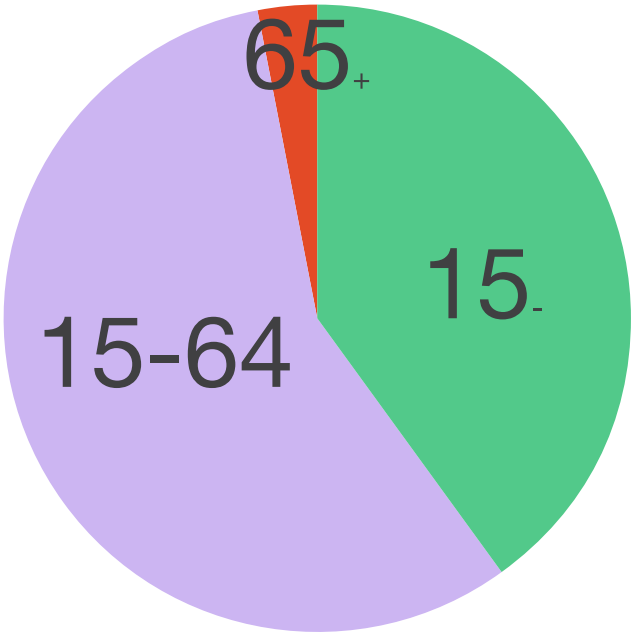


Figure 3.8: The Population of Iraq Age Groups



PRESSURES FROM THE MUNICIPAL SERVICES SECTOR

INTRODUCTION

The municipal services sector stands as one of the largest sectors and it significantly impacts natural resources. This influence is directly correlated with the size of the population. The issue of municipal services is one of the most important topics that draws the attention of decision-makers, politicians and planners, It involves the development of appropriate service management methods and active engagement of local communities in the ongoing enhancement of municipal services, all with the ultimate goal of improving the quality of life for citizens. Service institutions within this sector face numerous economic, political, social, and cultural changes and challenges. These changes have led to a heightened focus on the services they provide. In response to the surrounding challenges, municipalities, in general, are striving to enhance their services and transition towards leadership in sustainable development. This transformation and effective project management can be facilitated through the implementation of development plans.

The Municipality of Baghdad, located in the heart of the capital city Baghdad and the municipal directorates in the governorates, constitute the local authority responsible for the coordination and administration of municipal services. These services are vital to the well-being of citizens and encompass drinking water, sanitation, solid waste management, as well as the maintenance of parks, gardens, the environment, building regulations, population services, and other initiatives aimed at promoting a healthy and comprehensive societal well-being. The significant factors and challenges stemming from the delivery of municipal services will be discussed, with reference to relevant indicators, as follows:

MAIN INDICATORS

Based on the statistical reports issued by the Central Bureau of Statistics within the Ministry of Planning for the year (2021) and the reports issued by the Municipality of Baghdad and the Ministry of Construction, Housing and Municipalities, the key indicators of services and the associated pressures can be summarized as follows:

Water for Drinking and Domestic Use

Iraq is grappling with a multifaceted crisis, which is anticipated to persist and may result in humanitarian, economic, security and social repercussions, including population displacements. Statistical data related to water quantity and quality indicators, particularly concerning drinking water services (as shown in Table 3.2), reveals an increase in the number of potable water production plants with an increase in the quantity of water for drinking and domestic use produced compared to 2017 and 2020 by 6.8% and 14.5%, respectively. However, it is noteworthy that there has been no corresponding increase in the percentage of the population served by potable water networks. It's important to highlight that one of the major challenges contributing to the inefficient use of water is the low level of awareness among citizens. Reports issued by relevant authorities have indicated this lack of awareness as a significant issue.

Table 3.2: Main Statistical Data Related to Water Quantity and Quality Indicators (Source: Ministry of Planning, Central Bureau of Statistics, Environment Statistics Section, 2017 and 2020)

Index	Index value for the year	
	2017	2020
Water imports of the Tigris River and its tributaries and the Euphrates River for the water year 2019-2020 (billion m3/year)	40.06	49.59
Water imports per capita (m3/year)	1095.6	1237.09
Quantity of water supplied for (agricultural, domestic, industrial and environmental) uses (billion m3/year)	38.69	46.05
Highest annual total amount of rainfall (mm)	(Sulaymaniyah) 571	(Darbandikhan) 567

Highest annual evaporation amount from dams and reservoirs (million m3)	(Tharthar) 466.78	(Tharthar) 387.58
Number of water production plants	4987	5327
Average amount of raw water withdrawn to water production plants (million m3/day)	16,7	18.7
Average amount of drinking water produced (million m3/day)	13.8	15.8
Quantity of actual production of net water from water projects (million m3/day)	9.2	10.4
Actual production of pure water from water pools (million m3/day)	4.5	5.3
%) Percentage of water loss	24.3	20.1
%) Percentage of population served by potable water systems	83.4	83.4
%) Percentage of urban population served by potable water systems	90.3	91.7
%) Percentage of rural population served by potable water systems	68.9	65.6
Average per capita supply of potable water supplied to the total population (liter/day)	327	356
Amount of water entering the marshes (billion m3/year)	3.2	5.86
The scarcity and fluctuation of electrical energy required for operation and the lack of awareness among %) citizens regarding rationalizing consumption are among the most important problems	100	100

When examining the disparities in water quantity and quality in central and southern Iraq over the past two decades, It is evident water that water quality in Iraq is suboptimal due to various factors. These factors include war, lack of maintenance, encroachments, and ineffective water monitoring. Consequently, there has been a notable increase in waterborne infections, which frequently result in illness or even fatalities.

The primary contributor to Iraq's exceptionally poor water quality is the ongoing war, which has severely contaminated natural water sources. The devastation caused by the conflict has led to the seepage of heavy metals, oils, sewage, medical waste, and other hazardous materials into local land and water sources.

The statistics reveal that among the remaining marsh dwellers, only 13% have access to a piped water supply. Meanwhile, 23% of villages rely on purchasing water from tankers, and 38% of villages obtain potable water from reverse osmosis units. Disturbingly, over one-third of the population in these areas directly accesses drinking water from the marshes without any form of treatment. This practice is hazardous as the marshes are contaminated with pesticides, salts, and untreated sanitary and industrial discharges from their sources.

Najaf governorate stands out with the highest water supply penetration and overall water demand. However, it's important to note that approximately 16% of this water demand was not met between 1998 and 2018. In contrast, governorates such as Babil, Karbala, Qadisiya, Dhi Qar, and Muthanna consistently face frequent shortages in their public water supplies, occurring almost every two years.

The information provided by the Baghdad Governorate Water Directorate reveals that the city of Baghdad operates a total of 13 drinking water purification projects. Additionally, there are five raw water stations established to fulfill the needs of implementing the green belt in accordance with the city's foundational design. This design aims to ensure a clean and healthy environment while providing raw water for the irrigation of gardens and crops in residential and green areas. With the growing demand for drinking water and domestic use, these stations have also been repurposed to equip water complexes for the production of potable water, particularly in areas located far from the purification projects.

The percentage of the population served with pure drinking water has reached 100% for all areas within the fundamental design of the city of Baghdad. The production of drinking water in this area amounts to 4,205,000 cubic meters per day. The city of Baghdad features 13 ground tanks for water storage, with four located on the Karkh side and nine on the Rusafa side. Additionally, there

is a tenth reservoir currently under construction to address the increasing water demand in the city. In contrast, the urban population in Ota reports a service rate of approximately 60%. On the other hand, Dhi Qar governorate reports the lowest percentage of service to the rural population, standing at 25% (refer to Table 3.3).

Based on the drinking water quality reports from the years 2017 and 2021, it is observed that drinking water purification projects in the governorates of Nineveh and Saladin consistently achieved the highest acceptable percentages in various examination parameters, including turbidity, salt concentration, bacteriological examination, and residual chlorine, with a 100% compliance rate for both years. Conversely, drinking water purification projects in Dhi Qar governorate demonstrated the lowest acceptable rate in turbidity examination, with figures of 20% and 4.07% for 2017 and 2021, respectively. Furthermore, the drinking water purification projects in Basra governorate recorded the lowest acceptable percentages in testing salt concentration, with rates of 11.08% in 2017 and 15.25% in 2021, as indicated in Table 3.4.

Table 3.3: Number and Percentage of Population Served by Potable Water Distribution Networks by Environment and Governorate for the Year 2020

Governorate	Population			Number of Served Population			% Percentage of population served		
	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total
Nineveh	2,382,132	1,546,083	3,928,215	2,310,668	1,159,562	3,470,230	97.0	75	88.3
Kirkuk	1,243,881	438,928	1,682,809	1,169,248	390,646	1,559,894	94.0	89	92.7
Diyala	848,350	875,888	1,724,238	848,350	700,710	1,549,060	100.0	80	89.8
Anbar	933,217	932,601	1,865,818	737,241	652,821	1,390,062	79.0	70	74.5
Amanat Baghdad	6,311,527	0	6,311,527	6,311,527	0	6,311,527	100.0	0.0	100.0
Outskirts of Baghdad	1,176,560	1,070,538	2,247,098	705,936	428,215	1,134,151	60.0	40	50.5
Babylon	1,049,856	1,124,927	2,174,783	892,378	618,710	1,511,088	85.0	55	69.5
Karbala	858,171	425,313	1,283,484	832,426	370,022	1,202,448	97.0	87.0	93.7
Wasit	873,884	578,123	1,452,007	873,884	462,498	1,336,382	100.0	80	92.0
Saladin	757,567	922,448	1,680,015	606,054	451,999	1,058,053	80.0	49	63.0
Najaf	1,106,811	442,977	1,549,788	1,084,675	416,398	1,501,073	98.0	94	96.9
Qadisiyah	778,901	580,741	1,359,642	638,699	365,867	1,004,566	82.0	63	73.9
Muthanna	398,334	459,318	857,652	338,584	298,557	637,141	85.0	65	74.3
Dhi Qar	1,416,271	790,243	2,206,514	1,175,505	197,561	1,373,066	83.0	25	62.2
Maysan	865,530	306,272	1,171,802	778,977	260,331	1,039,308	90.0	85	88.7
Basra	2,487,658	575,401	3,063,059	2,238,892	489,091	2,727,983	90.0	85	89.1
Total	**23,488,650**	**11,069,801**	**34,558,451**	**21,543,044**	**7,262,989**	**28,806,033**	**91.7**	**65.6**	**83.4**

Table 3.4: Percentage of acceptability of drinking water tests in the governorates

Governorate	Acceptability by examination % of turbidity		Acceptability of salt % concentrations		Acceptability by bacteriological examination %		Residual chlorine % acceptability	
Year	2017	2021	2017	2021	2017	2021	2017	2021
Nineveh	100	100	100	100	100	100	100	100
Saladin	100	100	100	100	100	100	100	100
Kirkuk	99.9	100	97.01	100	100	100	100	100
Diyala	97.61	100	98.8	99.27	99.87	100	99.9	100
Baghdad	55.22	96.86	99.68	98.78	97.79	99.44	99.26	99.64
Babylon	90.36	68.93	100	100	99.97	98.64	99.87	100
Holy Karbala	99.89	47.3	100	99.67	100	100	100	99.89
Najaf	82.84	95.69	98.6	100	96.15	99.85	94.94	99.97
Wasit	62.18	-	96.87	-	100	-	99.78	-
Diwaniyah	78.24	16.85	96.42	98.95	99.14	100	99.31	100
Muthanna	62.26	34.28	46.74	35.69	99.35	98.94	99.57	99.85
Maysan	23.99	40.49	19.45	19.84	100	100	100	100
Dhi Qar	20	4.07	90.86	98.84	100	95.24	100	99.45
Basra	92.61	71.56	11.08	15.25	99.92	100	99.88	99.87
Anbar	95.51	100	100	100	100	100	99.38	100

In the sewage services sector, there has been a notable increase in the number of central treatment plants and medium to small treatment units compared to 2017 and 2020, with a significant rise of 22.2% (Table 3.5). Additionally, there has been a substantial increase of 34.4% in the percentage of treated wastewater in Iraq. However, there has been a decrease in the percentage of the population served by sewage networks (both waste and shared) by 1.73%. On the flip side, there has been an increase in the percentage of those served by the independent treatment system (ground tank) and the percentage of those served by the rainwater network, with rates of 11.52% and 5.3%, respectively. These statistics highlight that many human settlements in Iraq lack basic sanitation systems, and approximately 61% of villagers resort to using areas near their homes for sanitation directly. Furthermore, as more than a third of villages directly utilize water from rivers or swamps without any form of treatment, the current sanitation situation poses significant public health concerns. Waterborne disease outbreaks are frequent, underscoring the critical need for wastewater treatment services.

The medical effluent in hospitals, which can amount to hundreds of liters per day, varies depending on the hospital's capacity and the number of its specialties. It is disposed of into the sewage network after undergoing on-site disinfection operations. Most of these effluents are a result of washing laboratory and microbiology instruments, as well as from the fixation of clinical pathology histological examinations used for diagnostic purposes. Additionally, some effluents arise from the use of drugs in the treatment of cancerous diseases and small amounts of blood fluids. This category also includes remnants from routine washing of the clothing worn by laboratory employees, which may be contaminated with blood fluids or body fluids. Furthermore, the waste from the blood bank includes blood fluids that do not meet donation criteria due to the presence of pathogens or containers of expired blood fluids. Liquid waste and feces generated from laboratory tests, as well as blood samples used for laboratory testing, also contribute to these effluents. The liquids resulting from dialysis operations are diverse, and effluents from the preparation and cooking of food for patients, as well as from patient bathing, are additional sources of medical effluent in hospitals.

In the treatment of liquid waste resulting from various activities, a common practice is to conduct an analysis and monitor its biological and chemical components using environmental monitoring devices. Following these assessments and in accordance with established environmental controls, the waste is typically directly discharged into the sewage system. It then undergoes further treatment through a final filtration process to ensure it meets the specifications and standards set by the Ministry of Environment. This meticulous treatment process is essential to ensure the discharged water complies with environmental regulations. However, it's important to note that this practice places significant demands on the sewage network and can impact the overall quality of wastewater in the region. Proper management and maintenance of the sewage infrastructure are critical to handle this additional pressure and maintain compliance with environmental standards.

Table 3.5: The most important statistics of the indicators of the sewage sector (source: Ministry of Planning, Central Bureau of Statistics, Environment Statistics Section, 2017 and 2020)

Index	Index value for the year	
	2017	2020
Number of central treatment plants and medium and small treatment units	54	66
%) Percentage of treated wastewater generated to treatment plants and units	45	60.5
%) Percentage of treated wastewater to design capacity of treatment plants and units	50.2	70.9
Amount of sludge produced by treatment plants and units (thousand tons/year)	22.34	34
Number of primary treatment plants	-	2
Number of secondary treatment plants	25	64
Number of central treatment plants	26	36
Number of central treatment plants operating (partially operational)	19	28
Number of stalled central treatment plants	7	8
Number of central treatment plants operating within the basic design of the municipality	10	12
Number of medium and small treatment plants	28	30
Number of medium and small treatment plants operating (partially operational)	15	24
Number of medium and small treatment plants located within the basic design of the municipality	21	20
Number of total pumping stations	1282	1332
Number of stalled pumping stations	19	12
%) Percentage of people served by sewage networks (Waste and Shared) in urban areas	51	50
%) Percentage of Employees of Sewage Networks (Waste and Shared) in Iraq	34.6	34
%) Percentage of Employees of the Independent Treatment System (Ground Reservoir) in Iraq	51.2	57.1
Percentage of those not served by sewage networks (waste and shared) and independent treatment %) system (ground tank) in Iraq	14.2	8.9
%) Percentage of those served by rainwater checks (rain and shared water) in Iraq	39.4	41.5
Percentage of those served by sewage networks (waster and shared) and their network is connected to %) treatment plants and units in Iraq	29.1	28.9
Percentage of governorates that suffer from the problem of poor awareness and misuse of sewage %) networks	100	100

In the municipal services sector, as indicated in Table 3.6, there has been a 4.36% increase in the percentage of the population served in the waste collection service in Iraq, excluding the Kurdistan region, when comparing the years 2017 and 2020. Conversely, there has been a 3.28% decrease in the amount of waste that was removed. At the same time, there has been a significant increase in the amount of regular waste that was recycled, with a growth of 17.83%. It is worth noting that there has also been a 25% increase in the amount of waste generated per capita per day.

Table 3.6: The most important statistics of the indicators of the municipal services sector

Index	Index value for the year	
	2017	2020
Total number of municipal institutions	251	256
%) Percentage of beneficiaries of the urban waste collection service	87.7	89.9
%) Percentage of beneficiaries of the waste collection service in Iraq (excluding Kurdistan Region)	61.9	64.6
Amount of waste collected (ordinary waste, debris and scrap) (million tons/year)	20.37	19.7
Amount of hazardous waste collected (tons/year)	1191.7	1053
Average amount of waste generated per capita (kg/day)	1.2	1.5
%) The most common disposal method is landfill in sites that are not environmentally approved	93.8	87.5
Number of landfill sites with environmental approvals	57	74
Number of landfill sites not environmentally approved	148	146
Number of waste sorting and recycling plants	1	2
Regular amount of recycled waste (tons/year)	9755	11495

The issue of solid waste is increasingly receiving attention from states due to its harmful effects on public health, the environment, and the degradation of the overall quality of life. Additionally, it poses social and economic challenges, incurring significant costs that could be saved or avoided with proper management.

as there is no approved strategy for solid waste management at the present time, but rather adopts waste management in three stages: collection, transport and landfill. For example, the city of Baghdad is divided geographically into (14) municipal departments and three municipal sections. These departments, through the cleaning departments, collect and reduce waste on a daily basis by mechanical and human effort, and a committee is currently being formed by the General Secretariat of the Council of Ministers for the purpose of preparing the national plan for waste management and in the short, medium and long term, and includes representatives from the Secretariat General Council of Ministers, Ministry of Housing, Construction and Municipalities, Municipality of Baghdad, Ministry of Environment and National Investment Commission. While the quantities of solid waste generated annually are on the rise, the waste management mechanisms in place, encompassing collection, transportation, sorting, treatment, recycling, and final disposal, are not yet fully developed. These processes lag behind the waste management methods and recycling practices seen in many other countries. Iraq currently lacks comprehensive strategies and plans that include standards for handling these wastes to effectively control environmental pollution. At present, there is no approved strategy for solid waste management. Instead, the approach in Iraq primarily involves three stages: collection, transport, and landfill. For example, the city of Baghdad is geographically divided into 14 municipal departments and three municipal sections. These departments, along with their cleaning divisions, undertake the daily collection and reduction of waste through both mechanical and manual efforts. To address these challenges and move towards more sustainable waste management, a committee is being formed by the General Secretariat of the Council of Ministers. The committee's purpose is to develop a national plan for waste management in the short, medium, and long term. It includes representatives from the Secretariat General Council of Ministers, the Ministry of Housing, Construction and Municipalities, the Municipality of Baghdad, the Ministry of Environment, and the National

Investment Commission. This collaborative effort is a step towards improving Iraq's waste management strategies and practices.

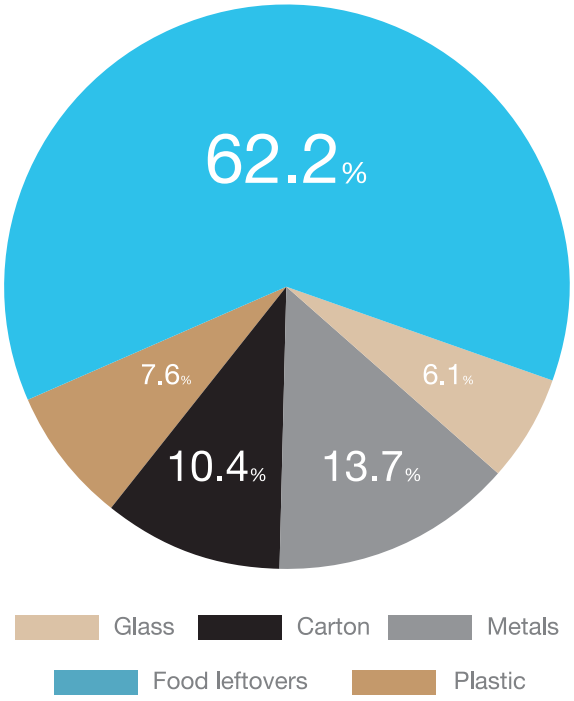
The current waste management situation in general results in significant losses as a valuable and substantial resource is being squandered. This resource could meet essential needs, particularly in the face of the ongoing financial crisis. Instead of utilizing these resources, large quantities of waste continue to accumulate in various areas, often at haphazard collection sites and transfer stations that do not adhere to environmental standards. Furthermore, the practice of indiscriminate and intentional burning of all types of waste, including materials that could be recycled, has become a primary means of disposal. Unfortunately, this method contributes to air pollution, adding to the environmental challenges caused by random and unregulated landfills located in several crucial areas.

Data from the Baghdad Solid Waste Management Plan of 2011 provides insight into waste production rates. It reveals that for Baghdad city, the production rate of organic waste, glass, paper and cardboard, metal, and plastic waste is 0.412, 0.02, 0.118, 0.060, and 0.012 (kg/capita/day), respectively, in relation to the total per capita waste production. In areas surrounding Baghdad city, these rates are 0.535, 0.073, 0.085, 0.097, and 0.103 (kg/capita/day), respectively. Notably, organic waste or food waste constitutes the most significant portion of waste generation, accounting for 62.2% of the total waste, while glass waste makes up the smallest percentage at 6.1% (see Figure 3.8). This data underscores the pressing need for improved waste management practices and the importance of recycling and resource recovery.

The current situation of sanitary landfill sites in Iraq is a cause for concern. The majority of these sites fail to meet environmental standards, and they are often mismanaged, leading to various negative environmental consequences, including incineration. Iraq has a total of 192 sanitary landfill sites located across all governorates. Of these, only 28% have obtained environmental approval, while the remaining 72% lack such approval.

In addition to landfill sites, diversion stations play a role in waste management, temporarily collecting municipal solid waste from different areas before being transported to final landfill sites. Iraq has a total of 87 diversion stations spread across all governorates. However, only 14 of these have

Figure 3.8: Gross per capita waste production per city



received environmental approval, while the remaining 73 lack such approval.

One of the significant challenges Iraq faces in waste disposal pertains to hazardous waste, whether in solid or liquid form. The production of hazardous waste is increasing, particularly due to heightened activities in sectors such as oil production. Regrettably, there is currently no established and regulated landfill specifically designated for hazardous waste in Iraq, highlighting a critical gap in the country's waste management infrastructure.

PRESSURES FROM THE INDUSTRIAL SECTOR

INTRODUCTION

The industrial sector holds significant importance in Iraq due to its crucial role in establishing the material foundation for progress across various domains, including the economic, political, and social spheres. Furthermore, industrial activities represent a significant contributor to air pollution, characterized by the release of harmful gases and particles. This pollution stems from the utilization of outdated technologies in the production processes, the obsolescence of production lines, inadequate maintenance procedures, and a lack of efficient control measures. Moreover, the industrial sector exerts a direct impact on water and soil pollution by discharging liquid or solid waste without proper treatment or with only rudimentary treatments. According to the Environmental Reality Report of 2017, industrial sector-related pollution emerges as a prominent source of environmental pollution, particularly affecting water resources due to:

- Many industrial activities in Iraq are established without due consideration for environmental conditions, often choosing their locations near rivers or disposing of waste without taking environmental factors into account.

- The water recovered from industrial processes often contains high concentrations of pollutants, and a significant portion of it is released into rivers without proper treatment. The discharge of liquid waste from various industrial sectors results in environmental pollution, causing physical, chemical, and biological impacts on the elements of the environment. These effects can vary depending on the type of industry and the technology employed. Current environmental legislation mandates the provision of effective treatment facilities for liquid waste discharge from industrial activities. These specialized facilities are designed to reduce pollutant levels through a series of consecutive stages, ensuring that pollutant concentrations remain within the limits set by existing legislation.

We will now address the most significant drivers and pressures resulting from industrial activities by referencing their respective indicators as follows:

MAIN INDICATORS

Preparation of Industrial Facilities

Table 3.7 presents the key statistics for the industrial sector in Iraq. It shows that the percentage of the number of factories in the public and mixed sectors increased by 3.9% when comparing data from 2017 to 2020. Furthermore, there was a significant rise in the amount of hazardous and non-hazardous waste generated by public and mixed sector companies and laboratories, with an increase of 100% and 117.9%, respectively.

In the year 2020, the total number of large industrial establishments in operation reached 719. These establishments are categorized by their economic activities, with 50% engaged in extractive industries (excluding oil) and manufacturing industries, followed by 30% involved in the manufacturing of food products. The remaining 20% encompass various other industrial activities (Table 3.8).

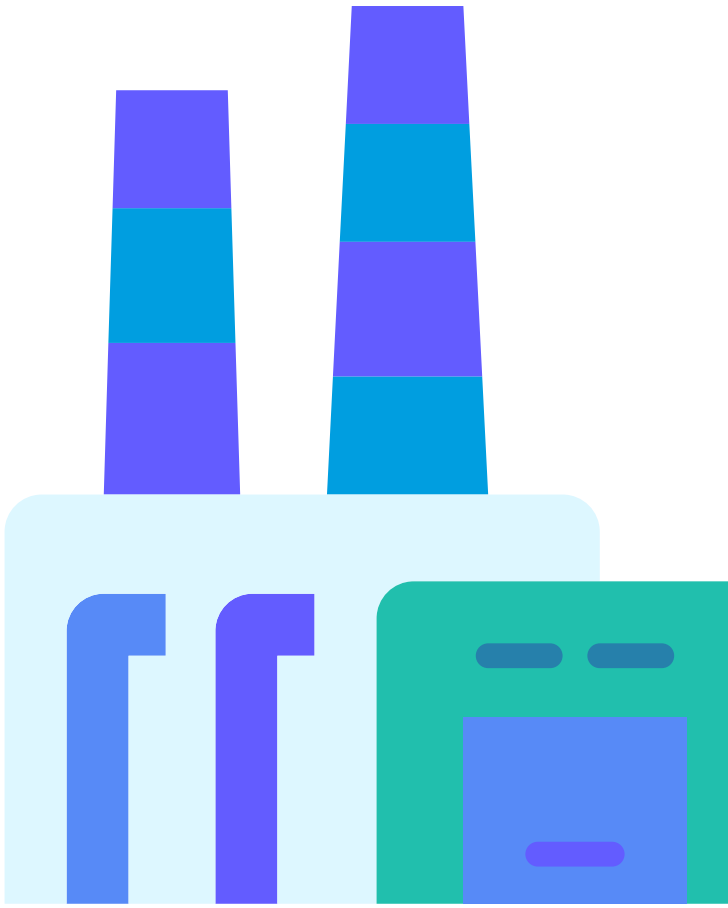


Table 3.7: Main statistics of industry sector indicators (source: Ministry of Planning, Central Bureau of Statistics, Environment Statistics Section, 2017 and 2020)

Index	Index value for the year	
	2017	2020
%) Percentage of operating laboratories affiliated to the Ministry of Industry and Minerals (public sector) and mixed sector companies	66.3	68.9
Monthly average amount of hazardous industrial waste generated from the factories of the Ministry of Industry and Minerals (public sector) and mixed sector companies (tons/month)	1.25	2.5
Monthly average quantity of non-hazardous industrial waste generated by the laboratories of the Ministry of Industry and Minerals (public sector) and mixed sector companies (tons/month)	3825.9	8336.9
Percentage of operating plants affiliated to the Ministry of Industry and Minerals (public sector) and mixed sector companies that rely on the %) liquefaction network as a source of water	26.5	49.3
Daily average amount of water used in the laboratories of the Ministry of Industry and Minerals (public sector) and mixed sector companies that rely on the liquefaction network as a source of water (thousand m3/day)	71.2	119.3
The average daily amount of water discharged from the laboratories of the Ministry of Industry and Minerals (public sector) and mixed sector companies that rely on the liquefaction network as a source of water (thousand m3/day)	36.3	39.7
Number of red meat slaughterhouses	104	103
%) Percentage of the number of stalled red meat slaughterhouses	58.6	54.4
Quantity of effluents discharged from red meat slaughterhouses (thousand m3/day)	136	145
Number of red meat slaughterhouses that own incinerators	34	40
Quantity of solid waste generated from red meat slaughterhouses (thousand tons/year)	16.02	20.6

Table 3.8 presents data on the number and percentage of laboratories affiliated with the Ministry of Industry (public sector) and mixed sector companies, categorized by their functional status and sector for the year 2020.

Sector	Number of Companies	Number of laboratories by functional condition			Percentage of distribution by functional condition		
		Working	Stalled	Total	Working	Stalled	Total
Chemical and petrochemical	8	12	21	33	36.4	63.6	100.0
Engineering	15	64	13	77	83.1	16.9	100.0
Food and Pharmaceutical	2	9	9	18	50.0	50.0	100.0
Textile	1	30	7	37	81.1	18.9	100.0
Construction and Industrial Services	3	25	20	45	55.6	44.4	100.0
Mixed Sector Companies	13	15	0	15	100.0	0.0	100.0
Total	42	155	70	225	68.9	31.1	100.0

Table 8.3: Number and percentage of laboratories by financial situation and sector for the year 2020

In 2020, the engineering sector boasted the highest number of companies, with a total of 15 companies and 77 laboratories (see Figure 3.9). Notably, stalled factories accounted for 31.1% of the overall number of laboratories.

When comparing the number of operational establishments in 2020 to that of 2019, which stood at 670, there was a notable increase of 7.3%. This increase can be attributed to the growth of private activities within the manufacturing sector across all governorates (see Figure 3.10).

Examining the scale of the industrial sector, the data reveals a rise in the number of large industrial establishments that have been operational in recent years. These establishments are categorized based on their primary economic activities, with a significant presence in both extractive industries and manufacturing (see Figure 3.11). The industrial indicators for the year 2020 highlight that the manufacturing of other non-metallic mineral products took the lead in terms of the number of establishments within the manufacturing sector, followed closely by the activities in the food products industry.

Air Quality

The available data pertaining to the industrial sector underscore its substantial contribution to air pollution. It is important to note, however, that there is a lack of data regarding air pollutants stemming from industrial processes due to the absence of monitoring devices for airborne pollutants. Consequently, reliance will be placed on the data found in the Environmental Reality Report of 2017, which furnishes information on air emissions originating from the industrial sector. This report indicates that several industries in Iraq are significant contributors to air emissions, including:

- Cement Plants: The number of cement factories reached 19 in Iraq in 2017, while there are approximately eight cement factories in the Kurdistan region. Data indicates that there are 58 dust precipitators in these laboratories, and all of these precipitators are functioning effectively. It is noteworthy that there are no air quality measurements available for cement plants. Additionally, it's important to highlight that the majority of cement factories in Iraq were constructed without conducting an environmental impact assessment study or obtaining environmental approval. Many of these factories are situated near major population

Figure 9.3: Number of Laboratories of the Ministry of Industry and Mixed Sector by Sector for 2020

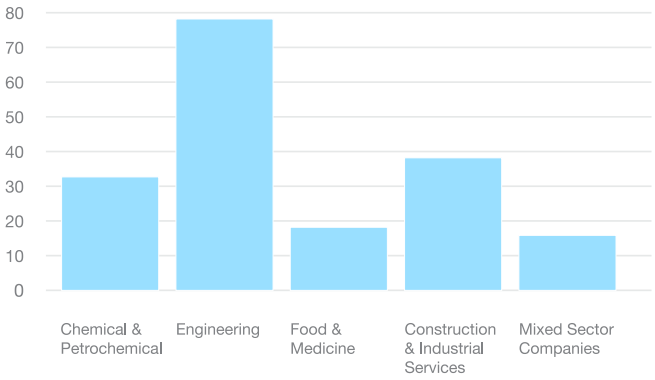


Figure 10.3: Number of Establishments by Sector for 2019-2020

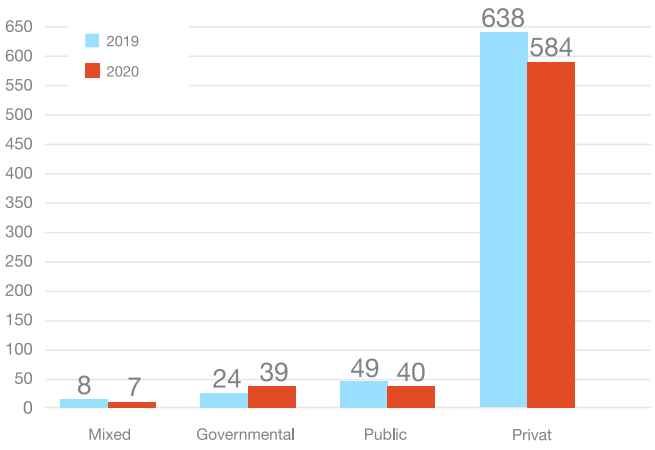
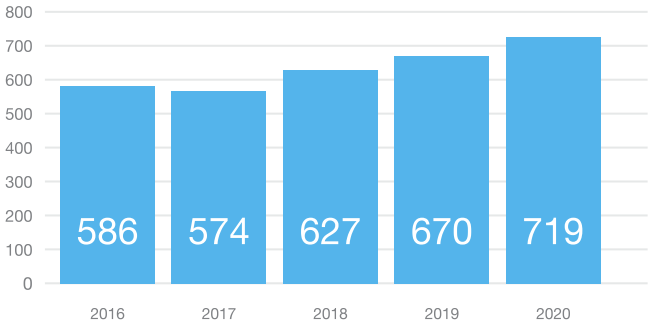


Figure 11.3: Number of major industrial establishments



centers, including Kufa Cement Factory, Badoush Cement Plant, Fallujah Cement Plant, South Cement Factory, and Kubaisa Cement Plant. Furthermore, these cement plants dispose of cement dust generated from kilns at unregulated landfill sites.

- Brick Factories: In 2017, Iraq had a total of 673 brick factories spread across Baghdad and various governorates. Available data indicates that 78% of these factories are equipped with automatic burning systems. Moreover, there is an established mechanism for monitoring the environmental performance of these industries, which has resulted in the issuance of 66 legal procedures against brick factories that have violated environmental requirements.

- Asphalt Plants: In 2017, Iraq had a total of 350 asphalt plants. Data available from 2017 indicates that 33% of these plants lack means to control gas emissions, such as dust precipitators. Furthermore, in the same year, 9 legal actions were taken against asphalt plants that had violated environmental requirements.

- Food Laboratories: The number of food laboratories in 2017 reached 1,282. A significant portion of these facilities did not possess environmental approvals. In the same year, 96 legal actions were taken against laboratories that had violated environmental requirements.

Effluents

In total, the companies and factories under the Ministry of Industry consume approximately 119.3 thousand cubic meters of water per day, with a daily discharge of about 39.7 thousand cubic meters into water sources. Notably, 48.8% of the water used is consumed by the chemicals and petrochemicals sector. The discharge of liquid waste from industrial activities across various sectors contributes to environmental pollution, resulting in physical, chemical, and biological effects on the elements of the environment, particularly when the necessary treatments to reduce pollutants are absent. These effects can vary depending on the type of industry and the technology adopted.

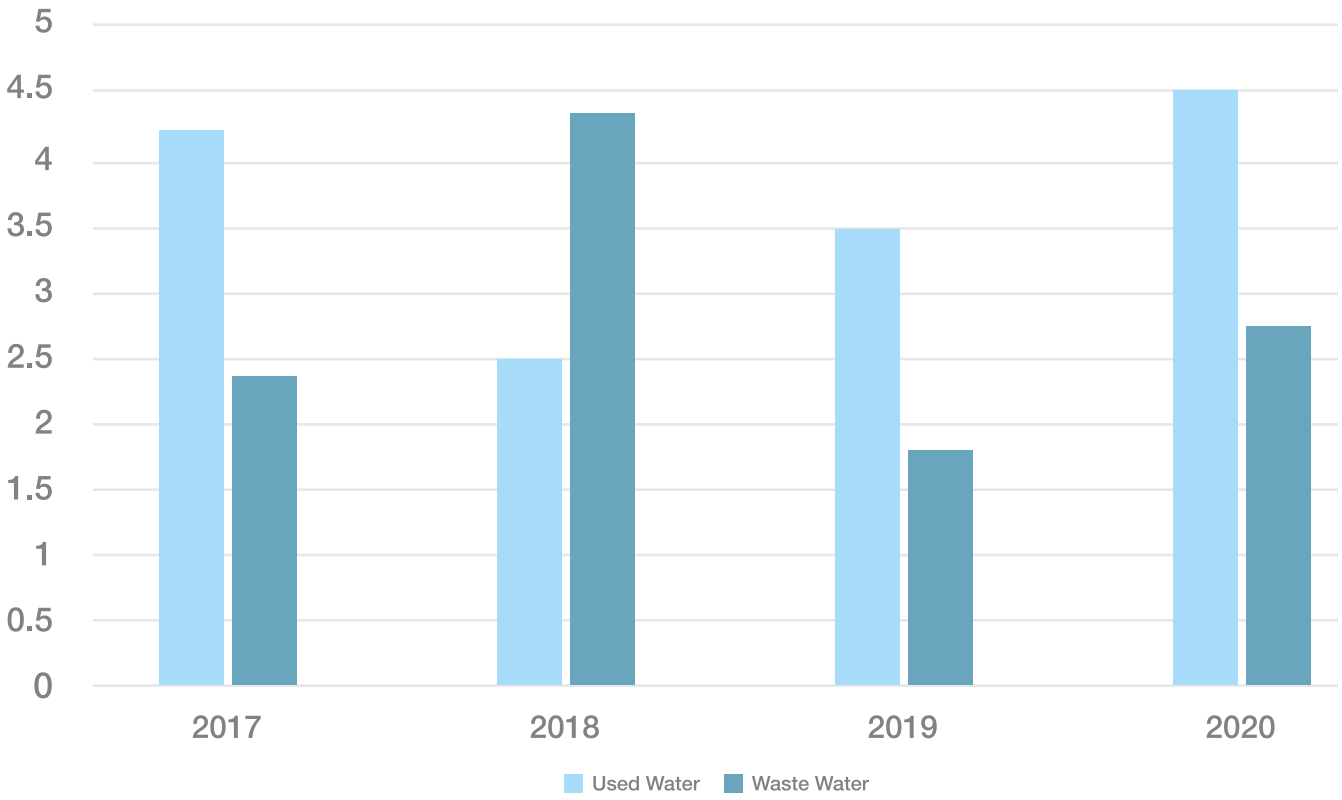
Current environmental legislation mandates the establishment of efficient treatment units for industrial discharges. These specialized facilities are designed to reduce pollution loads through a series of consecutive stages, ensuring that pollutant concentration levels remain within the limits set by existing legislation.

Table 3.10 presents data on the number of factories affiliated with the Ministry of Industry and Minerals (public sector) and mixed sector companies, categorized by the water source used, drainage destinations, and sector for the year 2020.

Table 3.10: Number of factories affiliated to the Ministry of Industry and Minerals (public sector) and mixed sector companies by water source used, drainage destinations and sector for the year 2020.

Sector	Number of laboratories	Number of laboratories by water source used							Number of plants that do not use water	Number of laboratories by discharge bodies								Number of plants that do not drain water
		Tigris River	Euphrates River	Shatt Al-Arab	Liquefaction	Subterranean	Other	Total		Store in select locations	Taps	River	Sewer network	Rotate	Agricultural use	Other	Total	
Chemical and petrochemical	33	3	3	4	10	2	1	23	10	13	3	4	3	0	1	0	24	9
Engineering	77	28	1	3	24	0	0	56	21	3	8	3	7	0	0	0	21	56
Food and Pharmaceutical	18	0	0	0	7	1	0	8	10	0	3	0	3	0	2	0	8	10
Textile	37	4	9	0	14	0	0	27	10	1	3	2	14	0	2	0	22	15
Construction and Industrial Services	45	7	4	0	3	3	0	17	28	6	3	2	8	1	1	0	21	24
Mixed Sector Companies	15	1	0	0	14	0	0	15	0	4	0	0	9	0	0	1	14	1
Total	**225**	**43**	**17**	**7**	**72**	**6**	**1**	**146**	**79**	**27**	**20**	**11**	**44**	**1**	**6**	**1**	**110**	**115**

Figure 3.12: shows the quantities of water used and discharged from the industrial sector during the last four years.



The available data for 2020 concerning the industrial sector (Figure 3.13) reveals that 49.3% of industrial companies and factories primarily depend on liquefied water as their main water source. This is followed by the Tigris River at 29.5% and the Euphrates River at 11.6%. Notably, 35.1% either do not use water or have ceased operations.

Data show that 40% of these industries rely on the sewage network to discharge wastewater, while 24.5% of them collect this water in specific locations, and 51.1% of these industries do not discharge any water Figure 3.14.

Finally, it should be noted that slaughterhouses are another source of liquid waste in Iraq. Figures for 2020 show that slaughterhouses consume about 155,000 cubic meters of water annually. 82% of this water comes from the public network (liquefaction), 9% from tankers and 8% from groundwater. The data also indicate that most of the water consumed in slaughterhouses is disposed of as wastewater. The amount of wastewater from slaughterhouses in 2020 was about 145,000 cubic meters per year. They are disposed of in sewer pits or treatment units.

Figure 3.13: Percentage distribution of water sources used in industries for 2020

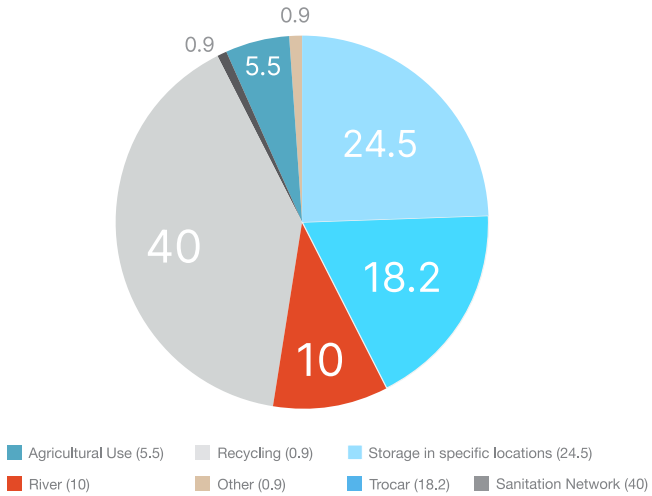
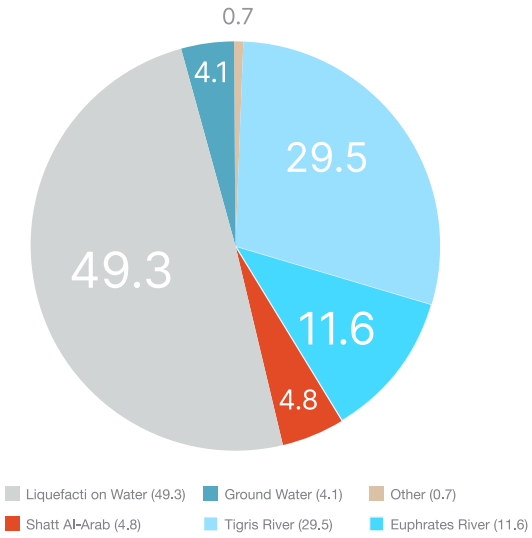


Figure 3.14: Percentage distribution of water sources used in industries for 2020



Solid Waste

Table 3.11 provides information on the number and percentage of factories affiliated with the Ministry of Industry and Minerals (public sector) and mixed sector companies that dispose of solid industrial waste based on the waste classification and sector for the year 2020.

Table 3.12 shows the monthly average amount of hazardous and non-hazardous solid industrial waste generated from factories affiliated to the Ministry of Industry and Minerals (public sector) and mixed sector companies that dispose of solid industrial waste according to the classification of waste and sector for the year 2020.

Table 3.11: Number and percentage of factories that dispose of solid industrial waste according to the classification of waste (for the year 2020)

Sector	Number of laboratories	Number of plants according to their disposal of solid industrial waste			Number of plants that do not dispose of solid waste	Percentage Distribution of Plants by Disposal of Industrial Solid Waste			Percentage of plants that do not release solid waste
		Hazardous	Non-hazardous	Total		Hazardous	Non-hazardous	Total	
Chemical and petrochemical	33	0	5	5	28	0.0	100.0	100.0	84.8
Engineering	77	12	26	38	39	31.6	68.4	100.0	50.6
Food and Pharmaceutical	18	1	4	5	13	20.0	80.0	100.0	72.2
Textile	37	3	3	6	31	50.0	50.0	100.0	83.8
Construction and Industrial Services	45	0	5	5	40	0.0	100.0	100.0	88.9
Mixed Sector Companies	15	0	4	4	11	0.0	100.0	100.0	73.3
Total	**225**	**16**	**47**	**63**	**162**	**25.4**	**74.6**	**100.0**	**72.0**

Table 3.12: Monthly average quantity of hazardous and non-hazardous solid industrial waste generated from factories affiliated to the Ministry of Industry and Minerals (public sector) and mixed sector companies

Sector	Amount of solid industrial waste (kg/month)			Percentage of solid industrial waste
	Hazardous	Non-hazardous	Total	
Chemical and petrochemical	0.0	7,036.6	7,036.6	0.1
Engineering	1,733.0	179,613.0	181,346.0	2.2
Food and Pharmaceutical	65.0	14,343.1	14,408.1	0.2
Textile	750.0	59.7	809.7	0.0
Construction and Industrial Services	0.0	8,134,333	8,134,333	97.5
Mixed Sector Companies	0.0	1,500.0	1,500.0	0.0
Total	**2,548.0**	**8,336,885.4**	**8,339,433.4**	**100.0**

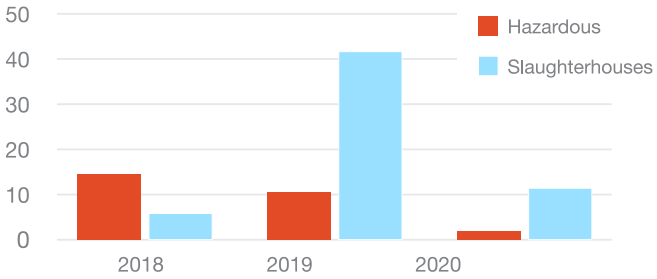
Table 3.13: indicates the method of solid waste disposal by industry type.

Sector	Number of laboratories	Number of laboratories by methods of disposal of hazardous solid waste							Number of laboratories by methods of disposal of non- hazardous solid waste						
		Released in sites	Burned in an incinerator	Reused in the same company	Transferred to a health site	Sent to another party	Sold	Other	Released in sites	Burned in an incinerator	Reused in the same company	Sent to another party	Sold	Buried	Other
Chemical and petrochemical	33	0	0	0	0	0	0	0	0	0	1	3	0	1	0
Engineering	77	0	0	4	0	5	2	3	5	2	1/4	3	0	2	1
Food and Pharmaceutical	18	0	1	0	0	0	0	0	0	4	0	0	0	0	0
Textile	37	2	0	0	1	0	0	0	0	0	3	0	0	1	0
Construction and Industrial Services	45	0	0	0	0	0	0	0	0	0	2	0	3	1	0

Types of Waste: The information shows that there are several types of waste produced by the industrial sector in Iraq, namely:

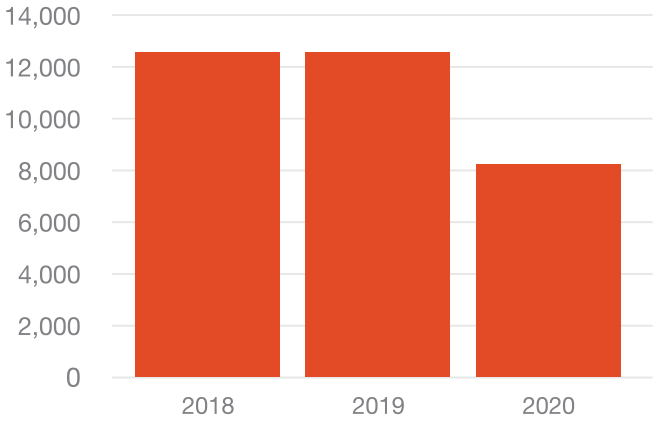
- **Non-hazardous solid industrial waste:** In 2020, available data indicates that the total amount of non-hazardous solid industrial waste generated reached 8,336 tons per month. A significant portion of this waste, approximately 97%, originates from the construction sector and industrial services. Regarding the disposal of non-hazardous waste, the industrial sector predominantly resorts to reuse as the primary method.
- **Hazardous industrial waste:** Also in 2020, the data shows that hazardous industrial waste production amounted to 2.5 tons per day. The majority of this hazardous waste, around 68%, is generated by the engineering sector. When it comes to disposal methods for hazardous industrial waste, the data suggests that sending it to other destinations is one of the most commonly employed practices.

Figure 3.16 shows the quantities of hazardous industrial solid waste and slaughterhouse waste in the last three years .



- **Waste from the red meat slaughterhouses:** According to data from 2020, waste generated by red meat slaughterhouses is estimated at approximately 20,000 tons per year. These slaughterhouses often sell a significant portion of their usable waste, such as skin and heads, while the remaining parts are either incinerated or disposed of at municipal assembly sites.
- **Waste from white meat slaughterhouses:** The data also indicates that white meat slaughterhouses produce around 140 tons of solid waste annually, with a majority of them situated in agricultural areas.

Figure 3.15: Quantities of non-hazardous industrial waste in the last three years (tons/month)



PRESSURES FROM THE HEALTH SECTOR

INTRODUCTION

The health sector in Iraq continues to grapple with numerous problems and challenges, primarily stemming from the exceptional circumstances faced by Iraqi society. The healthcare system remains plagued by issues related to the quality of services, as well as the limited availability and inadequacy of medical supplies. This shortfall has had adverse repercussions, notably in the realm of inadequate oversight of imported and sold medicines and food products, a failure to implement necessary measures to address water, air, and soil pollution, weak enforcement of legislation and guidelines concerning noise sources and modern communication infrastructure such as towers. All of these factors have taken a toll on the human and environmental health in Iraq.

Moreover, the shortcomings within the government health sector have fueled the growth of the private health sector, making it challenging for various segments of the population to access appropriate healthcare due to the high costs associated with private healthcare and the absence of a comprehensive health insurance system. In continuation of the discussion in the first chapter addressing environmental challenges in Iraq, we will now highlight the most significant challenges within the healthcare sector. These key environmental challenges in the field of health include:

- **Internationally prohibited weapons:**

notably depleted uranium, were extensively utilized by the US military in the bombardment of infrastructure, as well as strategic military and civilian sites in Iraq. In the 1991 war alone, the US army deployed over 300 tons of depleted uranium, and during the 2003 invasion of Iraq, estimates vary between 170 to 1700 tons, according to reports from the United Nations. Despite the substantial quantity of depleted uranium employed, neither local nor international bodies, nor any United Nations organizations, have conducted a thorough and comprehensive study to address this critical issue, propose suitable solutions, or investigate the presence and impact of depleted uranium on human health and the environment, including its various components. It is well-established that ionizing radiation from radioactive elements, such as depleted uranium, can result in a range of illnesses that may manifest rapidly and lead to swift fatality in cases of high concentrations. Furthermore, diseases may emerge years later, including certain types of cancers. Ionizing radiation also has repercussions on the offspring of individuals exposed to it and influences the growth and development of fetuses during pregnancy.

- **Sources of medicines:**

The sources and origins of medicines entering Iraq since 2003 have exhibited significant variation and unpredictability. This has made it challenging, even for experts, to accurately identify them. Importantly, the import and distribution of medicines are no longer exclusively managed by the Ministry of Health; private companies and drug stores have become active participants in the pharmaceutical trade. Regrettably, this expansion in the supply chain has opened the door to the introduction of expired medical materials and medicines or products from unverified sources, raising concerns about the quality and safety of pharmaceuticals available in the country.

- **Food Safety:**

According to a 2013 UN report, Iraq relies heavily on food imports, including beef, poultry, oils, fats, and dairy products. Furthermore, Iraq acquires approximately 60-70% of its vegetable supply from neighboring countries. Additionally, it is expected that Iraq's reliance on wheat imports from abroad will increase by 70% in the future.

Despite the substantial quantities of food entering Iraq daily from various countries and sources, the level of health control remains below the required standards, if not entirely absent. Consequently, there is a lack of assurance regarding the safety of food consumption by Iraqi citizens, particularly in the case of frozen dairy, meat, chicken, and fish.

Some reports have raised concerns about the presence of formalin (a substance suspected to be carcinogenic) in certain imported dairy products, the detection of pesticides in imported frozen meat, and the treatment of some food products with gamma rays, which can lead to the formation of free radicals associated with cancer. Moreover, there are concerns about the import of fish raised in contaminated water sources and the sale of expired foodstuffs after altering or removing the expiration date.

Furthermore, issues related to the inadequate storage, transportation, and sale of milk derivatives, juices, soft drinks, fish, chicken, and frozen meat have been noted. Additionally, the repeated freezing and thawing of frozen food products can render them susceptible to the growth and proliferation of bacteria and microbes. These issues collectively pose a significant threat to public health in Iraq.

- **Mobile Towers and Antennas:** Despite the existence of guidelines provided by the Ministry of Environment, as published in the Iraqi Gazette, issue 4157 on 5/7/2010, with the aim of safeguarding individuals from potential biological effects associated with non-ionizing radiation generated by mobile phone systems, it is a common occurrence to witness the presence of numerous, and perhaps even hundreds, of communication towers on the rooftops of residential houses and buildings in every neighborhood and city. Regrettably, these installations often disregard the provided guidelines and existing laws.

- **Indiscriminate Slaughtering:** In Baghdad and the provinces, the phenomenon of slaughtering animals indiscriminately on roadsides and in squares is widespread. They occur without the necessary hygiene conditions or official health control, which contributes to the pollution of the environment with slaughter residues, the multiplication of insects on it and the spread of diseases. Despite working to combat this phenomenon from time to time, it is still a common phenomenon spread within cities, including the capital, Baghdad, as well as the spread of the phenomenon of breeding or selling animals in some public and open places.

- **Noise:** The issue of noise in Iraq, particularly in the city of Baghdad, has escalated due to the large influx of vehicles without proper regulations and the absence of stringent laws to deter the use of alarm devices in restricted areas. Instances of gunfire and the excessive use of alarm devices at events like weddings, funerals, sports matches, and other gatherings have further contributed to this problem. The situation is compounded by the widespread use of electricity generators, as well as activities related to construction, excavation, craft workshops, industrial laboratories, sound recording studios, household electrical appliances, and more.

Additionally, a recent phenomenon has emerged, involving the modification of motorcycle and car exhaust systems to produce the maximum possible noise from their engines. It is important to note that prolonged exposure to loud noise and sounds can lead to various health effects, including discomfort, heightened stress, nervous tension, sleep disturbances, insomnia, reduced concentration and comprehension, and an increased prevalence of hearing impairments. Furthermore, continuous, and loud noise can have detrimental effects on the development of embryos during the early stages of pregnancy.

MAIN INDICATORS

Health indicators encompass multiple dimensions that provide a comprehensive overview of the healthcare situation at various levels. These indicators offer precise numerical data and percentages reflecting the progress achieved in hospitals and health facilities over the past few years.

From Table 3.14, it is evident that the number of government hospitals increased by 8% in 2020 compared to 2017. Simultaneously, there was a 22% increase in the total number of hospitals. It's worth noting that there was a 9.7% decrease in popular medical clinics, whereas there was a significant rise in specialized centers and primary health care centers, marking a 32.7% and 5.5% increase, respectively, during the same period.

Furthermore, there was a notable 9% reduction in viral hepatitis cases, contrasted by an alarming increase in the number of cases related to immunodeficiency disease and cancer, which saw a surge of 121% and 40%, respectively.

Table 3.14: The most important statistics of health indicators (source: Ministry of Planning, Central Bureau of Statistics, Environment Statistics Section, 2017 and 2020)

Indicators	Index value for the year	
	2017	2020
Number of government hospitals	273	295
Number of private hospitals	127	155
Number of popular medical clinics	378	341
Number of specialized health centers	180	239
Number of primary health care centers	2658	2805
Number of cases of chickenpox	64489	-
Number of cases of scabies	13514	-
Number of cases of viral hepatitis	25458	23164
Number of immunodeficiency disease cases	95	210
Number of tuberculosis cases	7707	-
Total incidence of cancerous tumors	25598	35864

HEALTH CONTROL

Since its establishment in 1935, the Ministry of Health has placed a special focus on health control, carrying out responsibilities related to the monitoring and supervision of food establishments and laboratories to ensure adherence to health standards and regulations in accordance with the approved mechanisms and legal frameworks. This commitment aims to ensure that the community enjoys access to safe and pathogen-free food and water.

Table 3.15 presents data pertaining to the operational health control activities at the governorate level, while Table 3.16 provides information on health control, inspection visits, and the measures undertaken in 2021. Additionally, Table 3.17 displays data on health control activities conducted in food factories, and Table 3.18 showcases the health control activities related to water quality for the year 2021.

Table 3.15: Executive health oversight activity in Iraq

No. of periodic investigations of communicable disease		Health education courses			Audit staff workers			Health Unit
No. of cards for medical cards	No. of vaccinated persons against typhoid	No. of participant	Seminars	No. of courses	Para Administrative and service workers	Para medical	medical staff	
7921	1675	7277	83	360	0	142	24	Baghdad/ Al-Karkh
8504	4033	7241	230	466	0	171	7	Baghdad/ Al-Rusafah
7454	626	5281	177	414	0	125	24	Basrah
6836	147	6688	71	442	0	129	13	Nainawa
2179	725	919	140	121	0	46	0	Missan
2928	1470	2248	215	186	0	75	6	Al-Diwanya
3953	501	984	103	54	0	94	5	Dyala
4428	5	3437	106	62	0	99	2	Al-Anbar
3362	0	1320	96	110	0	124	7	Babil
6175	6	4629	212	263	0	123	2	Karbala
4275	4176	853	66	53	0	144	0	Karkuk
2591	733	819	46	53	0	65	0	Wasit
6064	2552	4044	306	350	0	140	1	ThiQar
1826	722	1355	120	96	0	51	1	Al-muthanna
5661	3649	5536	745	414	0	54	5	Salah Aldeen
5891	412	3012	39	129	0	74	2	Najaf
80,048	21,432	55,643	2,755	3,573	0	1,656	99	total

Table 3.16: Health monitoring activity and actions

No. of investigated samples				Type of field visits for general shops				No. of general shops				Health Unit
Imported		Local		Quantities if materials		No. of inspected visits						
Invalid	Valid	Invalid	Valid	Liquid material	Solid material	Multi sectors	Individual	Assigned to courts	No of Closed and exceeding shops	No. of inspected visits	No. Total	
141	4489	71	1462	94248	265549	1852	700	89	5274	45006	5534	Baghdad/ Al-Karkh
56	5442	150	5506	1475933	492216	368	523	230	4105	82622	6491	Baghdad/ Al-Rusafah
186	3752	284	2279	86111	442154	284	299	29	1305	74308	5447	Basrah
173	675	617	3278	19366	228742	346	974	3	447	47424	5139	Nainawa
7	1041	24	255	9202	49859	187	134	0	402	10988	1017	Missan
6	80	50	1057	74269	50308	403	290	0	475	62267	1816	Al-Diwanya
16	1213	93	2301	320706	369902	577	584	46	592	29765	2596	Dyala
5	17	0	298	219344	55868	959	1014	0	174	25908	2490	Al-Anbar
21	80	62	419	87559	215107	546	1198	0	748	34531	3104	Babil
73	1756	71	1553	244511	361237	302	473	0	3007	33541	4814	Karbala
3	1187	135	3337	155772	241095	151	242	0	864	24369	4081	Karkuk
0	310	38	1610	22172	49942	295	572	91	561	17509	1842	Wasit
61	522	91	256	21295	69597	424	664	0	1778	40470	2989	ThiQar
0	5	25	100	120063	117793	375	468	0	732	13756	1677	Al-muthanna
2	34	8	72	33806	51902	747	2717	0	1876	40616	3383	Salah Aldeen
37	417	80	3344	44334	70512	287	180	0	328	28875	2371	Najaf
787	21020	1799	27127	3028691	3131783	8103	11032	488	22668	611955	54791	total

Table 3.17: Health monitoring on the food industry plants

No. of trade markers		Unaccredited factories			Food factories				Health Unit
Non registers	Registers	No. of fined factors	Closed No.	Total No.	Assigned to the courts	Closed No	Visited No.	Factories total No.	
-	140	193	129	65	1	103	2275	183	Baghdad/ Al-Karkh
56	260	74	68	89	7	158	3251	263	Baghdad/ Al-Rusafah
4	0	0	0	-	-	6	1417	133	Basrah
-	152	33	33	11	-	24	2201	265	Nainawa
24	18	9	2	3	1	1	1139	45	Missan
-	41	0	0	-	-	3	450	64	Al-Diwanya
-	106	5	5	2	1	24	1285	108	Dyala
-	29	12	0	6	-	-	791	66	Al-Anbar
-	109	3	0	9	2	27	2568	332	Babil
-	106	0	0	-	-	108	1234	100	Karbala
32	85	0	0	-	-	46	2919	96	Karkuk
-	20	6	3	2	-	38	568	56	Wasit
-	56	3	9	3	-	25	391	75	ThiQar
-	35	1	0	-	-	24	365	35	Al-muthanna
27	31	0	0	-	-	29	518	57	Salah Aldeen
-	114	2	0	1	7	21	1325	118	Najaf
143	1400	341	249	191	19	637	22697	1996	total

Table 3.18: Health monitoring activities on water quality

Tab water samples for lab examination				Water projects stations & parks					Health Unit
No. of results of samples			PHCC Served with drinking water	No. of results of samples			Visited No.	Total No. of actually workers	
Invalid	Valid	No.Total		Invalid	Valid	Total No.			
488	1418	1906	107	202	296	498	660	55	Baghdad/ Al-Karkh
821	1052	1873	106	335	215	550	636	53	Baghdad/ Al-Rusafah
944	4	948	126	761	3	764	1701	167	Basrah
229	1425	1654	56	45	397	442	619	53	Nainawa
1195	100	1295	30	389	0	389	708	59	Missan
526	651	1177	70	649	1186	1835	1944	162	Al-Diwanya
505	1591	2096	69	138	812	950	941	94	Dyala
0	0	0	115	179	1640	1819	2227	264	Al-Anbar
608	1175	1783	110	521	1479	2000	1968	164	Babil
733	731	1464	56	486	471	957	948	79	Karbala
159	1470	1629	55	32	496	528	552	46	Karkuk
1209	448	1657	71	801	761	1562	2316	193	Wasit
283	0	283	74	133	4	137	1380	115	ThiQar
851	40	891	39	645	58	703	1032	68	Al-muthanna
302	486	788	44	379	498	877	1298	123	Salah Aldeen
367	866	1233	78	181	571	752	972	81	Najaf
9220	11457	20677	1206	5876	8887	14763	19902	1776	total

Table 3.19: shows data on COVID-19 infection, recovery, and percentages during 2021 at the governorate level.

Recovery per. From the number of recoveries	Covid-19 cure cases	Infection per. From the total number of infections	Covid-19 cases	Health Unit
15%	227759	15%	228616	Baghdad/ Al-Karkh
11%	160729	11%	161383	Baghdad/ Al-Rusafah
1%	20697	1%	21420	Madinat Al-Tib hospital
28%	409185	27%	411419	Baghdad governorate
11%	167436	11%	168007	Basrah
3%	47226	3%	47686	Nainawa
4%	60138	4%	60569	Missan
3%	46832	3%	47179	Al-Diwanya
4%	55922	4%	55970	Dyala
1%	12669	1%	12691	Al-Anbar
3%	41327	3%	41738	Babil
4%	58016	4%	58412	Karbala
3%	43950	3%	44572	Karkuk
5%	79113	5%	79394	Wasit
5%	66674	4%	67424	ThiQar
1%	21055	1%	21164	Al-muthanna
2%	32741	2%	33181	Salah Aldeen
5%	68003	5%	68396	Najaf
82%	1210287	81%	1217802	total (Excluding KRI)
NA	NA	NA	NA	Erbil
NA	NA	NA	NA	Duhok
NA	NA	NA	NA	Sulimaniyah
100%	1487250	100%	1498600	total

MEDICAL WASTE

Medical waste generated by healthcare institutions, research centers, laboratories, and other sources poses a significant risk to both human health and the environment. It exerts additional pressure on solid waste management, and improper handling can lead to the potential exposure of workers and the wider community to infectious diseases and physical injuries, including wounds. Furthermore, it can result in environmental damage.

The Ministry of Health's strategy for managing medical waste involves a shift from previously used incinerators to heat treatment devices, such as shredding autoclave kilns. These heat treatment devices are currently in use across all health departments. In addition to this, each department is equipped with an incinerator with a capacity of 250 kg per hour. This approach aims to enhance the safe and efficient disposal of medical waste while minimizing the associated risks to health and the environment.

PRESSURES FROM THE AGRICULTURE SECTOR

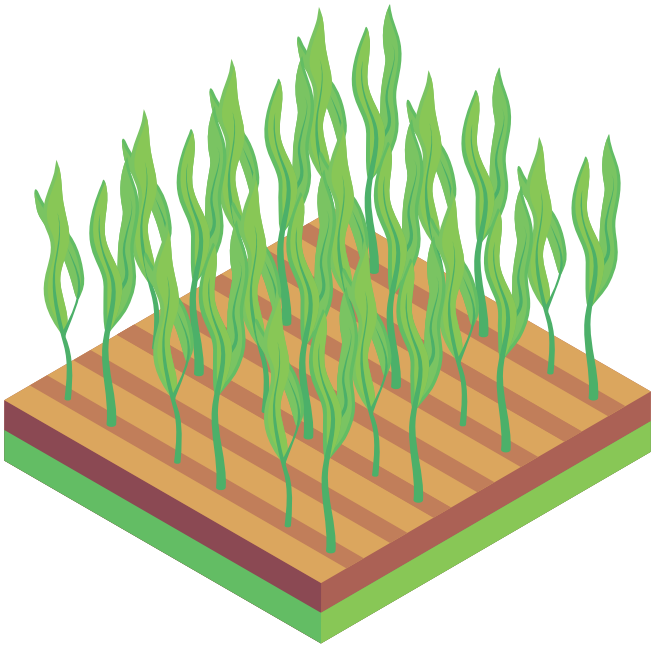
INTRODUCTION

Agriculture stands as one of the primary economic activities that significantly contribute to the national economy, and its connection to food security is integral to national stability. The attainment of food security hinges on the availability of locally produced food. When the agricultural sector experiences growth and development, it plays a pivotal role in diversifying the economy, reducing poverty, improving the trade balance, and fostering growth in associated sectors. Developing the agricultural sector also aids in addressing unemployment, curbing the volume of imports, advancing society, strengthening the economy, and ensuring that local agricultural products are safer for consumers compared to imports. This is especially crucial given the association between many modern diseases and food consumption, and the positive impact of agricultural development on environmental conditions.

However, it's important to note that, according to Iraq's Nationally Determined Contributions on Climate Change, the agricultural sector is one of the most water-intensive sectors in the country, accounting for approximately 35 billion cubic meters of water consumption per year. This sector consumes about 85% of Iraq's water resources. Due to the usage of open and outdated irrigation channels, inadequate water resource management, dilapidated infrastructure, and the application of traditional irrigation methods (e.g., surface irrigation) for certain crops like rice, the volume of irrigation water has exceeded recommended levels over time, leading to elevated water tables and soil waterlogging and salinization. This poses significant challenges to sustainable agricultural practices and necessitates better water management strategies in the sector (Table 3.20).

Table 3.20: Main agricultural statistics (source: Ministry of Planning, Central Bureau of Statistics, Environment Statistics Section, 2017 and 2020)

Indicators	Index value for the year	
	2017	2020
Arable land area (million dunums)	23.4	13.5
Area of desert land (million dunums)	26.8	27.2
Area of land threatened by desertification (million dunums)	93.8	94.3
Area of contaminated hazardous areas (munitions, remnants of war, minefields, etc.) (million m2)	479.3	2,574.7



MAIN INDICATORS

ARABLE LAND

Table 3.20 indicates a significant reduction in the area of arable land during the period between 2017 and 2020, with a notable decrease of 42%. Simultaneously, there has been an increase in desert lands and lands

Table 21.3

Governorate	Natural forest area	Artificial forest area				Total area of natural and artificial forests
		***Forest areas of the Department of Forestry and Desertification projects			The are a of forests belonging to the directorates of agriculture of the governorates and the list until 31/12/2020	
		Existing forest area until 31/12/2019	Wooded areas during 2020	Total		
Nineveh	..	35	0	35	198	233
Kirkuk	638,220	3,294	0	3,294	968	642,482
Diyala	..	644	0	644	25	669
Anbar	0	0	0	0	664	664
Baghdad	0	3,390	10	3,400	0	3,400
Babylon	0	0	0	0	1,821	1,821
Karbala	0	0	0	0	237	237
Wasit	0	10,672	10	10,682	100	10,782
Saladin	0	0	0	0	140	140
Najaf	0	0	0	0	658	658
Qadisiyah	0	0	0	0	820	820
Muthanna	0	0	0	0	0	0
Dhi Qar	0	0	0	0	0	0
Maysan	0	0	0	0	250	250
Basra	0	0	0	0	270	270
Total	638,220	18,035	20	18,055	6,151	662,426
Kurdistan Region						
Duhok	1,040,908	-	-	-	8,068	1,048,976
Sulaymaniyah	570,496	-	-	-	15,980	586,476
Erbil	543,032	-	-	-	8,536	551,568
Total	2,154,436	..	..	..	32,584	2,187,020
Total Iraq	2,792,656	18,035	20	18,055	38,735	2,849,446

Data unavailable ..

Natural forests in Kirkuk province except Garmian district *

Decrease in forest areas belonging to the projects of the Department of Forestry and Desertification due to terrorist and military operations in the governorate **

The forest areas of the Department of Forestry and Desertification represent only wooded land and not the total area of the forest

vulnerable to desertification, marking a 1.7% and 0.53% rise, respectively. Most notably, the area of open land in 2017 and 2020, which remains at risk, has expanded from 479.3 million square meters to 2,574.7 million square meters, representing a substantial increase of 437%.

– **Forests**

Table 3.21 provides data on the area of natural and artificial forests, measured in dunums, for each governorate in the year 2020. The source of this information is the Ministry of Agriculture, specifically the Planning and Follow-up Division, as well as Statistics.

– **Irrigation Method**

Fertile lands comprised the largest expanse, covering approximately 6.7 million dunums, followed by irrigated lands at 5.0 million dunums, and lands utilizing wells, which accounted for 2.8 million dunums (as shown in Figure 3.17). This situation underscores a significant concern due to the reliance on rainfall and surface water sources, as there has been a noticeable decrease in rainfall and a critical decline in water inflows from the Tigris and Euphrates rivers. This vulnerability highlights the pressing need for sustainable water resource management practices in order to safeguard agricultural productivity and mitigate potential water shortages.

– **LANDS THREATENED BY DESERTIFICATION AND SAND DUNE**

Table 3.22 provides information on the distribution of land areas threatened by desertification and sand dunes by governorates for the year 2020. It's important to note that data concerning the extent of land affected by soil erosion and desertification in Iraq is presented in Table 3.23, with data available for the year 2016. Unfortunately, data for the subsequent years (2017-2020) is not available.

Figure 3.17: Area of cultivated land according to the nature of irrigation for the year 2020, Source: Ministry of Planning, Central Bureau of Statistics

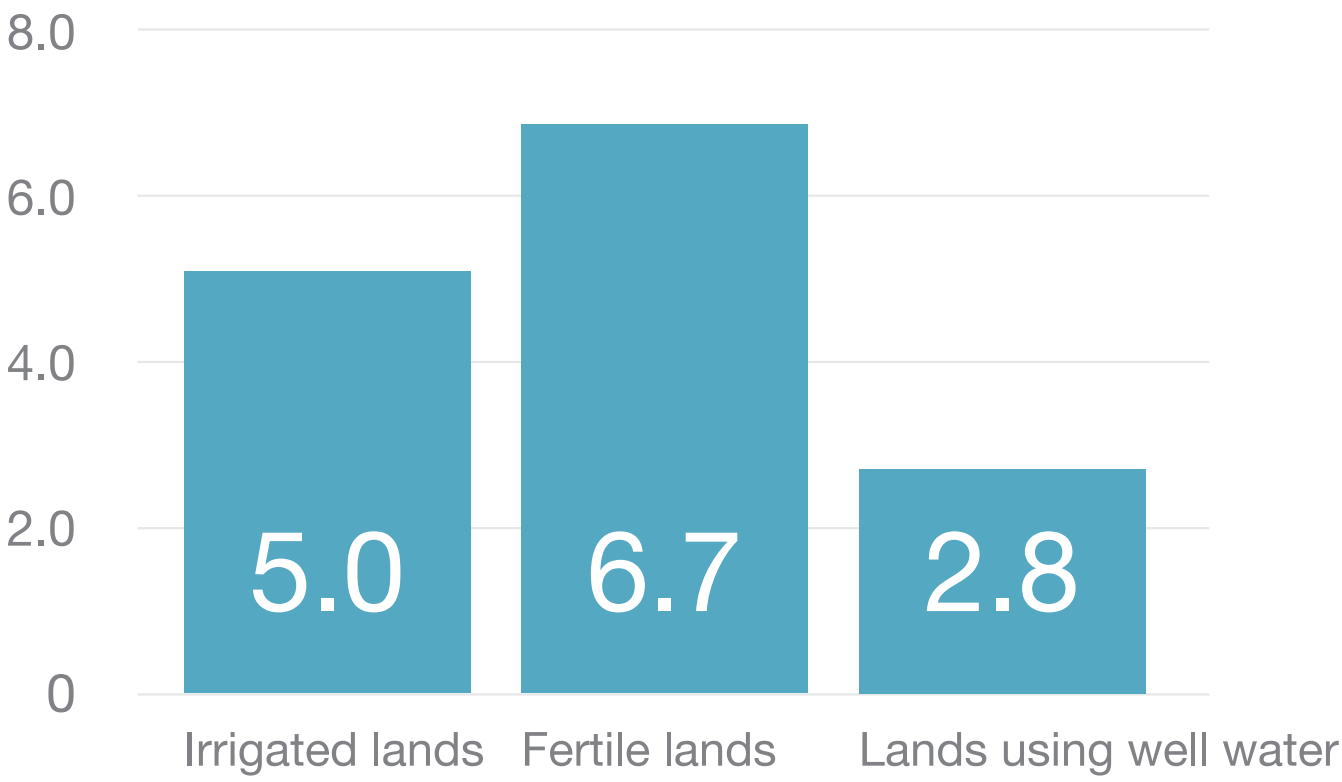


Table 3.22: Area of desert, desertified areas, those threated by desertification and sand dunes for the year 2020 (Source: Ministry of Agriculture/Planning and Follow-up Department/Statistics Department)

Governorate	Desert and desertified lands (dunums)	Lands threatened by desertification (dunums)	Sand Dunes (Dunum)
Nineveh	2,293,220.0	4,137,640.0	1,078,000.0
Kirkuk	11,725.7	661,980.0	0.0
Diyala	657,476.0	1,737,990.0	49,147.6
Anbar	7,467,920.0	45,804,400.0	72,126.0
Baghdad	87,973.6	414,612.0	0.0
Babylon	26,921.8	317,202.0	2,656.2
Karbala	428,932.0	1,094,350.0	29,768.2
Wasit	1,106,680.0	2,093,360.0	25,764.7
Saladin	929,360.0	4,982,240.0	1,235,420.0
Najaf	666,568.0	10,287,900.0	31,597.3
Qadisiyah	338,226.0	1,300,360.0	59,516.0
Muthanna	6,515,160.0	13,796,000.0	1,486,770.0
Dhi Qar	1,459,660.0	1,759,030.0	68,566.4
Maysan	1,439,960.0	2,423,940.0	91,724.4
Basra	3,348,780.0	2,920,310.0	10,781.8
Total	26,778,563.1	93,731,314.0	4,241,838.6
Kurdistan Region			
Duhok	..	..	0.0
Sulaymaniyah	..	..	0.0
Erbil	..	..	0.0
Total	441,798.1	563,086.0	0.0
Total Iraq	27,220,361.2	94,294,400.0	4,241,838.6

Data not available, Note: The percentage of desert and desertified lands (15.6%) and lands threatened by desertification (53.9%) and their total (69.5%), which represents the .. percentage of degraded land of the total area of Iraq

Table 3.23: Area affected by soil erosion and desertification in Iraq in 2016 (Source: Ministry of Agriculture/Planning and Follow-up Department/ Statistics Department)

Type of desertification	Intensity	Affected area (dunums)
Wind erosion	Light - Medium	5,724,000
	Intense - Very intense	2,612,000
Water erosion	Light - Medium	18,764,000
	Intense - Very intense	
Soil salinization	Light - Medium	5,288,000
	Intense - Very intense	26,716,000
Soil hardening	Calcification	67,084,000
	Gypsum	34,400,000
Total area affected by soil erosion and desertification	**160,588,000**	

Note: Data for the years 2017, 2018, 2019 and 2020 are not available, so data for 2016 was published

CONTAMINATED HAZARDOUS AREAS

Table 3.24 presents data on the extent of hazardous areas contaminated with various forms of explosives, including confrontation land, cluster munitions, remnants of war, minefields, explosive devices, and unexploded ordnance. The data covers the period from 2004 to 2020. This data highlights the significant issue of land contamination with hazardous materials and the devastating impact it has on large areas of land, including those that were previously used for agricultural production. The contamination has resulted in substantial land loss and poses considerable risks to the population and their livelihoods.

Table 3.24: Area of hazardous areas contaminated with various forms of explosives, measured in square meters (m2), including confrontation ground, cluster munitions, remnants of war, minefields, improvised explosive devices, and unexploded ordnance. The source of this information is the Ministry of Environment, specifically the Department of Planning and Follow-up.

Governorate	Open (risk remains)	Closed (removing risk)	Ongoing work	Total
Nineveh	28,921,324	384,841,565	28,596,539	442,359,428
Kirkuk	25,829,533	78,780,794	11,289,769	115,900,096
Diyala	357,910,246	11,826,773	1,126,666	370,863,685
Anbar	184,370,482	651,690,946	12,983,051	849,044,479
Baghdad	13,893,027	92,550,950	0	106,443,977
Babylon	247,321,170	4,917,769	71,076,472	323,315,411
Karbala	6,181,780	7,294,845	0	13,476,625
Wasit	110,145,024	40,639,950	0	150,784,974
Saladin	87,937,419	263,883,252	474,866	352,295,537
Najaf	3,822,584	11,382,827	0	15,205,411
Qadisiyah	41,284,712	49,998,268	19,502,084	110,785,064
Muthanna	86,131,733	138,030,941	27,300,918	251,463,592
Dhi Qar	89,564,834	109,745,528	13,167,308	212,477,670
Maysan	70,502,662	282,369,044	7,976,733	360,848,439
Basra	1,220,916,525	954,848,928	38,202,552	2,213,968,005
Total	2,574,733,055	3,082,802,380	231,696,958	5,889,232,393

Note: 1- The value (0) means that no detection of contaminated hazardous areas in the governorate is carried out or the area value is less than (m²)
As a result of the modernization work of non-technical surveys, the total contaminated areas were reduced from the previous year in the governorates (Karbala, Wasit, Najaf and -2 Muthanna)
The closed areas in Karbala province decreased from the previous year as a result of checking their data with the coordinates and correcting the connection of the dangerous -3 .area with the area of the concerned governorate

POLLUTION OF THE SOIL

Soil pollution results from the accumulation of various substances, including toxic compounds, salts, chemicals, radioactive materials, and all pathogenic factors in the soil, all of which have adverse effects on plant growth, animal health, and human well-being. The presence of these pollutants in the soil is primarily attributed to human activities, although some of them can occur naturally, such as the accumulation of mineral elements in the soil in concentrations exceeding permissible limits. Factors contributing to soil pollution encompass:

1. **Seepage of waste from landfills into the soil.**
2. **Discharge of factory waste into the soil.**
3. **Contaminated water infiltrating the soil.**
4. **Underground storage tank explosions.**
5. **Excessive use of pesticides and fertilizers.**
6. **Leakage of solid household waste into the soil.**

The accumulation of municipal waste in urban areas, coupled with the absence of organized landfills, stands as a primary contributor to soil pollution in Iraq. The rapid population growth has led to an upsurge in waste generation, placing considerable strain on the existing waste management infrastructure. Consequently, many families resort to improper disposal methods and haphazard waste accumulation. Furthermore, the current waste management system exhibits inefficiency due to the lack of proper waste collection, sorting, treatment, and disposal facilities. It is worth noting that the existing waste management system relies on a limited number of landfill sites, many of which do not meet the requisite landfill conditions. In 2017, there were approximately 195 landfill sites, which increased to 220 by 2020. Notably, the quantity of waste disposed of in 2017 was estimated at 20.37 million tons, decreasing to 19.7 million tons by 2020. This decline, in the face of a growing population, signifies that substantial volumes of waste are being managed on the soil surface, thus significantly contributing to soil pollution.

The lack of awareness among farmers and inadequate regulatory oversight by the relevant authorities have resulted in the excessive use of fertilizers and pesticides. The overuse of agrochemicals, in turn, results in the accumulation of non-biodegradable chemicals in the soil. Pesticide pollution is a significant form of chemical soil pollution that stems from agricultural practices employing organic or inorganic compounds to combat harmful organisms that threaten both human and animal food sources, as well as agricultural productivity. The chemical compounds comprising pesticides are applied in various ways, depending on the location and type of infestation. Some are directly added to the soil surface, while others are injected beneath the soil surface. Additionally, some pesticides are sprayed onto plant leaves or bushes, while others are applied directly to seeds before planting. Some are distributed in the form of dust (fogging) on plants. The misuse of pesticides concerning their quality, quantity, concentrations, application methods, and timing has led to environmental pollution, affecting soil, water, and air. It is noteworthy that there is a discrepancy in pesticide usage over the years from 2017 to 2021, as evidenced by Table 25.3. In 2019, Iraq's pesticide consumption was estimated at 428.5 tons and 238.9 thousand liters. Improper storage of agrochemicals in warehouses can result in container damage or product expiration. Damaged and expired containers are typically disposed of or buried, leading to frequent spills that contaminate the soil.

A similar situation exists with chemical fertilizers, which represent another source of soil pollution. Data reveals a consistent increase in the quantity of fertilizers used over the period from 2017 to 2021, signaling the likelihood of a rise in soil pollutants.

Hazardous waste, encompassing electrical and electronic equipment, components, and accessories, along with damaged or expired parts and products containing polychlorinated biphenyls (PCBs), chlorofluorocarbons (CFCs), polyvinyl chloride (PVCs), and toxic compounds like lead, mercury, and cadmium, also play a significant role in soil pollution.

According to data from the Ministry of Environment, the total amount of hazardous waste generated from various sectors in 2020 was estimated to be approximately 2.547 tons. This waste was distributed across different sectors as follows: 39% originated from agriculture, 26% from industry, 23% from the oil sector, and 9% from healthcare waste. Additionally, there is a significant quantity of hazardous waste stemming from imported or used products, including items like auto parts, used tires, leather, used electrical and electronic appliances,

and used household equipment. These items impose a substantial burden, in addition to domestic sources of hazardous waste. It's important to note that the importation of such used items is regulated and prohibited under used import controls and international conventions.

Moreover, the healthcare sector in Iraq consistently generates an average of 331 tons of hazardous medical waste per month. Although there is a general practice of segregating medical waste from non-medical waste, it's worth noting that 57% of healthcare institutions only partially adhere to this segregation process. Medical waste in Iraq is typically managed through various methods, including autoclaves, chopping and shredding machines, or medical incinerators situated within government hospitals. Private hospitals and other healthcare facilities often transport their medical waste to the nearest government hospital with these incinerators for disposal when they lack the means to treat it on-site. Unfortunately, the majority of these incinerators fail to meet environmental standards and operate at temperatures insufficient for complete combustion. As a result, they do not effectively destroy all toxic and infectious elements of medical waste, leading to its disposal in municipal waste. This situation persists despite instructions from the Ministry of Health regarding the proper management and segregation of waste (both hazardous and non-hazardous) and the treatment of healthcare waste, further contributing to soil pollution.

Table 3.25: The most important indicators of pesticide and fertilizer use in Iraq (Source: Ministry of Planning, Central Bureau of Statistics, Department of Environmental Statistics, 2017-2020)

Indicators	2017	2018	2019	2020
Total pesticides used to control (insects, fungi, diseases, non-insect and bush) (tons)	283.2	175.5	428.5	11.9
Total pesticides used to control (insects, fungi, diseases, non-insect, and bush) (thousand liters)	251.3	488.8	236.9	60.0
Quantity of fertilizers prepared for governorates (thousand tons)	479.5	503.1	490.8	523.3

Human activities across various sectors, whether industrial, service-related, or agricultural, are significant contributors to soil pollution. These activities commonly release untreated solid and liquid waste onto adjacent lands, resulting in soil contamination by a variety of chemical compounds and elements. Among the most prominent pollutants are heavy metals such as cadmium, copper, nickel, lead, zinc, mercury, chromium, and others. These heavy metals are noteworthy due to their ease of transfer to the soil and their persistence, making them difficult to decompose. They remain stable in the soil for extended periods, potentially altering the chemical composition of the soil when present in concentrations exceeding normal limits. This poses a serious environmental threat and underscores the importance of addressing soil pollution resulting from human activities.

Likewise, pollution stemming from the oil industry, including activities related to extraction, refining, the natural gas sector, and the transportation and distribution of petroleum products, has significantly disrupted ecosystems. This disruption primarily occurs due to the leakage of hydrocarbon pollutants into the soil, with adverse consequences for the environment and soil quality.

In conclusion, it is evident that the national institutional and legal framework lacks clear instructions, standards, or laws that define the factors of soil pollution. Furthermore, there is an absence of a well-established program to combat soil pollution. As a result, diagnosing soil quality and assessing the extent of pollution remain challenging tasks.

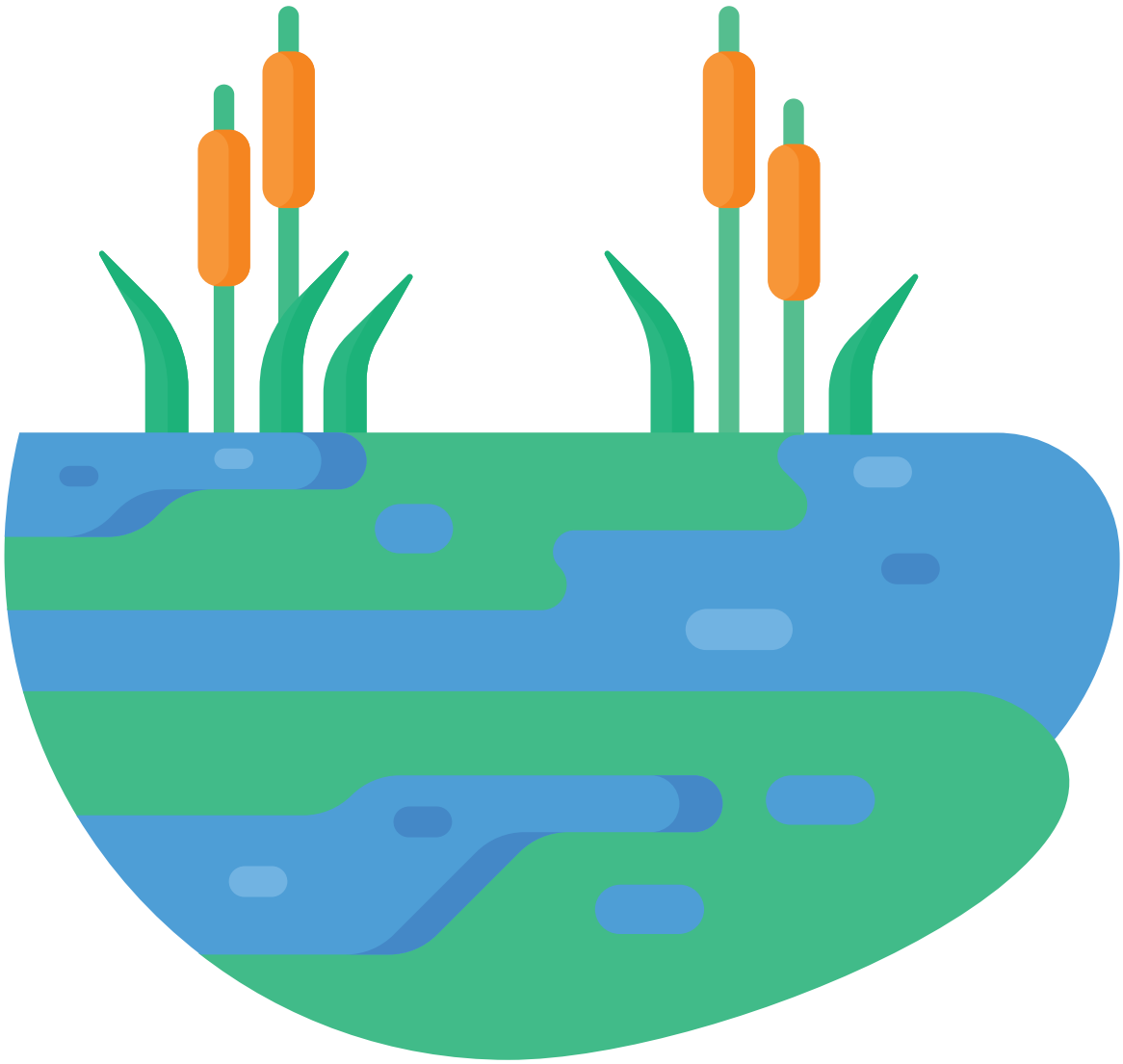
PRESSURES FROM THE WATER SECTOR

INTRODUCTION

Iraq faces significant challenges arising from the adverse impacts of climate change, particularly due to its location in an arid and semi-arid region. This geographical setting has exacerbated the scarcity of freshwater resources, transforming it into a pressing crisis with potentially severe consequences. As a response to this crisis, there is growing pressure on the consumption of groundwater and surface water systems, including strategic storage in reservoirs and dams.

Changing economic structures, expanding populations, and the process of urbanization, coupled with the emergence of various industries that have substantial water requirements, are the principal drivers behind the increasing demand for water. This demand encompasses various purposes, including human consumption, agriculture, and industrial applications.

The major surface water sources in Iraq, particularly the Tigris and Euphrates rivers and their tributaries, originate from outside Iraqi borders. These water sources have been significantly impacted by development projects and dams constructed in the upstream countries. Consequently, water resources in Iraq have come under immense pressure, resulting in a substantial reduction in the water allocations received by Iraq. This situation is a cause for concern as it could potentially give rise to internal crises and contribute to instability, especially within the context of Iraq's political, economic, social, ethnic, and environmental challenges.



MAIN INDICATORS

ANNUAL REVENUES OF THE TIGRIS AND EUPHRATES RIVERS AND THEIR TRIBUTARIES

The annual water flow from the Tigris River was estimated at 11.44 billion cubic meters in 2020, a decrease from 13.81 billion cubic meters in 2017. Additionally, the annual water flow from the tributaries was estimated at 13.63 billion cubic meters in 2017 and increased to 17.95 billion cubic meters in 2020. As for the Euphrates River, the annual water flow was estimated at 13.16 billion cubic meters in 2017 and significantly increased to 20.20 billion cubic meters in 2020 (Table 3.26).

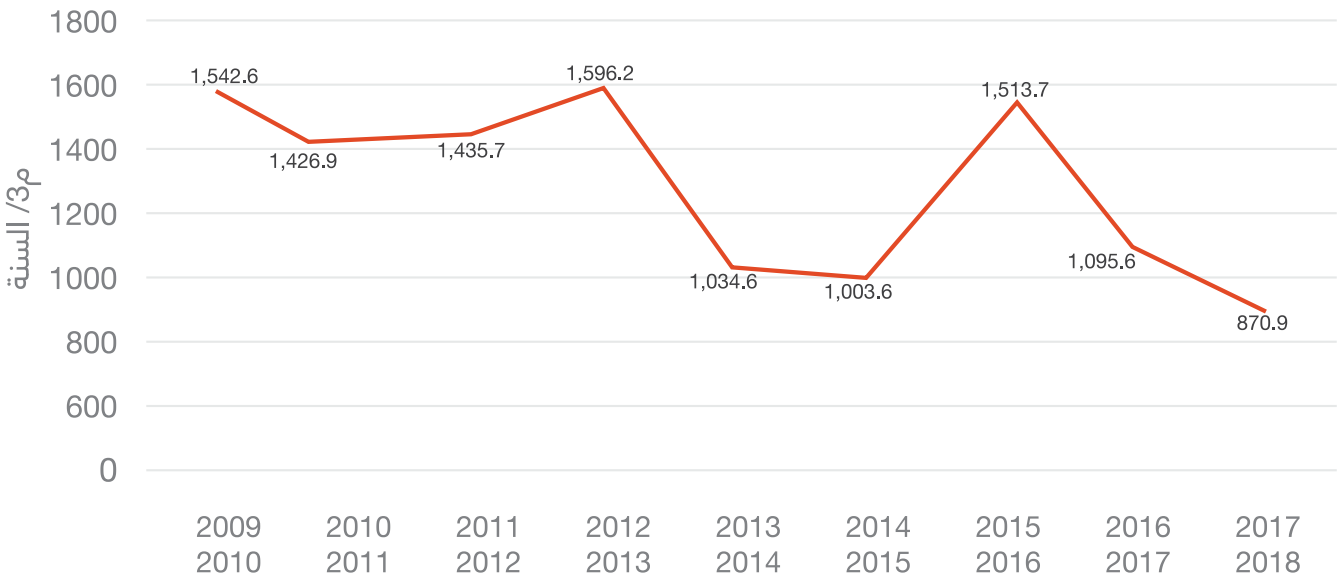
Table 3.26: Annual revenues of the Tigris and Euphrates rivers and their tributaries

The River and its Tributaries		Annual Revenue (Billion/ m3) 2017	% Percentage	Annual Revenue (Billion/ m3) 2020	% Percentage
Main Tigris		13.81	34.1	11.44	23.1
Tributaries	Upper Zab	7.32	17.9	10.23	20.6
	Lower Zab	3.09	7.6	4.29	8.7
	Adhaim River	0.81	2	0.94	1.9
	Diyala	2.41	5.9	2.49	5.0
Total revenues of the Tigris River and its tributaries		27.44	67.5	29.39	59.3
Euphrates		13.16	32.5	20.20	40.7
Total revenues of the Tigris and Euphrates		40.60	100	49.59	100

WATER IMPORTS PER CAPITA

Iraq's per capita water imports were estimated at 870.8 cubic meters per year in 2018, and this figure increased to 1237.09 cubic meters per year in 2020. It is worth noting, as shown in Figure 3.18, that there is a fluctuation in the per capita share of water due to its dependence on water revenues and the ongoing growth in the population.

Figure 3.18: Iraq's Annual Water Per Capita



THE AMOUNT OF WATER PREPARED FOR DIFFERENT USES

In 2018, the total amount of water allocated for various purposes, including agricultural, domestic, industrial, and environmental uses, was approximately 31.82 billion cubic meters. This amount increased to 46.05 billion cubic meters in the year 2020. It is also important to consider the average per capita allocation of potable water and domestic use by governorate, as shown in figures 3.19 and 3.20 for the years 2018 and 2020.

Figure 3.20: Average per capita water used for drinking and domestic use supplied to the population during 2018

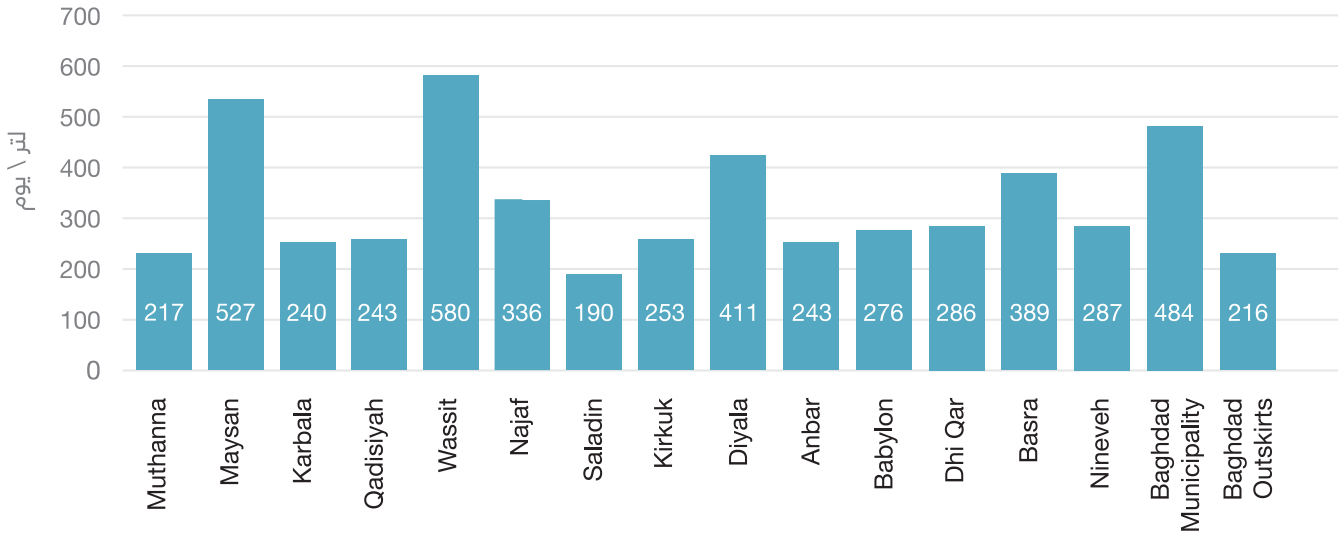
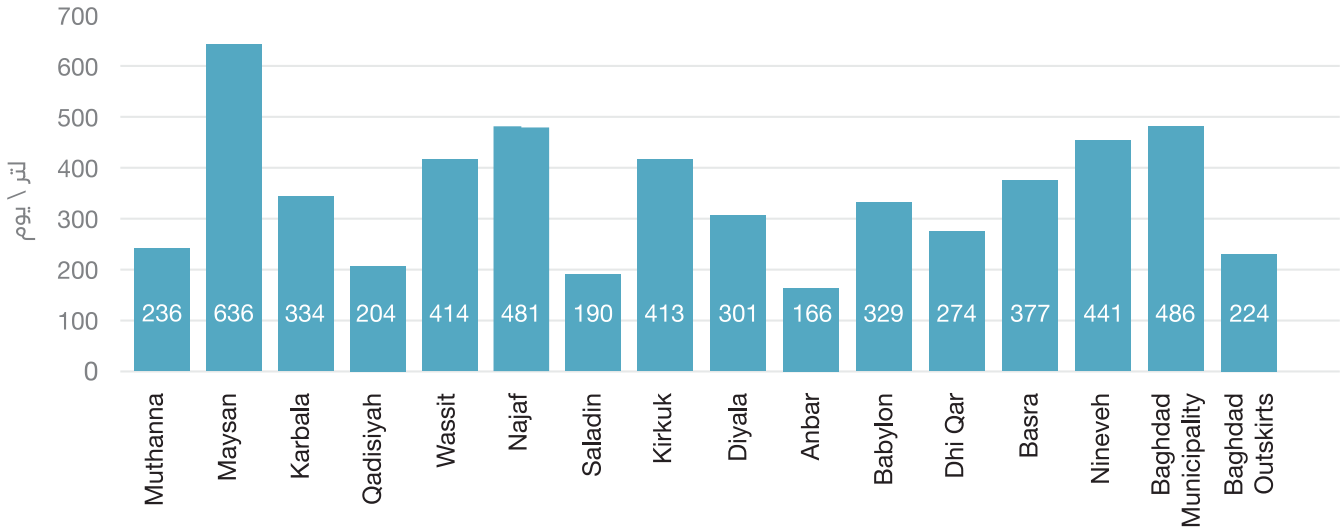


Figure 3.20: Average per capita access to water used for drinking and domestic use supplied to the population during 2020



PERCENTAGE OF SUBMERSION IN THE MARSHES

Since 1985, efforts were initiated to drain the marshes, primarily as an unintended consequence of the Iran-Iraq war. It's important to note that some of these marshes had been designated as restricted zones due to the conflicts. Iraqi authorities conducted engineering operations that resulted in the desiccation of the water in the Hawizeh marshes, which are located near the Iraqi-Iranian border.

The marshes once covered an extensive area of over ten thousand square kilometers in southern Iraq. However, during the Iraqi/Iranian war in the 1980s, authorities excavated the so-called Victory Canal between the Tigris and Euphrates rivers. This canal led to the displacement of the marshes' inhabitants as they sought to escape the conflict. Subsequently, as the water levels in the marshes dwindled, the remaining inhabitants also migrated away, leaving behind the marshes that had previously acted as vital natural filters for the waters of the Iraqi Tigris and Euphrates rivers. These marshes had been home to numerous migratory birds, playing a crucial role in the ecosystem. Regrettably, with the decline in water levels and the departure of their inhabitants, the marshes began to slowly deteriorate and die.

In the early 1990s, following the conclusion of the Second Gulf War, extensive efforts were undertaken to drain the marshes in southern Iraq. Government authorities initiated a large-scale engineering campaign with the objective of draining the marshes. The Al-Ezz River was created to divert the water from the Tigris and Euphrates rivers that used to flow into the marsh areas of Al-Batira, Al-Aridh, and Al-Majar Al-Kabir. This resulted in the conversion of most of the lands in these marshes into semi-reclaimed projects, covering an area of approximately 450,000 acres. These marshes included regions like Al Gedi, Al-Sahin, and Al-Sikal, and the engineering effort involved the active participation of various parties, along with the full utilization of resources from the irrigation departments. Embankment dams were constructed to block the flow of water from the rivers that used to nourish the marshes, redirecting them to flow into the Euphrates River near Qurna. This operation also entailed altering the course of the Euphrates River from its previous location east of Nasiriyah to the general estuary. The estuary originally served as a channel for saline water, leading to Khor Al-Zubair in the Arabian Gulf. Additionally, an embankment dam was built between the district of Medina and the governorate of Nasiriyah to prevent the flow of Euphrates water into the Hammar marsh via tributaries, with further embankments within the marshes themselves to expedite their drying process. (Table 3.26)

This process significantly altered the way of life in the region, which had endured for more than 5,000 years. The once-vast marshes, spanning an area of 15,000 to 20,000 square kilometers, dwindled to less than 2,000 square kilometers. The central marshes, in particular, experienced a staggering 97% reduction and transformed into arid lands. This led to the mass migration of the marshes' population. The drying operations were compounded by a substantial decline in the water levels of the Tigris and Euphrates rivers. This reduction was primarily attributed to the construction of dams in Syria, Turkey, and Iran, as well as the international blockade imposed on Iraq, which persisted for several years.

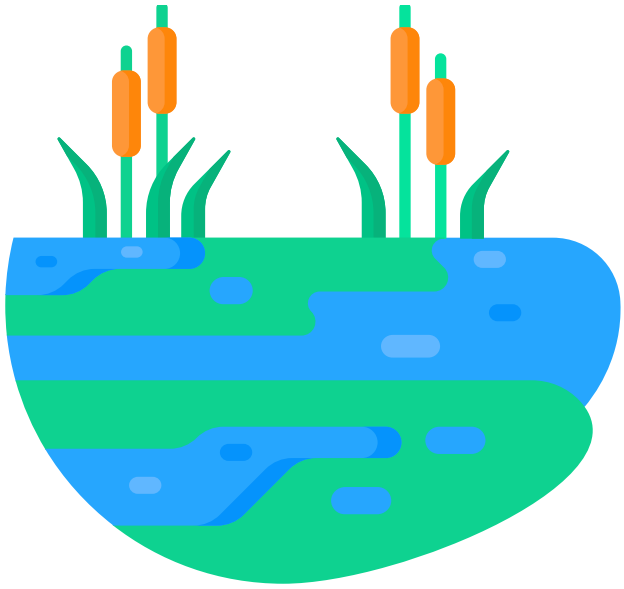
The desiccation of the marshes had a significant influence on the alteration of climatic conditions, thereby affecting agricultural circumstances and human life. The average temperature in the region increased, as the temperature for the ten years prior to the drying was 23.9°C, but it rose to 25.17°C in the 1990s. Similarly, the maximum temperature also experienced an increase, from 31.6°C to 33.2°C. Furthermore, there was a notable decrease in humidity levels, dropping from 61% to 41%. These changes in climate can be attributed to the fact that the prevailing northwest winds in the region began blowing over dry land where there was no moisture to mitigate the high temperatures.

The transformation of environmental structures resulted in the displacement of the majority of the Marsh Arab population, who had developed a unique way of life that was entirely dependent on water. It's important to highlight that the drying process caused an increase in temperature, a decrease in humidity, and a higher demand for water for agricultural crops due to increased evaporation rates. Livestock, in particular, required larger quantities of water and were at greater risk of drought as a result. Additionally, rare birds left the region, and numerous species of birds, plants, and animals faced extinction. Furthermore, the drying of the marshes led to the spread of salts in the soil and alterations in its characteristics, including the disintegration of soil molecules. This made it easier for the wind to carry away essential elements necessary for agricultural production.

Table 3.26: Rates of Immersion in the Iraqi Marshes

Marsh Name	Governorate	Area before drying (km2)	Area after recovery (km2)			Total submerged and unsubmerged area (km2)	Percentage of Immersion
			Excluded from Immersion	Unsubmerged	Currently submerged		
Hawizeh	Maysan	1800	745	105	950	1055	90.0
	Basra	550	228	20	302	322	93.8
	Total	2350	973	125	1252	1377	90.9
Central Marshes (Qurna Marshes)	Maysan	1450	220	460	770	1230	62.6
	Basra	500	345	-	155	155	100.0
	Dhi Qar	1050	15	450	585	1035	56.5
	Total	3000	580	910	1510	2420	62.4
Hammar	Basra	1200	637	89	474	563	84.2
	Dhi Qar	1800	600	182	1018	1200	84.8
	Total	3000	1237	271	1492	1763	84.6
Grand Total for Each Governorate	Maysan	3250	965	565	1720	2285	75.3
	Basra	2250	1210	109	931	1040	89.5
	Dhi Qar	2850	615	632	1603	2235	71.7
Total marshes		**8350**	**2790**	**1306**	**4254**	**5560**	**76.5**

the Euphrates River and increase to more than 250 meters at the Iraqi-Jordanian and Saudi borders. However, in the vicinity of the Euphrates River and along the Euphrates Fault, the groundwater level experiences a sharp decline as it flows toward the sedimentary plain. In the Jazira region, groundwater depths typically range between 10 to 20 meters. Within the foothills, these depths extend from 20 to 30 meters. In the area between Baghdad and Kut, groundwater depths vary from 1 to 5 meters. The sedimentary plain, on the other hand, features notably shallow depths, sometimes falling below a meter. Moreover, the high salinity of the soil in this region presents a significant challenge with regard to groundwater in the sedimentary plain.



Water began to gradually return and cover some of the marshes in southern Iraq after April 2003. The local marshland residents played a role in this process by intentionally creating fractures in the dams that had prevented the flow of water into the marshes. Although this effort was somewhat random, it led to the flooding of a significant portion of the dried-up marshes. In May 2003, the Ministry of Water Resources took the initiative to coordinate a controlled, scientific plan for the revival and rehabilitation of the marshes in the southern governorates. They established the Marshes Recovery Center, which played a crucial role in opening dams, canals, and gates of closed regulators, thereby increasing the flow of water toward the desiccated marshes. Even though a decade had passed since the marshes had dried up, there were positive signs of environmental improvement in the dry marshes of the south. In addition, heavy rains in 2003 contributed to raising water levels, particularly as it was a year marked by abundant rainfall, surpassing the general average. This was especially true in the upper Tigris and Euphrates basin in Turkey, following a four-year drought (1999-2002). For the first time since the early 1990s, streams and waterways were filled with water, and the rate of discharge in the channels increased, despite high evaporation rates. Despite the somewhat random and unsupervised nature of the restoration efforts, they resulted in the emergence of a diverse biological and environmental landscape. Changes in plant and animal communities occurred due to hydrological alterations and increased water levels in rivers and marshes, which impacted soil and water characteristics. These changes led to alterations in the region, including an expansion of submerged areas, a decrease in dried areas, and increased water flow in the canals and rivers in various directions, revitalizing the marshes and ecosystems. Additionally, key branches of the Tigris and Kahla River, feeding the Hawizeh Marsh, were reconnected, and the Kassara channel, linking the Hawizeh Marsh to the Tigris River, was reopened.

Significant portions of the marshes have successfully returned to their natural state, although the quantities of water responsible for this restoration are somewhat lower than the water levels experienced prior to the drying of the marshes. Based on data regarding the immersion rates in the marshes for the year 2020, the percentage of inundation typically falls within the range of 75% to 82% (Table 26.3).

GROUNDWATER

The hydrogeological characteristics depicted on the hydrogeological map of Iraq indicate that Iraq can be physiographically divided into the following regions: the mountainous region, the undulating region, the Western Desert, the islands, and the sedimentary plain. Within each of these regions, the depths and quantities of groundwater exhibit variations.

In general, the flow of groundwater aligns with the topography of the various regions in Iraq. The sedimentary plain area, being the lowest in terms of topography in Iraq, serves as the focal point for groundwater movement from all surrounding areas. Consequently, the sedimentary plain functions as the primary drainage area for groundwater from all regions across Iraq.

The depths of groundwater throughout Iraq also vary, as they are located at depths ranging from (3 m) to more than (300 m) (Figure 21.3). The depths of the underground groundwater are very important factors in the investment of groundwater, and its uses, as it is very important in estimating the costs of drilling, the quality of the rigs used, the drilling route, the designs of the wells and the quality of the pumping equipment used. Noting that these depths increase in the Western Desert towards the west, ranging from 10 meters along the banks of the Euphrates River to increase to more than 250 meters at the Iraqi-Jordanian and Saudi borders, but near the Euphrates River, and along the Euphrates Fault, the groundwater level drops sharply towards the sedimentary plain.In the Jazira region, the depths of groundwater range between 10-20 meters, while within the feet of the hills, these depths range between 20-30 meters, and the depths between Baghdad and Kut range from 1-5 meters. The depths are shallow in the sedimentary plain, sometimes reaching less than a meter, and with the presence of high salinity in the soil in this area, groundwater posed a major problem in the sedimentary plain. The depths of groundwater in Iraq exhibit considerable variation, spanning from as shallow as 3 meters to exceeding 300 meters (see Figure 21.3). These groundwater depths play a vital role in the utilization and investment of groundwater resources. They have a significant impact on the estimation of drilling costs, the selection of appropriate drilling equipment, the planning of drilling routes, well designs, and the quality of pumping equipment. It is worth noting that these depths tend to increase in the Western Desert, particularly towards the west. Depths range from approximately 10 meters along the banks of

The annual renewable groundwater supply in Iraq ranges from approximately 4.3 to 5.243 billion cubic meters, and this quantity can vary in response to changes in rainfall, typically reaching about 8.8%. The quality of groundwater and its salinity levels also fluctuate in accordance with the movement of groundwater. In the northern and northeastern regions of Iraq, groundwater is generally bicarbonate and fresh. In contrast, within the eastern and western parts of the country, it tends to be sulfuric and exhibits weak to medium salinity. As one moves towards the central and southern parts of the sedimentary plain, the groundwater transitions into chloride water with high salinity. You can refer to Table 3.27 for a detailed presentation of the most critical groundwater indicators in Iraq.

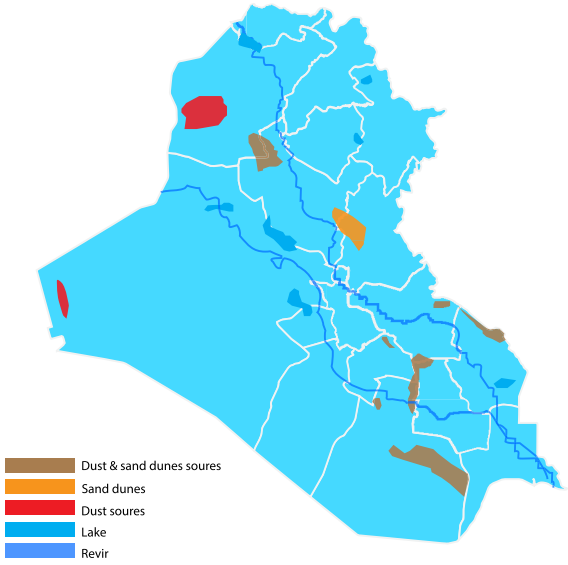


Table 3.27: Groundwater indicators in Iraq, source: Ministry of Planning, Central Bureau of Statistics

Governorate Name	Number of Wells		Productivity rate l/s		Salinity rate mg/L	
	2017	2020	2017	2020	2017	2020
Nineveh	-	57	-	6.5	-	3333
Kirkuk	6	14	6	8	2500	2150
Diyala	9	30	5	5	4500	879
Anbar	14	27	6	4.5	3500	1873
Baghdad	159	18	3	2	5000	1981
Babylon	22	-	3	-	4000	-
Karbala	73	9	6	5	3250	2998
Wasit	2	9	5	5.5	3250	14182
Saladin	29	44	5	6.5	4500	2545
Najaf	42	19	5	4	4500	1767
Qadisiyah	27	-	4	-	5000	-
Muthanna	35	9	5	9	4500	3472
Dhi Qar	77	1	3	1.5	7000	6100
Maysan	31	14	5	5.5	5000	5222
Basra	26	3	5	4.5	5000	15000

PRESSURES FROM THE TRANSPORT SECTOR

INTRODUCTION

In recent years, Iraq has experienced substantial growth in its road network, with significant expansion both in interregional connections and within urban and rural areas. These expansions have exceeded their previous scale and have incurred substantial costs. Additionally, other transportation sectors, including air transport, which involves the development of airports and aircraft, road transport, which includes the establishment of railways and the utilization of trucks, and public transport, featuring buses and public taxis, have also witnessed a noteworthy acceleration in government and private investments. These investments have elevated the transportation sector to a level where it competes on an international scale.

Global experiences underscore the crucial importance of developing and organizing transportation sectors due to their direct connection to the civilizational and urban advancement of nations. The transport sector assumes a pivotal role in various facets of modern life as a consequence of the increasing reliance of populations and economic activities on the evolution of transportation services. This is essential for meeting the transportation and mobility needs of both individuals and goods. The progress of many countries in terms of economic and social development is intricately tied to the advancement of the transport sector, particularly the road network. Furthermore, investments in transportation carry significant political, economic, and social implications, both on a national and individual level. As the global population continues to grow, leading to an increased demand for transportation services, there is a corresponding surge in the demand for the fuels that power various modes of transport. One of the consequences of this heightened demand for fuel in the transportation sector is the increased level of air pollution. This is especially pertinent in the case of Iraq, where the fuel contains a substantial amount of sulfur, resulting in the emission of sulfur dioxide along with suspended particles, nitrogen oxides, volatile organic compounds, carbon dioxide, and unburned hydrocarbons.

MAIN INDICATORS
AIR TRANSPORTATION

Between the years 2017 and 2020, the number of aircraft operating at Iraqi airports for the Iraqi General Company for Iraqi Airways reached a total of 32 aircraft. In the year 2020, the cumulative number of landing and departing flights at Iraqi airports, serving various Iraqi, Arab, and foreign airlines, amounted to 43,367 flights. These figures are based on the Air Transport Statistics Report for 2020. Notably, the number of flights experienced a significant decline of 43% in comparison to previous years, primarily due to the restrictions imposed by the COVID-19 pandemic, as illustrated in Figure 3.22 and Table 3.28.

Figure 3.22: Number of flights landing and departing from Iraqi airports for the years 2016-2020

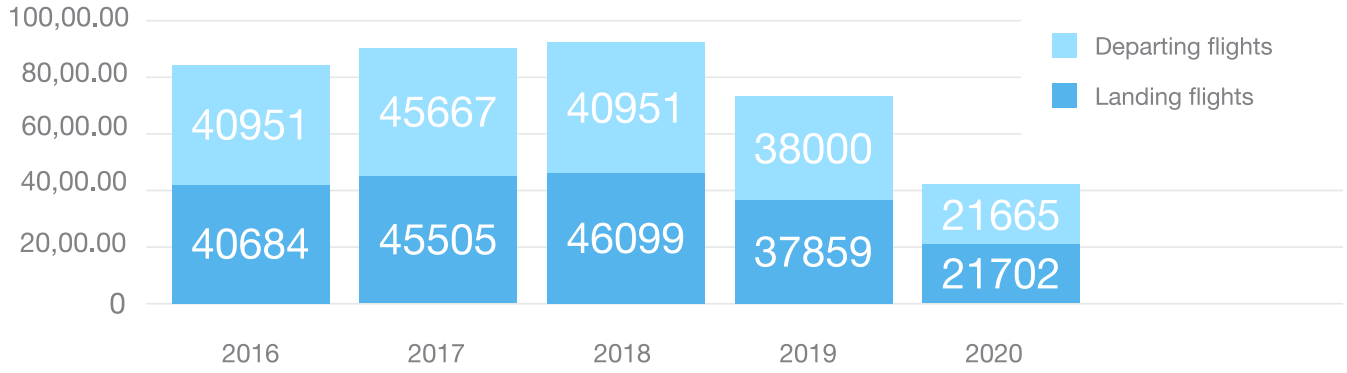


Table 3.28: Air Transport Indicators in Iraq

Details	Index	
	2017	2020
Number of aircraft operating at Iraqi airports	32	32
Number of flights at Iraqi airports on Iraqi Airways flights	36,933	11,150
Number of (landing) flights at Iraqi airports on Iraqi Airways flights	18,400	5,398
Number of flights (departures) at Iraqi airports on Iraqi Airways flights	18,533	5,752
Number of passengers (arrivals + departures) at Iraqi airports and transported on Iraqi Airways State Company aircraft	3,840,077	786,032
Quantity of goods and mail transported for various Iraqi, Arab and foreign airlines and for all airports (tons)	33,369	35,419
Number of employees for the General Organization of Civil Aviation	2,078	1,350
Number of employees for the General Company of Iraqi Airways	3,128	2,758

Figure 3.23 illustrates the distribution of landing and outbound flights for Iraqi Airways in 2017, segmented by airports. Meanwhile, Figure 3.24 depicts the distribution of landing and outbound flights for Iraqi Airways in the year 2020, also categorized by airports.

Figure 3.23: Distribution of Iraqi Airways flights for 2017

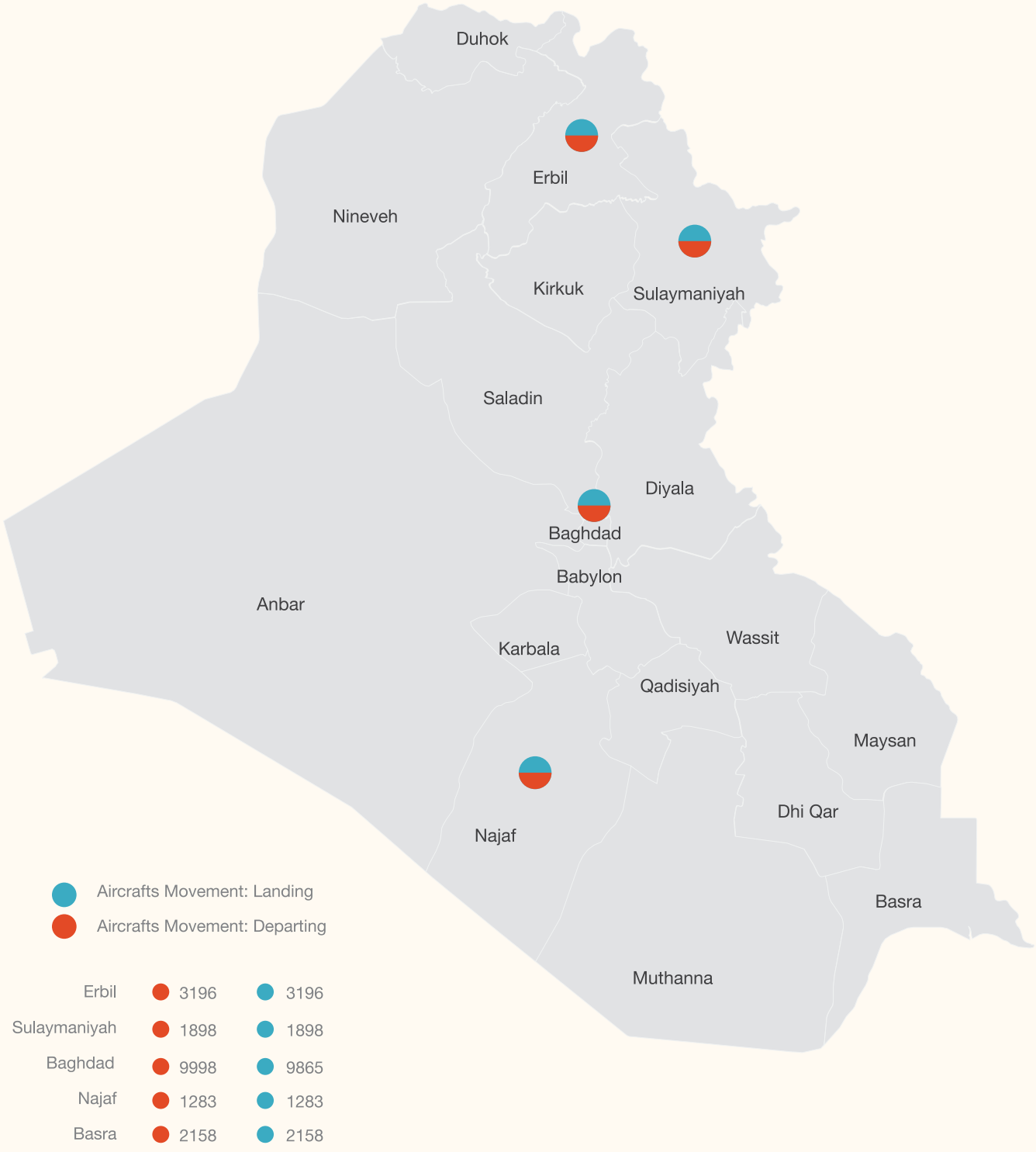
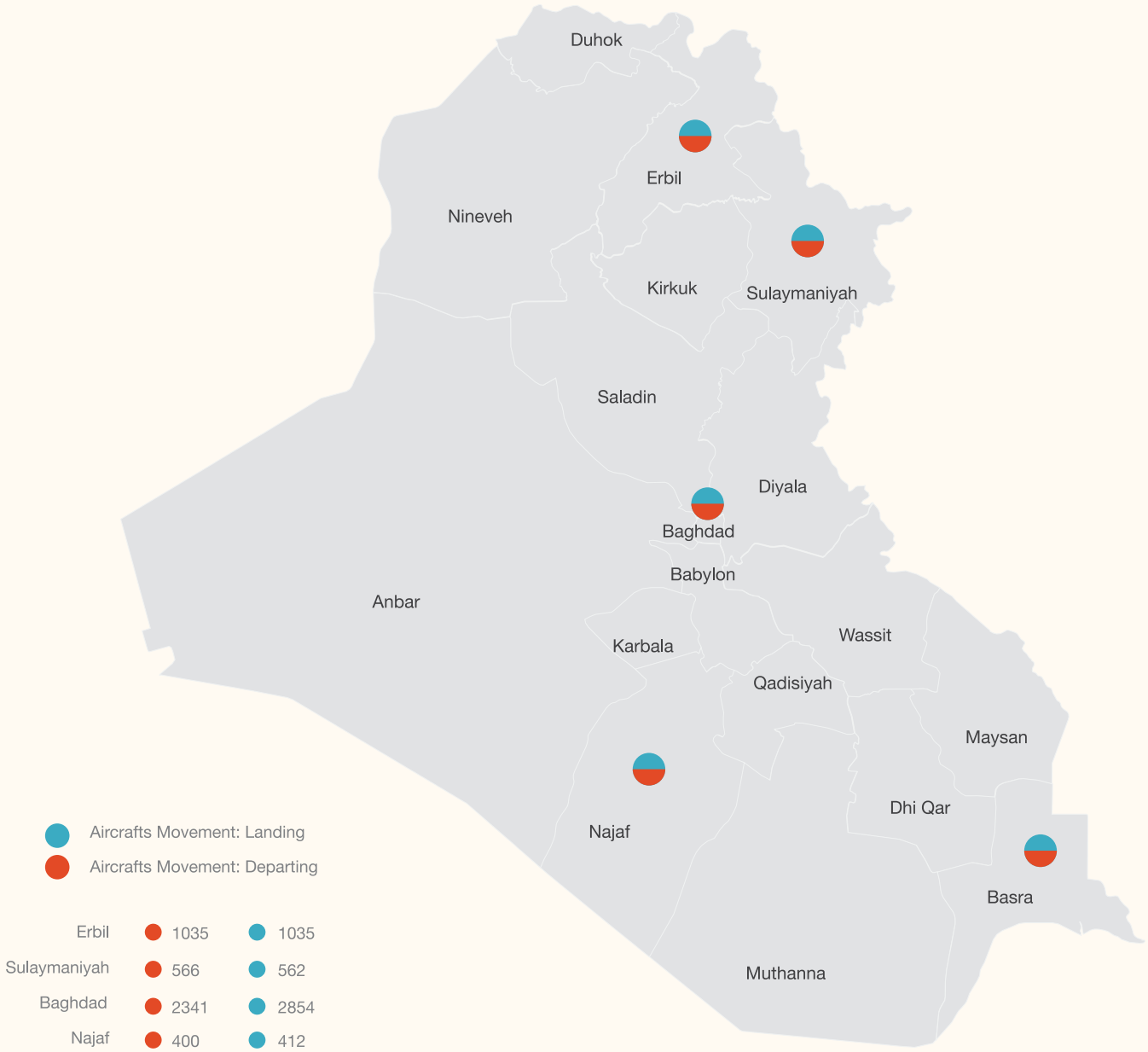


Figure 3.24: Distribution of Iraqi Airways flights for 2017



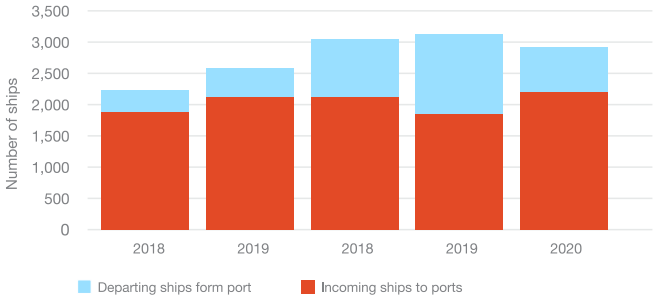
Erbil	1035	1035
Sulaymaniyah	566	562
Baghdad	2341	2854
Najaf	400	412
Basra	711	734

MARINE SHIPPING

Regarding maritime transport, Iraq has two key entities responsible for maritime activities. The first is the State Company for Ports of Iraq, which primarily concentrates on offering maritime services to both commercial and oil vessels. The second is the State Company for Maritime Transport, which plays a crucial role in maritime transportation within the country.

The water transport statistics reports for Iraq between 2016 and 2020 reveal that the number of ships involved in the transportation of goods arriving and departing from Iraqi ports reached 2,868 in the year 2020. This marks an increase compared to the year 2019, when there were 2,060 incoming ships, and 1,836 ships in the year 2019. In contrast, the number of ships departing from Iraqi ports witnessed a decrease in 2020, amounting to 808 ships, compared to 1,284 ships in 2019, as indicated in Figure 3.25.

Figure 3.25: Number of ships arriving and departing from Iraqi ports for the years 2016-2020



Regarding the General Company for Maritime Transport, the number of operating ships owned by the company remained constant at eight ships for the years 2016-2019. However, in the year 2020, the number decreased to seven ships.

ROAD TRANSPORTATION

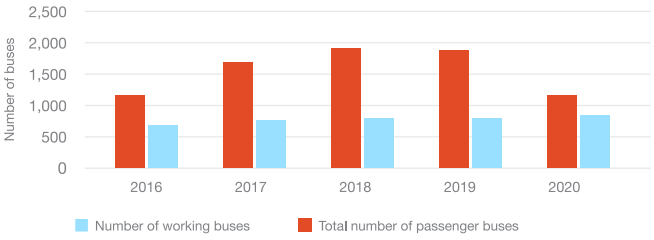
The land transport sector is divided into four sections: the public transport sector includes buses and trucks, private and government cars, as well as train transportation.

- **Public Transport Sector**

Two major companies operate in Iraq's public transport sector: The General Company for Land Transport and the General Company for the Transport of Passengers and Delegates.

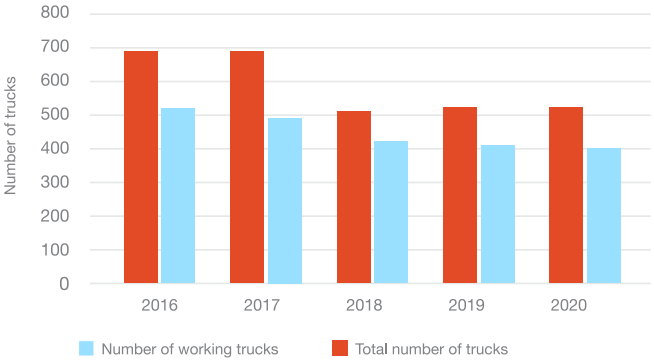
According to land transport statistics reports for the years 2016-2020 (Figure 3.26), the percentage of buses used for passenger and delegation transport, out of the total number of buses available at the General Company for the Transport of Passengers and Delegations, amounted to 53.6%, 38.3%, 32.9%, 35.3%, and 70.4% for the years 2016-2020, respectively.

Figure 3.26: Number of buses of the General Company for the Transport of Passengers and Delegations and the number of buses operating from them for the years 2016-2020



The percentages of trucks used for public transport of goods amounted to 74.8%, 72.8%, 82%, 78.7%, and 75% for the years 2016-2020, respectively, out of the total number of trucks available at the General Company for Land Transport (Figure 3.27).

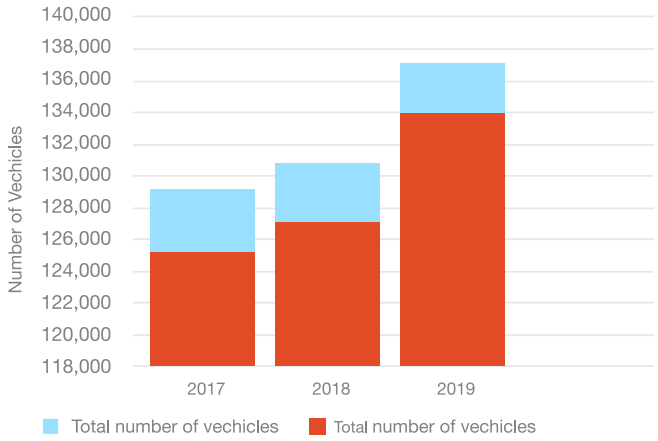
Figure 3.27: The total number of trucks of the General Company for Land Transport and the number of trucks operating for the years 2016-2020



- **Government Transport Sector**

In the government sector of Iraq, the total number of vehicles, including cars and motorcycles, for the year 2019 amounted to 9,137,371 vehicles. This represented a 5% increase compared to the year 2018 when the total number of vehicles stood at 8,130,775 vehicles, as depicted in Figure 3.28.

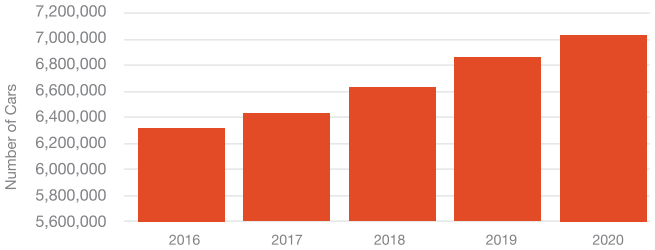
Figure 3.28: Number of vehicles operating in the government sector for the years 2017-2019



- **Private Transport Sector**

In the private sector, including the Kurdistan Region, the total number of cars reached 7,026,106 cars for the year 2020. This marked a slight increase of 0.2% compared to the year 2019 when the number of cars was 6,888,201. These statistics are based on reports for private sector cars from the years 2016 to 2020, as shown in Figure 3.29.

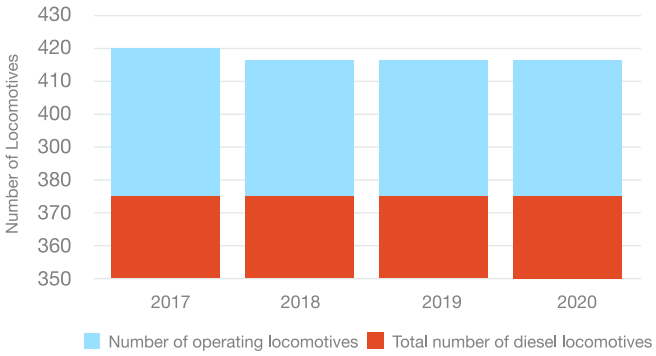
Figure 3.29: Number of private sector vehicles for the years 2016-2020



- **Railway Sector**

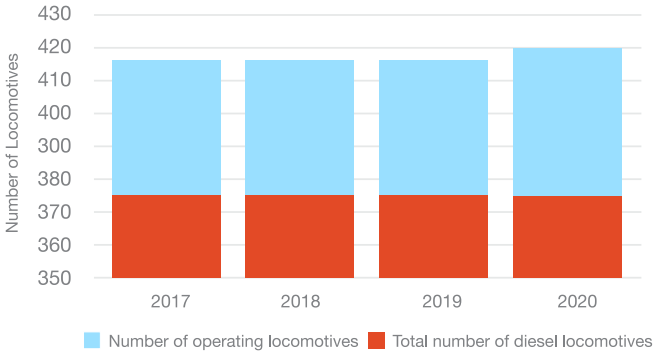
As per the railway statistics reports covering the years 2017 to 2020, the total number of diesel trailers was 375. In the year 2017, the operating rate was 12%, and it slightly decreased to 11% for the subsequent years, 2018 through 2020, as indicated in Figure 3.30.

Figure 3.30: Total number of diesel locomotives compared to the number of operating locomotives for the years 2017-2020



As for the Chinese locomotives, the total number of locomotives reached 120 for the years 2017-2020 with operating rates of 91-100% (Figure 3.31).

Figure 3.31: Total number of Chinese type locomotives and operating locomotives for the years 2017-2020 - Wetlands ecosystem Research Group, University of Exeter, U. K. 146 pp, 1993.



Amount of Fuel Consumed in the Transport Sector

Understanding the number of flights landing and departing from Iraqi airports is critical for estimating the quantity of fuel consumed in this sector and, by extension, the extent of air emissions and their impact on air pollution.

Data from the 2017 State of the Environment Report in Iraq indicates that the transport sector is responsible for 40-50% of suspended particulate matter emissions and 80% of carbon monoxide emissions, which are major contributors to air pollution. Analyzing the current state of the transport sector in Iraq, including all modes of transportation (air, sea, and land), is essential for determining its contribution to air pollution. This analysis also helps in estimating the improvements and developments needed to align with the goals of Iraq's National Environment Strategy.

The analysis of the current state of the transport sector should encompass the types and quantities of transportation used, the specific types of fuel used in each mode of transportation, the amount of fuel consumed for various distances traveled, and the resultant emissions based on fuel consumption.

Fuel consumption in the railway sector primarily depends on two important factors: mileage and fuel efficiency. Data from railway statistics reports from 2017 to 2020 indicate the fuel efficiency of passenger and freight trains. For passenger trains, fuel efficiency is measured in liters of fuel consumed per kilometer traveled (liters per passenger-kilometer), with 0.02 liters per passenger-kilometer in 2017, showing subsequent increases in the following years (see Figure 3.32).

The fuel efficiency of freight trains is measured in liters of fuel consumed per kilometer traveled (liters per ton-kilometer) and was 0.02 in 2017, declining in the subsequent years (see Figure 3.33).

Figure 3.32: Fuel efficiency for passenger transport for the years 2017-2020

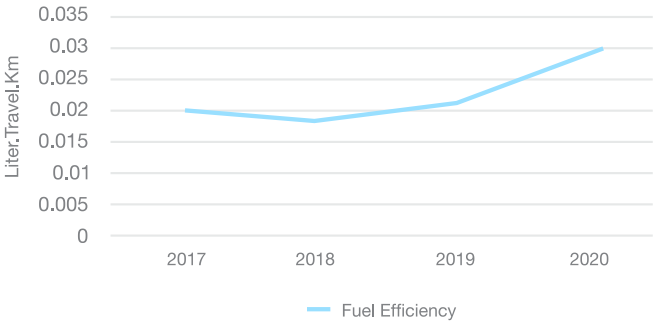
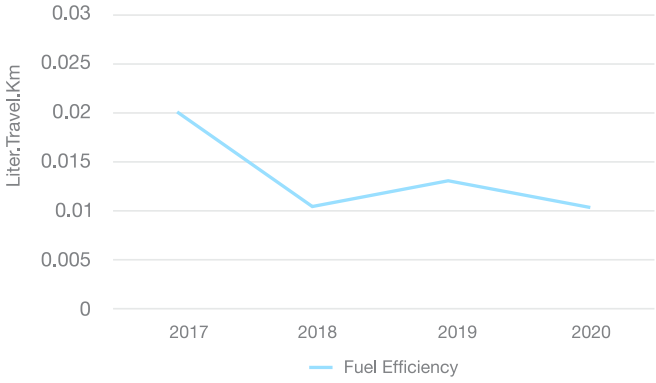


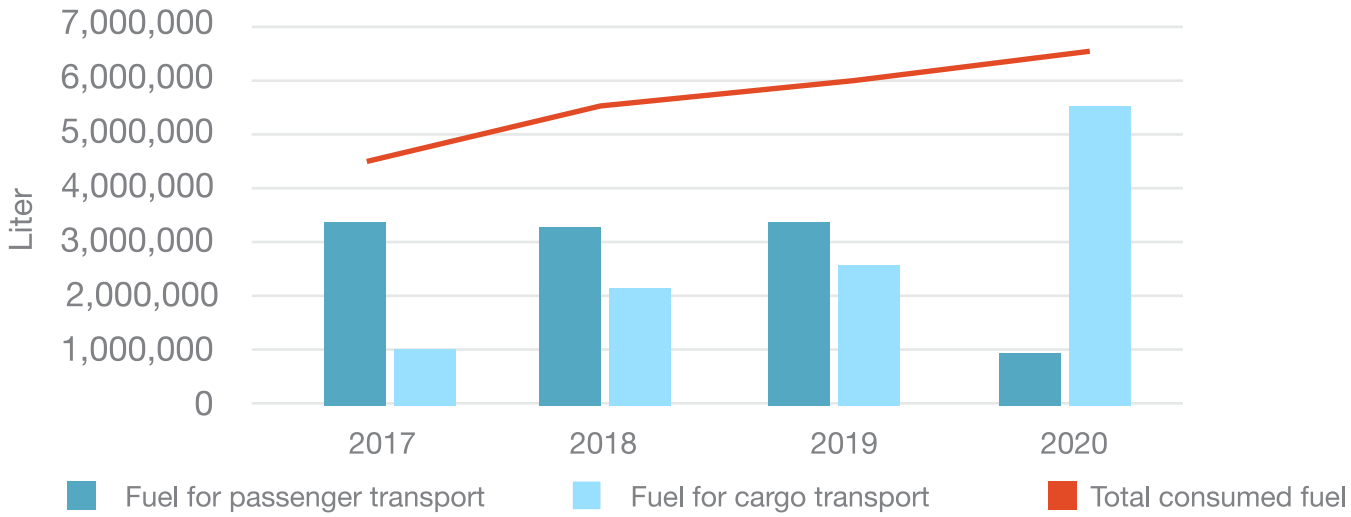
Figure 3.33: Fuel efficiency for cargo transport for the years 2017-2020



The number of kilometers traveled in the years 2017-2020 was 169, 178, 164, and 31 million passenger-kilometers, respectively. During the same years, the number of ton-kilometers traveled was 55, 199, 190, and 559 million tons-kilometers, respectively.

Consequently, the total fuel consumption for passenger and cargo transportation in 2017 was approximately 4,480,000 liters. This amount increased by 68% in 2022 due to the rise in freight transportation activities, leading to higher fuel consumption (see Al-Shatal 3.34).

Figure 3.34: Fuel consumption for freight and passenger transport in the railway sector for the years 2017-2020



PRESSURES FROM THE ENERGY SECTOR

INTRODUCTION

The production, transmission, and delivery of electrical energy to the citizens have a significant impact on the environment and cannot be completely avoided. However, these impacts can be mitigated through the adoption of measures that promote energy efficiency technologies across all sectors, including production, transmission, and distribution. Additionally, diversifying energy sources is critical.

Given the national conditions of electrical energy scarcity, increased demand, a growing population, and the effects of climate change in Iraq, the Ministry of Electricity faces high-cost challenges compared to neighboring countries. These challenges include ensuring a continuous and reliable supply of electrical energy to citizens 24/7, reducing environmental pressures, adhering to measures that combat climate change, and promoting environmental preservation and sustainable development. The third challenge is to meet the projected increase in future demand.

To address these challenges, Iraq relies on its national resources of oil and natural gas for electricity generation. The country is coordinating with the Ministry of Oil to plan for the future, particularly regarding the provision of natural gas, which is essential for operating power generation facilities serving various sectors, including residential, industrial, agricultural, and commercial. This approach aligns with the Ministry of Oil's goal to harness associated gas for the national economy's benefit and diversification.

Iraq is also committed to increasing its reliance on renewable energy sources to tackle the mentioned challenges. It has issued instructions related to renewable energy, established incentives to encourage investments in this sector, prioritized its use by citizens, and enacted laws promoting energy efficiency.

MAIN INDICATORS

GENERAL STATISTICS

Regarding the energy sector's activity in Iraq, the most significant statistics in this field (Table 3.29) indicate a 6% increase in the number of electric power plants, excluding the Kurdistan region, in comparison to 2017 and 2020.

The rise in the per capita energy allocation, excluding the Kurdistan region, was estimated at 453.8 kWh. However, upon referring to the same table, a decrease in the per capita electricity consumption (megawatts-hour/year) of 2.34% is observed. The decrease in per capita energy supplied can be attributed to network violations and the inadequate enforcement of deterrent measures by the relevant authorities

Table 3.29: The most important statistics of the indicators of the electric power sector (source: Ministry of Planning, Central Bureau of Statistics, Environment Statistics Section, 2017 and 2020)

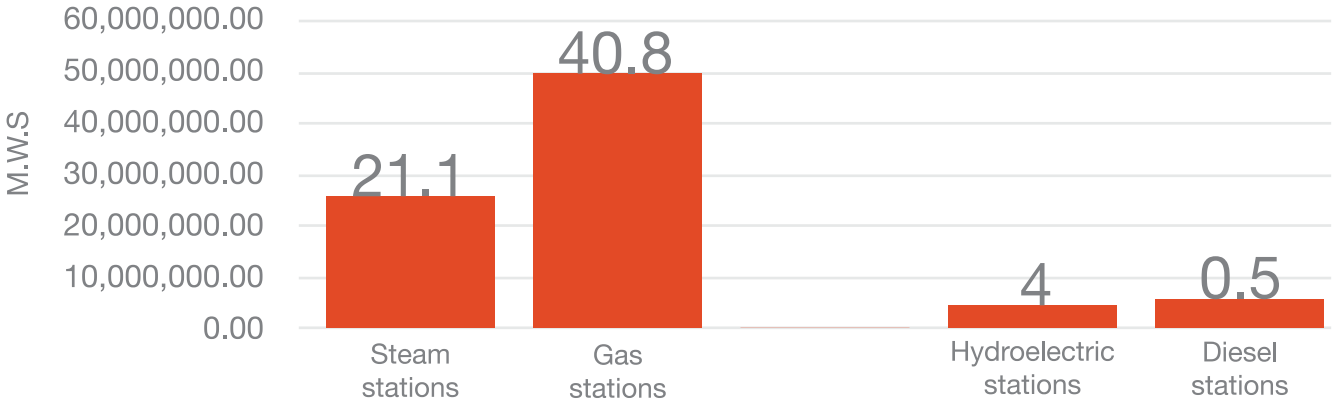
Index	Index value for the year	
	2017	2019
Number of power plants excluding Kurdistan Region	67	71
Quantity of vector electricity generated except for the Kurdistan region (Kwh)	85,508	87,900
Amount of electrical energy imported from neighboring countries + investment (KWh)	9,365	35,305
Amount of electrical energy purchased from the Kurdistan Region (KWh)	1,857	1,585
Total electrical power system (KWh)	94,873	123,205.3
Quantity of electrical energy prepared for sale (KWh)	40,770.62	42,086
%) Percentage of household consumption of electricity sold	61.3	61.4
%) Percentage of government consumption of electricity sold	18.5	12.3
%) Percentage of industrial consumption of electricity sold	12.3	11.2
%) Percentage of commercial consumption of electricity sold	6.1	6.2
%) Percentage of agricultural consumption of electricity sold	1.7	1.4
%) Percentage of consumption of electricity sold by those exceeding	6.2	7.5
Per capita electrical energy sold (mW. hour/year)	1.28	1.25

ENERGY PRODUCTION SOURCES

Iraq relies on multiple sources of electrical energy production to meet its diverse needs. These sources include steam stations, which produce electricity using steam, gas stations that generate electricity through gas combustion, hydroelectric stations, which produce electricity using water, and diesel stations that use diesel generators for electricity generation.

Up until 2019, gas plants played the most significant role in Iraq's electricity production, with 37 gas stations contributing to approximately 40.8% of the total electricity production. On the other hand, the 12 diesel plants had the lowest production rate for the same year, accounting for roughly 0.5% of the total electricity production, equivalent to 6,608,869 MWh (see Figure 3.35).

Figure 3.35: Quantities of electrical energy production from different stations MWh



POWER OUTPUT

Iraq faces a severe electricity shortage, estimated at about 20-25% of its total needs during the summer of 2019. The primary cause of this shortage is the destruction of electric power plants and the theft of certain parts due to the challenging conditions Iraq has experienced in recent years. This shortage imposes significant costs on the economy, wastes production time, and leads to capital asset damage. It also disrupts normal business operations and affects reliability. In a country experiencing both cold winters and extremely hot summers, electricity shortages lead to individual hardships as the lack of power from the grid has resulted in the proliferation of private diesel generators. The continued operation of these private generators leads to high generation costs, environmental pollution, and significant carbon emissions into the atmosphere.

The energy sector in Iraq has made significant progress in electrical energy production between 2014 and 2019. The annual increase in energy production quantities reached approximately 4,000,000 MWh, raising the production of electrical energy from 67,767,995 MWh in 2014 to 85,508,046 MWh in 2017, ultimately reaching 87,899,993 MWh in 2019. This increase is essential to meet the entire electricity demand. Iraq's annual electricity imports from 2014 to 2017 were about 12,000,000 MWh. However, these imports significantly rose in 2018 and 2019, resulting in Iraq's electricity imports amounting to approximately 22,000,000 and 35,000,000 MWh, respectively. Table 3.30 illustrates the rate of energy production in MW for the years 2018-2021.

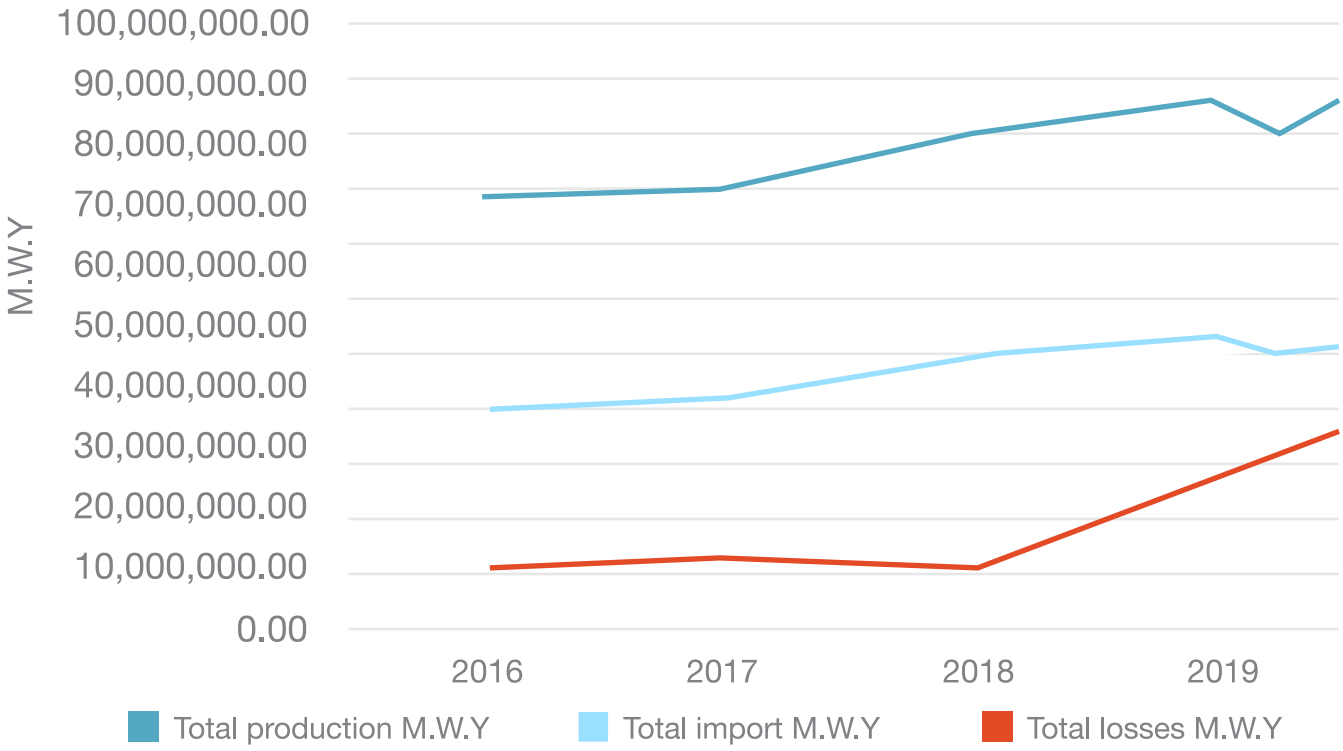
Table 30.3: Output power rate MW

Year	2018	2019	2020	2021
Production MW	12,112	14,000	14,274	14,563

ENERGY WASTED

The percentage of losses in the electrical energy produced constituted approximately 61.3% (electrical statistics) for the year 2019 of the net production, equivalent to 53,882,695 MWh, of which the technical losses did not exceed only 22% of the net energy processed, and the remaining value of 39.3% represented administrative losses, which do not have a negative impact compared to technical losses in terms of environment, so increasing the efficiency of electrical power systems, whether in the production, transmission or distribution stage, reducing the percentage of energy loss and lifting excesses will contribute significantly reducing emissions, especially if the sources of electricity generation are oil or gas. Figure 3.36 shows the readings of the quantities of electricity produced, imported, and lost for the years 2014-2019.

Figure 3.36: Quantities of production, import and technical and administrative losses in electrical energy for the years 2016-2019



The amount of fuel consumed in production

Table 3.31 shows the quantity and type of fuel consumed in gas, thermal and diesel power plants for the period 2018-2021.

Table 3.31: Quantity and type of fuel consumed in electric power plants

Year	Station Type	N.G (m3)	GAS Oil (L)	Diesel Oil (L)	Fuel Oil (L) N.G	Crude Oil
N.G (L)	Thermal	862,297,225	4,129,082	1,012,800	907,285,453	5,797,220,034
	Gas	9,589,730,461	643,373,171	392,535,400	177,272,329	3,350,043,262
2018	Diesel	0.00	21,311,766	0.00	561,718,006	0.00
	Gas	1,110,075,033	10,838,794	289,056,080	1,152,567,523	2,342,940
2019	Diesel	0.00	31,382,398	0.00	3,502,821,425	0.00
	Gas	16,794,199,334	621,120,798	428,379,540	832,508,098	2,060,946,008
2020	Diesel	0.00	29,880,749	0.00	1,016,000,066	0.00
	Gas	14,665,734,159	228,061,672	475,846,400	1,707,422,420	3,367,430,238
2021	Diesel	0.00	31,107,920	0.00	1,200,420,362	0.00

POWER CONSUMPTION

The data presented in the environmental statistics reports for Iraq's Electric Power sector indicate that the total consumption of electrical energy across all sectors, including domestic, commercial, governmental, agricultural, and industrial, amounted to approximately 42,088,620 MWh in the year 2019. This marked a 6% increase compared to the consumption in 2018, which was estimated at 39,593,993 MWh (see Figure 3.37). Table (3.32) provides the per capita energy consumption rates for the years 2018-2021.

Figure 3.37: Quantity of electrical energy consumption for the years 2018-2019 by sector.

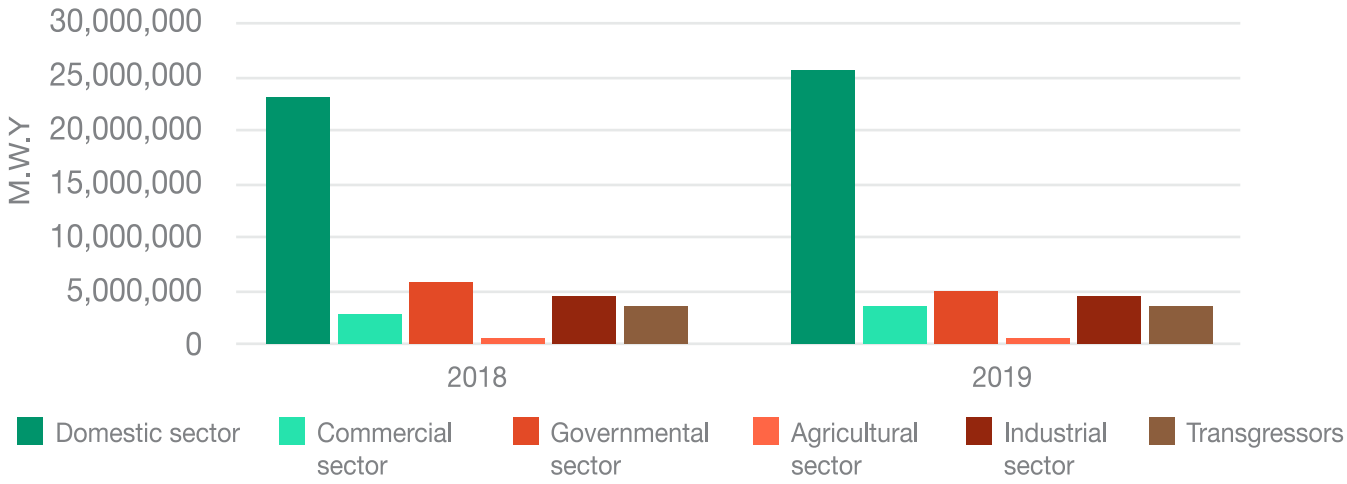


Table 3.32: Energy consumption per capita

Year	2018	2019	2020	2021
Total Produced Energy (MWh)	105,849,827	123,205,305	126,465,458	127,525,228
Population	32,814,590	33,678,525	34,558,451	35,453,043
Per capita (kWh)	3.226	3.658	3.659	3.597

RENEWABLE ENERGY

Recognizing the Ministry of Electricity's awareness of the importance of climate change vulnerability, a plan was put in place to move toward the implementation of renewable energy projects. Reputable companies in this field were engaged to undertake a portion of these projects. The French company Total was awarded a contract for a capacity of 1000 megawatts, the UAE's Masdar Company for 1000 megawatts, and the Norwegian company Scatec for 525 MW. It's worth noting that work is ongoing to complete the remaining projects, which will collectively yield a total production capacity of 7500 MW by 2025, as outlined in Cabinet Resolution No. 312 of 2021.

Renewable energy projects are currently in the planning and contracting stage, and various forms of clean energy are expected to play a role in the next five years.

ATMOSPHERIC EMISSIONS

In 1997, the base year, Iraq produced about 72,658 gigagrams of carbon dioxide equivalent from greenhouse gases to the atmosphere. The energy sector had the largest share of this contribution, with emissions accounting for approximately 75% of total emissions in Iraq, equivalent to 54,419 gigagrams. This percentage was distributed among different sectors, including the residential sector, which produced approximately 10,918 gigagrams as a result of the use of liquefied gas. Electricity production activities of various sources contributed 24,239 gigagrams of carbon dioxide.

Iraq's energy production sectors contribute significantly to air, water, and soil pollution due to increased air emissions, untreated industrial wastewater, and land pollution due to effluent spills. This pollution is generally attributed to:

- The use of diesel and heavy fuel in electric power plants.
- Lack of pollution control devices and monitoring devices for sources of energy production.
- Associated gas burning in oil extraction operations and oil industry.
- Industrial sites, power plants and oil refineries established in the past do not meet environmental requirements.
- The acute shortage of electricity supply to the population, and therefore reliance on alternatives, such as private diesel generators, to secure household electrical needs while causing air pollution in urban areas.
- Limited use of renewable energy in electric power generation.
- Based on the above, there are three main factors that cause air pollution mainly in the energy sector:
- Natural gas flaring operations are associated with oil extraction operations.
- Quantities of natural gas consumed in different industries.
- The amount of fuel consumed to produce electrical energy.

The Ministry of Electricity relies on speculative estimates based on programs and not on monitoring devices to measure emissions, as carbon dioxide emissions are estimated at one million tons/year as in Table 3.33.

Table 3.33: Estimates of gas emissions from power plants

Year	2018	2019	2020	2021
Million tons	33,970	34,200	39,967	77,640

The Ministry of Electricity relies on speculative estimates based on programs and not on monitoring devices to measure emissions, as carbon dioxide emissions are estimated at one million tons/year as in Table 3.34.

LIQUID AND SOLID WASTE

The operations generate both liquid and solid waste. The Ministry of Electricity generates various quantities and qualities of solid waste, including iron waste, non-ferrous metals, and empty barrels. In 2021, the estimated amount of scrap was 13,739 thousand tons, etc. Furthermore, there are various types of waste, some calculated by weight, while others are counted in numbers only. Moreover, waste management and procedures are in place. for these wastes through:

- Forming a technical committee to consider these materials consumed in accordance with the contexts and instructions 2.

- The approval of the Honorable Minister is then obtained to delete these articles in accordance with the terms of reference contained in the budget instructions for the year 2019.

- Coordination between public companies for several wastes is carried out by the competent authorities in the Ministry of Environment and the Ministry of Higher Education (formerly the formation of the Ministry of Science and Technology) (issuing a certificate of absence of these materials supporting the absence of radioactive materials and hazardous and biological chemicals before requesting the disposal of these wastes, and in the event that the presence of pollution is supported, the destruction and treatment are carried out jointly in the presence of the Ministry of Environment and the security authorities.

Preparing an inventory of the materials to be disposed of with all their details and weights by committees formed in the general company.

... These wastes are first presented to the government sector and the Ministry of Industry and Minerals in case of desire to purchase these wastes, where they are disposed of according to the approved contexts.

Table 3.34: Quantity and quality of wastewater (m3/year)

Year	2018	2019	2020	2021
Wastewater and Industrial Water m^3	5,410,976	5,480,562	5,486,534	5,567,977

PRESSURES FROM THE OIL PRODUCTION SECTOR

INTRODUCTION

The extraction and manufacturing of petroleum products significantly contribute to environmental pollution in various elements, including water, air, and soil. This pollution arises from activities such as drilling oil wells, both exploratory and productive, which may involve mud and chemicals that can leak or mix with the environment's components. Such activities result in groundwater, surface water, and land pollution in the vicinity of drilling sites. Additionally, the burning of associated natural gas and the radioactive pollution linked to the oil industry are environmental concerns.

Older Iraqi oil refineries, which lack modern technology, serve as significant sources of pollution in this sector. This section addresses the primary environmental pressures resulting from extraction and industrial activities.

MAIN INDICATORS

CRUDE OIL PRODUCTION

Iraq has the fifth largest reserves of proven oil reserves in the world and the tenth largest reserve of proven gas reserves, and in view of the increase in global demand for crude oil and Iraq's need for financial resources on which it relies in implementing development plans and meeting its financial needs, there is an increase in the amount of crude oil produced or exported when comparing the years 2017-2020 as shown in Table 3.35. The increase in production and exports will put increasing pressure on the components of the Iraqi environment.

Table 3.35: Oil Production Indicators

Indicators	2017	2018	2019	2020
Amount of oil produced (million barrels)	1543.2	1609.8	1670	1465
Amount of oil exported (million barrels)	1207.8	1445.9	1448	1257
Quantity of oil supplied to refineries (million barrels)	186.1	220.6	334	197
Quantity of oil supplied for electricity (million barrels)	62.5	12.9	51	57

GAS PRODUCTION

The efforts of the Ministry of Oil are one of the great efforts in the field of transforming the gas sector into a profit-generating sector, which is not as much exploited at present. The trend to increase gas production in order to obtain more profitable exports and power generation will be the main starting point in the transition process towards the exploitation of gas instead of oil. Table 3.36 shows the quantities of associated gas produced during the years 2017-2020.

The environmental reality indicates that the amount of gas produced, used and burned is constantly increasing (Table 3.37), but the production of marketed natural gas is not commensurate with the total production of natural gas and is not commensurate with Iraq's large reserves, in addition to what the gas industry suffers in Iraq and its low ability to convert natural gas into gaseous products that enhance the added value of this industry and the momentum of other industries and sectors.

Table 3.36: Associated Natural Gas Production Indicators

Indicators	2017	2018	2019	2020
Amount of associated gas produced (MQMQ)	1,009,518	269,117.0	469,245	409,211.1

Table 3.37: The amount of natural gas produced, consumed and burned in Iraq

Indicators	2017	2018	2019	2020
Amount of gas produced (mqmq)	29,870	31,358	32,699	28,738
Consumer Quantity (Mqmq)	13,231	14,522	15,453	14,812
Amount of Gas Burned (Mqmq)	16,639	16,834	17,258	14,173
%) Investment Percentage	44	46	47	52

PETROLEUM PRODUCTS

Despite the increase in total refining capacity in Iraq during the period from 2017-2020, oil refining capacity in Iraq increased from 187 million barrels in 2017 to 200 million barrels in 2020 (Table 3.38).

The consumption rates of petroleum products in Iraq are affected by several factors, including the number of population, GDP, prices of oil products, air temperature, as well as the number of cars and progress in the technological techniques used,

Table 3.38: Amount of refined crude oil

Indicators	2017	2018	2019	2020
Amount of refined crude oil (million barrels)	187.0	222.5	235.2	200.0

and Table 3.39 shows the amount of domestic consumption of various petroleum products during the years 2017 and 2021, which indicates a steady increase in consumption, which constitutes a great pressure on the environment as a result of the high levels of pollutants resulting from the consumption or combustion of fuel.

Table 3.39: Domestic consumption of petroleum products

Year	gasoline M3	Jet fuel M3	White oil M3	Gas oil M3	Fuel oil M3	Liquid gas M3	Naphtha M3	Dry gas M3
2017	7,196,000	281,000	1,752,000	6,462,000	15,451,000	1,621,000	-	13,231,000
2021	9,273,955	171,859	1,789,274	9,562,042	10,553,758	1,788,790	211,531	15,249,466,845

EFFLUENTS

Oil reservoirs contain formation water, which is withdrawn abroad during the production process, and it represents one of the largest liquid wastes in terms of volume, which is dealt with in the extractive oil industries, which contain a mixture of organic and inorganic pollutants, as well as containing the remnants of chemical additives that are used in the process of drilling wells, and this water can contain quantities of petroleum materials, which range between 500-2000 parts per million.

SOLID WASTE

Solid waste constitutes the largest volume of waste generated from the activities of the oil industry, and the rock cover constitutes an important part of this waste, and other waste includes drilling mud and .rock crushers

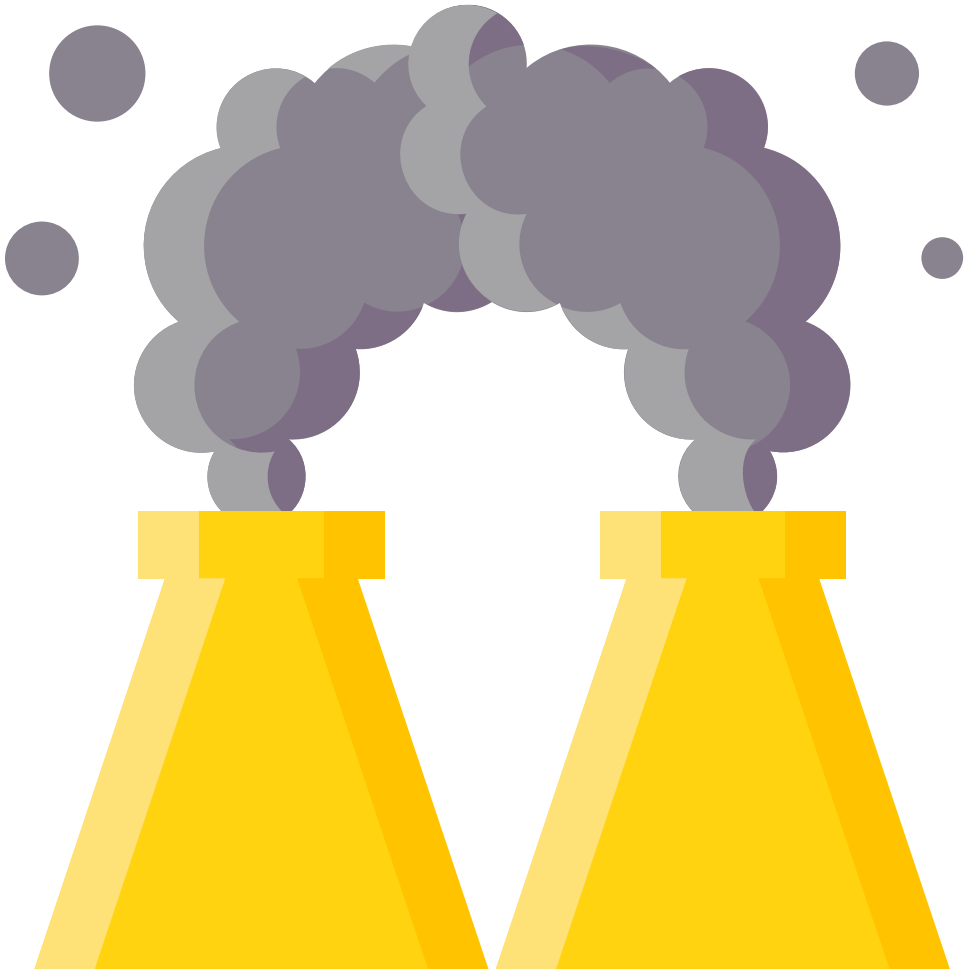
These residues released by the oil sector are one of the most dangerous solid pollutants due to their content of heavy hydrocarbons, such as polycyclic aromatics, as well as heavy metals found in crude oil, and then the release of these materials into the environment leads to significant pollution. Solid oil pollutants can be divided into residues of solid oil refining operations, and heavy oil residues resulting from oil derivatives treatment units, mud and mud left over from industrial water treatment units and sediments collected at the bottom of tanks, most of which are composed of heavy petroleum materials, as well as sand used in filtration processes, drilling mud, empty and damaged barrels for some types of improvers and chemicals, noting that the solid pollutants released by refining operations are estimated at about (2-3 kg) per one ton of crude oil .and the toxicity of these residues reaches 80%

EMISSIONS

The emission of greenhouse gases is the main cause of climate change in the world, which is an added and significant threat to the environment, as it led to a reduction in water levels due to the low rate of rainfall and high salinity of water, as well as the increase in periods of drought and desertification. All operations in the oil sector, whether in extraction or refinery operations, participate in increasing the percentage of gas emissions and Table No. (3.40) shows the number of gases burned in oil sites throughout Iraq, which will necessarily be a direct cause of the high rates of gases emitted at the oil site or nearby cities.

Table 3.40: Number of Gases Burned in Burners by Company and Type

Year	North Oil		Basra Oil	Central Oil	Dhi Qar Oil	Missan Oil
	Sweet gas	Acid gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas
2017	13,507,310	808,303,074	3,565,218,095.3	1,098,020,267	-	1,777,349,549
2021	12,119,839	738,442,837	11,011,189,197	225,971,115	516,958,012	2,019,590,551



CHAPTER FOUR:

IRAQ'S ENVIRONMENT'S RESPONSE TO PRESSURE

4

Environmental governance is a relatively new concept associated with the increasing awareness of communities and a growing interest in the principles of good governance. The definition of governance, according to the Arabic Language Academy, associates it with the term 'good management.' Its origin can be traced back to the ancient Greek word, denoting a set of laws, practices, policies, and standards that govern the interactions of individuals with their environment. It also regulates relationships between various stakeholders and upholds principles such as justice, transparency, and equality.

Environmental governance serves as a code of conduct focused on achieving sustainable development goals, protection the environment from pollution, preserving limited and non-renewable resources from unauthorized access, and positively impacting local communities by promoting justice and environmental sustainability. This is accomplished through the alteration of behavioral motivations, the enhancement of scientific knowledge, the adoption of decision-making methods related to environmental issues, and their support. It ensures the equitable distribution of all benefits gained through the implementation of environmental development programs.

ENVIRONMENTAL LEGISLATION IN FORCE

The Environmental Protection and Improvement Council, associated with the Ministry of Health (1995-1997), was the first organizational structure in Iraq to take on the responsibility of issuing environmental laws and regulations until 2003.

In 2003, with Iraq's transition to a new political system, both the political and institutional systems experienced significant changes. For the first time in Iraq's history, the Ministry of Environment was established, tasked with leading environmental legislation. This marked a substantial and pivotal development, aiming to shift the traditional perspective that had prevailed in Iraq's environmental efforts. Environmental work evolved into a more comprehensive view, emphasizing that the environment is a unified entity, not fragmented. It highlighted that environmental protection should encompass not only specific aspects or environmental sectors but also required a specialized ministry to implement legal provisions related to environmental protection across various domains.

To put this vision into practice, the Ministry of Environment Law No. 37 of 2008 was enacted, outlining the ministry's structure, responsibilities, objectives, and tasks. This was followed by the Protection and Improvement of the Environment Law No. 27 of 2009, which complements the legislative process for environmental protection. The following are the most important laws, legislations and environmental instructions in Iraq:

- Environmental Protection and Improvement Law No. 27 of 2009
- Internal Regulations of the Ministry of Environment Formations and Functions No. 1 of 2011
- Water Resources Conservation Regulation No. 2 of 2001
- Regulation of the maintenance of public rivers and waters from pollution No. 25 of 1967
- Instructions for the prevention of non-ionizing radiation issued by mobile phone systems No. 1 of 2010
- Instructions for the formation and tasks of the Environmental Protection Council No. 2 of 2010
- Instructions of the formations and tasks of the Council for the Protection and Improvement of the Environment in the Governorate No. 1 of 2012
- Instructions for the accreditation of consulting offices and laboratories in the field of environmental protection No. 1 of 2011
- Conditions for granting environmental approval for the establishment of radio and television broadcasting stations No. 2 of 2011
- Environmental Determinants of Project Construction and Monitoring the Safety of Implementation No. 3 of 2011
- Safety Instructions in the Use of Asbestos Silk No. 1 of 2002
- Instructions of National Emission Determinants for Activities and Works No. 3 of 2012
- Instructions for Dose Limitations of Exposure to

Ionizing Radiation No. 1 of 2010

- Internal Regulation for Controlling the Use of Sources of Radioactivity in Iraq No. 1 of 2006
- Law on the Protection of Wild Animals No. 17 of 2010
- Forestry and Quarrels Law No. 30 of 2009
- Noise Prevention Law No. 21 of 1966
- Safety Instructions in the Storage and Handling of Chemicals No. 4 of 1984
- Instructions for the manufacture, handling, and storage of pesticides No. 2 of 1990
- System of National Determinants of the Use of Treated Wastewater in Agricultural Irrigation No. 3 of 2012
- Ambient Air Protection System from Pollution No. 4 of 2012
- Ozone-Depleting Substances Control System No. 5 of 2012
- Instructions for Environmental Protection from Municipal Waste No. 2 of 2014
- Internal Regulations of the Environmental Police Department No. 1 of 2015
- Hazardous Waste Management Instructions No. 3 of 2015
- Instructions for the safe transport of radiation sources No. 2 of 2015
- Noise Control Law No. 41 of 2015
- Biosafety of genetically modified organisms and their products n°2 of 2015
- Noting that there are many regulations and instructions related to the Kurdistan Region, which can be summarized as follows:
- Law No. 8 of 2008 on the Protection and Improvement of the Environment in the Kurdistan Region
- Law of the Protection and Improvement of the Environment in the Kurdistan Region No. 3 of 2010
- Regulation of the establishment of nature reserves in the Kurdistan Region No. 9 of 2011
- Kurdistan Region Forestry Law No. 10 of 2012

MULTILATERAL ENVIRONMENTAL AGREEMENTS

In order to achieve the international partnership for the preservation of the environment, the Government of Iraq has signed and ratified many multilateral international environmental conventions and treaties, including the following:

- Convention on Biological Diversity
- Convention on the Regulation of Trade in Endangered Species of Flora and Fauna or CITES Convention (CITES)
- Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal
- United Nations Framework Convention on Climate Change
- Kyoto Protocol and Paris Agreement on Climate Change.
- Rotterdam Convention to promote better management in international trade in hazardous chemicals and pesticides for the protection of human health
- Stockholm Convention on the Protection of Human Health from Persistent Organic Pollutants (POPS)
- Kuwait Regional Convention for Cooperation in the Protection of the Marine Environment from Pollution
- United Nations Framework Convention to Combat Desertification
- Cartagena Protocol on Biosafety to the Convention on Biological Diversity

- Convention on the Conservation of Migratory Species of Wild Animals
- Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of Anti-personnel Mines
- Convention on Cluster Munitions
- Arab Strategy for Disaster Risk Reduction (2030)
- Vienna Convention and Montreal Protocol for the Protection of the Ozone Layer
- Ramsar Convention on Wetlands
- Convention on the Prohibition of the Development, Manufacture, Stockpiling and Use of Chemical Weapons and on their Destruction
- Minamata Convention on Mercury
- International Convention for the Control and Management of Ships' Ballast Water and Sediments
- International Convention on Civil Liability for Oil Pollution Damage
- Strategic Approach to International Chemicals Management (SAICM)
- World Heritage Convention
- Promotional Framework Convention for Occupational Safety and Health No. 187 of 2006.
- Occupational Safety and Health and Work Environment Convention No. 155 of 1981.
- Decisions of the Seoul Occupational Safety and Health Conference (Seoul Declaration) (2008). The declaration emphasized that "promoting high standards of safety and health at work is the responsibility of society as a whole and all members of society must contribute to achieving this goal by ensuring that occupational safety and health is prioritized in national agendas and by building and promoting a national preventive culture of safety and health."
- Istanbul Declaration for Occupational Safety and Health (2011).
- Decisions of the Jakarta Conference (2015) that emphasize the need to provide the requirements of occupational safety and health requirements when practicing work.
- Seoul Declaration for the Development of Occupational Health Services for All (31st ICOH Conference) in 2015.
- Convention 155: Occupational Health and Safety 1981.
- Convention 161: Occupational Health Services 1985.
- Convention 174: To prevent major industrial accidents (non-essential).
- Convention 184: Safety and Health in Agriculture 2001.
- Convention 62: Convention on Safety Provisions in the Construction Industry (1937).
- Convention 152: Convention on Occupational Safety and Health Provisions in Port Handling Operations (1979).
- Convention 155: Convention on Occupational Safety and Health and the Work Environment (1981) and accompanying directives.
- Convention 161: Convention on Occupational Health Services (1985).
- Convention 167: Convention on Safety Provisions in Construction (1988).
- Convention 170: Safety in the use of chemicals.

POLICIES & STRATEGIES

A number of policies and strategies have been issued with the aim of protecting the environment in Iraq, including the following;

NATIONAL ENVIRONMENT STRATEGY 2013

In 2013, Iraq developed its first environmental strategy. The strategy is formulated in order to achieve the visions of sustainable development. This has been facilitated through the adoption of policies and principles based mainly on modern environmental concepts prepared by developed countries and societies that preceded Iraq in addressing environmental problems and requirements, namely:

- Sustainability of natural resources
- Green Environmental Policy
- Environmental Audit
- Charging polluters related costs
- Participatory
- Ecotourism
- Compensation for damages

IRAQ VISION 2030

It is a comprehensive framework for the development process in Iraq developed in relation to the sustainable development goals to represent a roadmap towards achieving those goals in five axes, one of which is the sustainable environment axis, which seeks to provide a clean, safe and sustainable environment for the current and future generations, through the localization of the environment element in development plans and policies, in order to achieve a sustainable improvement in the quality of human life, ensure sustainability in production and consumption patterns, and reduce the repercussions of environmental pollution and climate change, in order to achieve the required environmental balance. It promotes the protection of biodiversity, within an effective implementation framework of international environmental conventions and their obligations.

The vision diagnosed the water issue, which threatens to worsen in light of environmental degradation and the consequences of climate change, which today poses an additional threat, from the perspective of increasing water demand and rising temperatures in a food-insecure environment. It pointed to the possibility of turning to new sources of growth, especially (green development), if infrastructure, housing, and transport systems are rehabilitated, in a way that enables society to adapt to climate change. Objectives have been set to achieve this priority:

- Reducing environmental pollution and greenhouse gas emissions.
- Efficient use of water resources.
- Environmental friendliness.
- Developing consumption and production patterns to achieve environmental sustainability.
- Protection of biodiversity and revitalization of marshes.

NATIONAL DEVELOPMENT PLAN 2018-2022

The National Development Plan for the years 2018-2022 is the most important step in the sustainable development journey in Iraq with regard to Iraq's Vision 2030, towards a future in which it aspires to be an advanced country at the economic, political, cultural, social, environmental, and psychological levels. The National Development Plan is prepared as a frame of reference for the national objectives of sectoral strategies, national documents and the international sustainable development goals 2015-2030 to achieve the goals and priorities set out in Vision 2030. The environmental objectives set out in the National Development Plan include:

- Ensure the availability and sustainable management of water and sanitation services
- Reduce air pollution and its impacts
- Protect, restore, and increase the sustainable use of ecosystems
- Addressing climate change and its impacts
- National Pollution Control Strategy

- The National Strategy for the Reduction of Environmental Pollution and the Action Plan in Iraq 2022-2030 were developed with the aim of controlling and reducing pollution by setting specific strategic objectives that will be achieved through an action plan.

ENVIRONMENTAL COMPONENTS

CLIMATE CHANGE

Since ratifying the Paris Agreement in 2021, the Iraqi government has made significant progress in scaling up its response to climate change impacts through new adaptation and mitigation strategies. One of the driving factors behind these efforts was Iraq's ambition to secure climate financing via the Green Climate Fund, attached to fulfilling the conditions outlined in the Paris Agreement. This motivation is partly fueled by the need to offset the loss of income resulting from low oil prices during the COVID-19 pandemic. The country's financial crisis was exacerbated by these low oil prices, given that over 90% of government budget revenues were previously derived from the oil sector. Additionally, Iraq aims to attract increased foreign investment in clean energy, which could further boost agriculture and food production, sectors that are heavily reliant on fossil fuels.

With the support of the United Nations Development Programme (UNDP), Iraq finalized its previously mentioned Nationally Determined Contribution (NDC) in December 2021. Iraq committed to a voluntary reduction of greenhouse gas emissions by 1 to 2% by 2030, with the possibility of further reducing emissions by up to 15% provided there is international technical and financial support, as well as political and security stability at the national level. This plan primarily targets the oil, gas, electricity, and transport sectors, which collectively account for 75% of Iraq's total greenhouse gas emissions.

The development of the NDC sets the stage for potential investments of up to $100 billion over the next decade to help transition the economy to a climate-neutral state, a crucial step that enhances food and water security. To bolster Iraq's resilience to climate change, the previous government reinstated the Ministry of Environment, which had been merged with the Ministry of Health in 2015 to reduce expenditures. Furthermore, the government is working on the launch of a 'Green Paper,' which outlines a concrete strategy for addressing climate change.

Despite strong political support from the outgoing government to address climate change's effects, Iraq still faces several significant challenges. These include limited institutional capacity to translate adaptation policies into on-ground projects, inadequate data, and analysis regarding the impacts of climate change on different sectors and communities, weak monitoring and reporting processes, and ineffective financing strategies. Iraq's NDC policies on food and water provision underscore the importance of building resilience in these sectors through the development of a comprehensive water and land strategy lasting until 2035. However, due to challenges related to institutional capacity and funding, creating a comprehensive operational strategy requires international support and collaboration with other local stakeholders. Corruption in budget allocation and expenditure, as well as the enforcement of laws, hampers proposed solutions to protect water resources and prevent the commercial or private use of agricultural land.

REDUCING AIR POLLUTION

In order to reduce air pollution, the following responses must be implemented:

- Updating legislation on air quality and reducing air pollution.
- Reduce greenhouse gas emissions, through the implementation of Nationally Determined Contributions (NDCs) to climate change that are committed to the preparation of the National Adaptation Plan and mitigation actions.
- Strengthening the ambient air quality assessment program and equipping all governorates with air quality monitoring stations.
- Ensure the effective application of self-monitoring practices and equip fixed and mobile sources of pollution with fixed measuring devices for gas emissions.
- Continue the Green Belt project, intensify vegetation, and stabilize the soil to reduce the impact of dust storms.
- Control vehicle emissions by enhancing inspection and control procedures while

encouraging the use of low-emission vehicles and cleaner fuels.

- Support cost-effective mass transit systems between cities and develop transport infrastructure in major cities.

- REDUCING WATER POLLUTION

- In order to reduce water pollution, the following responses must be implemented:

- Support and develop a water quality monitoring system.

- Use treated wastewater for irrigation or return treated wastewater to rivers to boost water imports.

- Completing the connection of drainage networks to the main drainage system to prevent the discharge of river water.

- Improve wastewater treatment systems across Iraq and prevent any network overruns.

- Oblige polluters to treat pollution, pay the costs of associated damages, and adhere to environmental determinants.

- Implementation of contingency plans for oil and chemical spills and ballast water management plans for marine waters.

- Activating strategic measures for regional cooperation on water shares with neighboring countries to reduce water scarcity and its impacts.

- Apply the law to reduce pollution (including salinity) in Iraqi rivers in southern Iraq, especially the Shatt al-Arab and the marshes.

- REDUCING SOIL POLLUTION

- To reduce soil and land pollution, the following responses should be implemented:

- Reduce the indiscriminate use of agrochemicals through a strict control system used in the import of chemicals including pesticides.

- Ensure that agricultural land is protected and preserved from diversion to other uses through the application of strict laws.

- Support and encourage the use of modern technologies to reduce pesticide consumption

- Manage the import and handling of toxic chemicals in Iraq with guidance for storage, transportation, and disposal.

- Continue to implement the dismantling and repair of facilities and sites related to Iraq's previous nuclear programme and the safe disposal of radioactive materials and waste, as well as the clearance of areas contaminated by mines and remnants of war.

- Reduce salinity, waterlogging and expose soils to desertification by continuing to stabilize sand dunes, intensify vegetation and land reclamation activities.

REDUCE POLLUTION FROM SOLID WASTE MANAGEMENT

To reduce solid waste pollution, the following responses must be implemented:

- Develop and implement integrated municipal waste management strategies at the national, regional and local levels.

- Encourage the reduction, recycling and reuse of municipal waste.

- Implementation and application of rules and regulations related to municipal waste management.

- Establish a national system for the management of hazardous waste including medical waste.

- Effective participation of the private sector in waste management.

- Promote and apply sustainable solutions in converting waste into energy or organic fertilizer.

- Assess contaminated sites in Iraq in conflict areas and develop plans for clean-up and disinfection procedures.

- Apply environmentally friendly methods of waste disposal such as cutting and sterilizing medical waste instead of incineration.

- Establish a hazardous waste management system through the development of a database of hazardous waste, and enforce legislation, in accordance with the requirements of relevant international conventions.
- Encourage research to develop technologies for the disposal, recycling and treatment of hazardous chemicals and wastes and assess their impacts on the environment and public health.
- End open burning by holding violators accountable and educating citizens.
- Support national legislation related to the management of radioactive materials and waste and regulatory and executive bodies to carry out their tasks in controlling and treating radioactive contamination.

REDUCING POLLUTION FROM THE INDUSTRIAL SECTOR

To reduce pollution from the industrial sector, the following responses must be implemented:

- Develop and modernize industrial processes and technologies to improve air and water treatment units through industrial modernization centers.
- Conduct environmental impact assessment studies for existing facilities established before Law No. 27 of 2009 and proposing corrective actions to combat pollution.
- Replace heavy oil fuels with alternative fuels (clean fuels such as gas) in power plants and other industries (such as brick factories).
- Promote and support industries to modernize their technologies and control air emissions and wastewater discharge.
- Improve industrial waste management by promoting waste recycling and reduce methods and issue relevant legislation.
- Strengthen the monitoring system to monitor environmental performance and ensure compliance with environmental legislation.
- Establish modern industrial cities to establish small industries in specific locations that comply with environmental determinants to control and treat pollution and close existing industries that pollute the environment near residential areas.
- Provide economic tools (fee reduction/waiver, low-interest loans, certificates of appreciation, awards) for technology development, adoption of clean technology, implementation of pollution control measures and compliance with environmental standards.
- Establish clean production centers and promote environmentally friendly production technologies and practices.
- Implement national emergency response plans and prevent accidents that pollute the environment.
- REDUCING POLLUTION FROM THE ENERGY SECTOR
- To reduce pollution from the energy sector, the following responses must be implemented:
- Using the natural base solution method by afforestation of the land surrounding the power plants.
- Improving the efficiency of transportation and distribution and following modern technological methods that help adapt to high temperatures.
- The specifications of electrical equipment used in the electricity sector change in line with the increase in temperatures.
- Achieving balance and integration between the various means of transport and making it an integrated system to maximize the volume of transport in Iraq and setting regulations governing this.
- Developing and providing mass public transport and infrastructure to avoid traffic congestion and improve living standards, including the provision of railway lines to transport goods and equipment between governorates and improve their efficiency.

- Provide advanced transport technologies that are resilient to the negative effects of climate change.
- Seeking to develop airports and land, sea and river transport centers and walking modern environmentally friendly trains such as electric trains.
- Supporting maritime transport and its importance in linking Iraq with the world and its impact on the movement of international trade and raising the standard of living of the individual.
- Conducting comprehensive studies to assess the effects of climate change and rising temperatures on the transport sector.
- Adopting renewable energy as a means of generating electricity.
- Reducing associated gas emissions by modernizing oil production facilities and treatment units and launching associated gas investment projects.

STRENGTHENING THE LEGAL AND INSTITUTIONAL FRAMEWORK

The following responses should be implemented at the legal and institutional level to ensure the appropriate implementation of pre-established comprehensive laws, regulations and standards related to the environment:

- Take an integrated approach to environmental protection to ensure mutual agreement and coordination between all national programs including Iraq's Vision 2030, the National Development Plan, and the Rafidain Restoration Document.
- Establish a reliable data collection system based on scientific foundations covering all regions of Iraq.
- Develop effective systems and institutions for monitoring and reporting on emissions, discharges and environmental quality as well as intensive capacity building for inspectors (including environmental inspectors) – including testing and measurement systems for environmental pollutants.
- Full support to the regulatory body, the Ministry of Environment and its branches in the governorates and the Environmental Protection Council in the Kurdistan Region.
- Procedures and tools to raise the level of environmental awareness of the public regarding sources of pollution, pollutant-producing industries, medical institutions and sanitation, in order to ensure understanding, cooperation and support environmental measures.
- Develop procedures that facilitate public participation in environmental management, women's participation in decision-making and in all aspects of environmental management.
- Provide administrative and judicial resources in relation to violations of environmental laws, accompanied by appropriate systems of adequate and deterrent means of law enforcement such as fines and penalties, including liability provisions under criminal jurisdiction for serious violations.
- Training employees and affected sectors of society through partnership with NGOs and civil society organizations to monitor facilities in remote areas.
- Providing adequate funding to executive institutions.
- Encourage environmentally friendly initiatives and provide economic tools to reduce pollution.
- Supporting the institutional framework for environmental protection in the Kurdistan Region.

INSTITUTIONAL RESPONSE

MINISTRY OF PLANNING

- Preparing a report on development gaps, which indicates a shortage in housing, work and services magazines and their repercussions on the local environment.
- Preparing a draft law on slums for the purpose of regulating housing abuses within cities and providing a suitable housing environment.

- Selecting sites for new cities and expanding the basic designs of existing cities for the purpose of creating a healthy environment suitable for living, reducing overcrowding in existing cities and providing new job opportunities.

- Nominating many rural villages for development and preparing basic designs for them in order to encourage housing in the countryside instead of migrating to the city.

- AMANAT BAGHDAD

- Waste Treatment and Electric Power Production Project

- Due to the increase in the amount of waste sorted per day, which reaches an average of (9000 tons/day), there has been a move towards the use of technologies and the production of electrical energy through investment offers submitted by companies specialized in this field and in coordination with the Ministries of Electricity and Environment, the National Investment Commission, the General Secretariat of the Council of Ministers and the Ministry of Planning, where several measures have been taken to facilitate the implementation of the project, including the issuance of a decision by the Council of Ministers to purchase the produced energy at promotional prices in addition to drafting the waste management law, preparing the terms of reference and a study on the components and proportions of waste in the city of Baghdad.

- Design and implementation of the project of managing treated wastewater for the uses of the green belt through the installation of a site treatment unit with a capacity of (15000 m3/day) to treat the wastewater released in the Saqlawiya trocar to irrigate the green belt area, where the project aims to reduce pollutants and develop an unconventional water source for agricultural purposes to overcome the scarcity of rainwater.

- Implementation of the tertiary treatment project for wastewater with a capacity of (300,000 m3/day), which is a stage that comes after the current treatment of wastewater through the installation of three units, two at the site of Rustumiya and one in Karkh/Al-Buaitha, and the requirements for the inclusion of the two projects have been prepared and will be announced soon.

- The project of rehabilitating the Buaitha landfill cell with a capacity of (1000 tons/day), where the procedures of landfill techniques are applied through a lined cell to preserve groundwater and a pipe network to collect methane gas, and the project is currently under implementation.

- Waste Tire Recycling Project: The project aims to reduce pollution resulting from tire accumulation, as the project works on the production of rubber granules that are used in the manufacture of (muqarnas tiles) and granules used in cement factories and building containers.

MINISTRY OF CONSTRUCTION, HOUSING AND PUBLIC MUNICIPALITIES

HOUSING SECTOR

- Iraq, represented by the Ministry of Construction, Housing and Public Municipalities, joined the membership of the Global Alliance for Building and Construction, which is the leading global platform for governments, the private sector, civil society and intergovernmental organizations to increase work to stop emissions from buildings and the construction sector efficiently and effectively through the use of thermal insulation techniques, environmentally friendly air conditioning systems, effective design of buildings, utilization of natural energies and promoting the production of environmentally friendly building materials and local products.

- Issuing many building codes that contribute to the adoption of environmental standards and requirements through the Iraqi Building Code project, including (natural lighting, interior lighting, city beauty, waste code, thermal insulation code, sanitation code in buildings, earthquake resistant buildings code, green building code) and distributing them to many state institutions.

- Coordination with the advisory bodies to use the effective design of buildings and new projects to make the most of lighting and solar energy and the use of thermal insulation techniques as well as modern building techniques such as (ICF, GRC)

- Rationalization of electrical energy consumption by replacing lighting installations from fluorescent to LED to reduce heat and greenhouse gas emissions at the Ministry's headquarters and structures, as well as in projects under implementation.

- Encouraging the implementation of housing projects according to the style of modern building systems to become green and environmentally friendly cities.

- Disseminating knowledge and awareness in the field of climate change risks, promoting scientific research and building capacities in the field of technological development, and providing the opportunity to prepare extensive studies to increase the knowledge aspect in this field.

- Highlighting the roles of the resident engineer for the projects supervised by our departments in coordination with the authorities (beneficiaries, implementers) the need to pay attention to planting and afforestation of squares and increasing green spaces, especially palm trees because of their importance in stabilizing the soil, preventing desertification and improving the atmosphere.

- Contribute through our researchers and participate in the issuance of scientific codes in the field of green building and benefit from natural lighting and solar energy.

- SANITATION SECTOR

- Completion of sewage projects by the Baghdad Sewerage Directorate and entered into service years ago, which are (Mahmoudia treatment plant, bridge, cities, Latifiya, Al Zohour.) The ones in the process of completion are (Youssoufia sewerage project, Rasheed, Tarmiya) and projects in the referral phase are (Abu Ghraib project, Al Nasr, Al Salam, Saba Al-Bur, Al-Wahda, Nahrawan), where it treats and filters sewage water and makes it within the determinants and controls approved by the World Health and Safety Organization and the use of the resulting water for agriculture and afforestation (green belt) and increase green areas for the treatment of gases and dust, as well as treatment plants contain odor and gas removal systems, which treat gases emitted from human waste.

- Establishing 59 filter stations distributed in the districts and suburbs of Baghdad Governorate to treat water collection in areas not currently covered by services and for the purpose of eliminating swamps and random water gatherings and accelerating rainwater drainage.

- Work is ongoing and continuous on the management of networks and treatment plants with the aim of expanding the water sector, reducing the negative effects of climate change, rehabilitating the sewage sector, increasing treatment plants to provide alternative water sources, reducing pollution of rainwater, recycling solid waste and preserving the environment.

- Spreading environmental awareness among citizens by removing violations and reducing water pollution.

- The Directorate of Diwaniyah Sewers has completed the project of expanding the sewage plant in the Khairi area with a design capacity (20,000 m3/day), which contributes to reducing pollution in the water, and formed a team from the concerned departments to prepare the designs of the green belt for the center of Diwaniyah district, which is fed from treated water from the central treatment plant, and there is also a project under implementation that includes a wastewater treatment plant with a design capacity of (100,000 m3). It is also rehabilitating the sewage treatment plant from Khairi area in the center of Diwaniyah district, and the implementation project of the sewage plant in Al-Daghara district is in progress.

- Implementation of the methane electric power production unit in the sewage treatment unit project for the holy city of Karbala/Phase II and III, in addition to that, the Karbala Sewerage Directorate treats wastewater according to the approved environmental determinants and according to the laws and instructions in force, in addition to providing the necessary support for industrial projects as far as it is related to strengthening cooperation with the aim of preserving the environment.

WASTE SECTOR

- Preparing the national plan for waste management in Iraq and includes five aspects (technical, legal, financial, human resources, awareness and media).
- Preparing an integrated database (amount of waste, landfill sites, transfer stations, sorting and recycling plant).
- Preparing an action plan for waste management in (Ramadi, Basra, Kirkuk, Dhi Qar).
- Preparing all documents for the new model sanitary landfill sites (bills of quantities, technical specifications, plans, construction accounts, feasibility studies, environmental impact reports, soil tests) in the cities of (Mosul, Tikrit, Baquba, Kut, Ramadi, Karbala, Diwaniyah, Samawah, Nasiriyah, Amara).
- Preparing a draft law on the management of municipal solid waste.
- Updating the position of municipal institutions in the governorates regarding the afforestation of green areas and the work of the national project to plant one million trees in Iraq.

MINISTRY OF INDUSTRY

The Ministry of Industry is actively involved in monitoring various issues, with a primary focus on climate change, water, environmental approvals, mines, radiation, the Minamata Agreement, chemicals, industrial waste, and the ozone agreement. Below, describes both the actions that have been implemented and the proposed responses.

Climate Change

- Develop a plan to replace the fuel used in cement industry furnaces from black oil to gas for all plants, and the conversion of (6) furnaces to gas instead of black oil has been completed.
- Coordination has been made with the Ministry of Environment to include the technology of recycling heat generated from cement kilns for the purpose of producing electrical energy or heating within the technological needs document (TNA) and waiting for the document to be approved to start implementation procedures.
- The Ministry is working on recycling waste according to the Ministry's specialization (tire recycling, plastic recycling, lead recycling), where the recycling of consumed tires was started in the State Company for Rubber Industries and tires through the spent tire recycling plant, in addition to recycling lead in the foundry of the State Company for the Automotive and Equipment Industry.
- Establishing (3) factories affiliated to the general formations of the Ministry for the production of economic lamps (LED) in order to contribute to reducing electrical energy consumption and thus contribute to reducing gas emissions.
- Work on the rehabilitation of existing factories and current production lines to be environmentally friendly and low on pollution.
- Seeking to localize the sustainable development goals and follow an integrated methodology to implement the goals and agenda 2030 by enabling decent work, capacity building, adopting intersectoral methodologies, collecting data related to the sustainable development goals, preparing programs for entrepreneurship and climate change, empowering women economically through training and sometimes financing them and developing entrepreneurial businesses.
- Seeking to consolidate the principles of green economy, sustainability of environmental resources and poverty eradication through the practices of the companies of the Ministry of Industry and Minerals.

WATER USES

- Implementation of (15) environmental projects to treat liquid tenders at an estimated cost of (135) billion dinars, in addition to the implementation and rehabilitation of (7) water treatment projects at the expense of qualifying companies during the past ten years, with an emphasis on companies to adhere to environmental determinants.
- A specialized nanotechnology team has been formed in our Ministry with the aim of studying the areas of use of nanotechnology in water treatment in order to develop methods of treatment of wastewater.

ENVIRONMENTAL APPROVALS

To coordinate with the Ministry of Environment to ensure that our companies' laboratories obtain environmental approval to continue their work in accordance with environmental conditions and determinants.

Landmines

- Coordination with the Ministry of Environment/ Department of Mine Affairs for the purpose of following up on the pollution caused by military operations that were in areas close to our companies' factories.

- Introducing the subject of artificial intelligence for the purpose of mine detection and detonation through the formation of a committee of concerned companies affiliated to our ministry in coordination with the Ministry of Environment/ Department of Mine Affairs.

RADIATION

Coordination with the Iraqi Authority for the Control of Radioactive Materials for the purpose of following up the transport, circulation, and safe disposal of radioactive sources in the laboratories of our companies.

- Removal of radioactive contamination in the iron and steel factory is one of the tasks of our Ministry.

- Removal of radioactive contamination in the General Company for Iron and Steel in cooperation with the Ministry of Environment to issue the final site launch certificate after taking the necessary measures for the storage and treatment of treated waste.

MINAMATA CONVENTION (MERCURY AND MERCURY COMPOUNDS)

Coordination is ongoing with the Ministry of Environment/Technical Department for the purpose of completing the requirements for the phase-out of mercury and its compounds to fulfill the commitment of our Ministry to implement the terms of the agreement, as Iraq recently joined the agreement.

Chemicals

- A sub-committee, the Technical Committee of the Data Bank, was formed in order to fulfill the commitment of the Ministry of Industry and Minerals to the decisions of the Central Data Bank Committee headed by the Ministry of Environment and supervised by the Council of Ministers' Advisors, and one of its most important tasks is to demonstrate the possibility of benefiting from stagnant chemicals in our Ministry's companies.

- A comprehensive study was submitted to the Ministry of Environment on the movement of hazardous chemicals in the warehouses of our companies' laboratories and factories, classifying all these materials, indicating the quantities of stagnant materials, and making important recommendations on them to avoid their accumulation and damage by obsolescence, since the destruction process requires large sums of money.

- Chemicals were classified into (98) substances that were not covered by the Ministry of Environment's guideline (Manual for Classification of Chemicals Threatening National Security), including (4) substances bearing the characteristics of the red list and (14) substances bearing the characteristics of the blacklist.

- An internal electronic system has been created to classify chemicals and the possibility of obtaining detailed reports on the condition, qualities, and movement of the material for several years in each company.

INDUSTRIAL WASTE

- Our Ministry's companies in the engineering sector are working to benefit as much as possible from the solid waste they put forward, as is found in the Diyala State Company, your State Company and the General Company for Mining Industries, especially non-hazardous waste.

- The chemical sector in Iraq does not produce hazardous solid waste, while hazardous waste may be reused at sites, as happens in the State Company for Rubber Industries and Tires, while the rest of the laboratories send it to other parties for the purpose of destruction in accordance with the directives and instructions of the Ministry of Environment.

- There are sustainable practices for a number of companies in our ministry to reduce production losses by following a policy of sustainable production and consumption, and most companies are keen to reduce the amount of waste.

- The phosphorgypsin in the general phosphate company is stored in tight concrete warehouses away from any human activity complexes at a certain depth in the ground and the company is not working.

- As for sulfur foam residues, and regarding sulfur stacks in Al-Mishraq General Company, all chemical security and occupational safety requirements were followed to avoid risks, as a specialized team was formed to assess the risks and determine their condition.

- Our Ministry is committed to environmental agreements with regard to hazardous waste (Basel and Stockholm Conventions) and the Ministry is also committed to local legislation such as the Public Health Law No. 89 of 1981.

OZONE CONVENTION

- Completion and operation of two Freon Gas Recycling Centers (HCFC) in the State Company for Electrical and Electronic Industries and the General Company for Southern Fertilizers to replace imported gases, especially R 22 gas used in air conditioners.

- Work with the Ministry of Environment to find environmentally friendly alternatives to refrigerant gases (Freon).

- Follow the policy of determining the shares of Freon gases HCFC at the companies of our ministries and mixed sector companies and provide the General Directorate of Industrial Development with various instructions in coordination with the Ministry of Environment according to the decisions of the Implementation Committee.

- The introduction of a new production line in the State Company for Steel Industries to produce foam as an alternative to the traditional production line, where the use of freon gases and hazardous materials for foam blowing was dispensed with.

MINISTRY OF HEALTH

- Implement good management programs for medical waste within the health institution, starting from sorting it at its source and ensuring its final treatment to ensure that it does not cause the spread of infection.

- Preparing the environmental guide for health institutions to be a reference for the process of hazardous medical waste management, which shows all stages of medical waste management (sorting, collection, transportation, treatment).

- Replacing used incinerators with heat treatment devices such as shredding autoclave devices which are currently used in all health departments, with one incinerator per circuit with a capacity of 250 kg/hour.

- Launching a project to install liquid waste treatment units in government hospitals with the (Membrane Bioreactor) system and the (MBBR) system for the purpose of reducing pollution rates and contributing to improving water quality.

MINISTRY OF AGRICULTURE

- Implementation of a national program for the propagation of seeds of the highest grades of the wheat crop in the degraded lands that suffer from low productivity, where good results were obtained and the degraded lands were converted into productive lands by cultivating (1065) dunums in the governorates of Wasit, Maysan, Holy Karbala and Diyala for several agricultural seasons.

- Treatment of (900) thousand dunums of creeping sand dunes on farms, traffic roads and irrigation channels in the governorates where sand dunes are present.

- Establishing (23) stations for the development of natural pastures and sowing pastoral seeds during the rainy season in large areas of land prone to degradation.

- Establishing (35) desert oasis in desert areas by planting salt-degrading plants and drought conditions.

- Establishing (9) sites in the Iraqi Hammad area to develop vegetation cover and reduce land degradation by taking advantage of rainfall.

- Preparing a document on neutralization of the impact of land degradation and submitting it to the Secretariat of the United Nations clarified the areas of degraded land in Iraq, which amounted to (25-26%) of the area of Iraq, where it was adopted as an official document.

- Disposal of salt puncture water and preventing its discharge to rivers or groundwater by implementing a network of trocar channels and discharging it towards the general estuary, which starts from northern Baghdad to the Arabian Gulf and a length of 565 km with the connection of the eastern rat trocar to it with a length of 261 km and is also linked to the general mouth of the eastern trocar with a length of 172 km.

MINISTRY OF WATER RESOURCES

- Water scarcity is one of the most prominent problems that put pressure on the environment in Iraq as a result of the failure of the countries of the Upper Tigris and Euphrates rivers to maintain Iraq's share, and how they have cut off the sources of some rivers, which greatly affected water revenues, in addition to the lack of rain and high temperatures as a result of climate change. The Ministry of Water Resources has taken measures to confront water scarcity and the resulting effects such as the impact of water storage and the deterioration of water quality, and these measures include:

  - Follow-up, organize and control water releases and ensure justice in water distributions between governorates in accordance with the general water budget prepared by the Ministry, and in cooperation with the Ministry of Agriculture, giving priority to the provision of drinking water and then securing water to irrigate orchards as a national necessity, while determining the areas that can be cultivated with the available water quotas.

  - Applying the spray system to achieve justice in water distributions between one governorate and another and within the governorate itself, as well as following up on the distribution of water to ensure that it reaches the main rivers in good quantity and quality.

  - Drilling wells in areas far from surface water sources and liquefaction stations in all governorates for public benefit using drilling rigs of the Public Authority for Groundwater (one of the Ministry's authorities).

  - The Ministry puts within its future plans the issue of switching from open to closed irrigation to transfer water and distribute it to agricultural lands, which is one of the most important methods of confronting climate change, in addition to that, it will contribute to strengthening Iraq's position in negotiating with upstream countries.

  - Expanding and deepening the nutrients of the marshes to maintain good quantities of water through the available releases received in accordance with the operational program of the Ministry for the purpose of reducing the effects of water scarcity, facing drought and reducing the impact of the lack of water supply in the marsh areas.

- The inclusion of the city of Chabayish in Dhi Qar Governorate among the cities of global wetlands, during the work of the fourteenth conference on wetlands, which was held in the Swiss capital, Geneva.

- Starting the implementation of the first phase of the Bada'a Canal project, which has a total length of 220.5 km, starting from the Bada'a regulator in Dhi Qar and to the sedimentation basins in Basra and with a discharge of 21 m3/s. This project will provide a fixed water share with good quantity and quality for drinking for Basra Governorate by converting the canal from open to closed for piped water transport.

- Preparing studies by Al-Raed Research Station/National Center for Water Resources Management (one of the formations of the Ministry of Water Resources) on the use of irrigation methods such as sprinkler or drip irrigation, smart irrigation and responsive drip irrigation.

- Studying the proposal to establish a cutting dam in Basra Governorate to prevent salt intrusion.
- Orientation towards the establishment of water harvesting dams in the western and northern regions and the Samawa and Najaf Badia to mitigate the effects of water scarcity and preserve the ecosystem and biodiversity.
- Developing and updating laboratory equipment in the Ministry's authorities to conduct chemical, physical and soil tests and identify sources of pollution and trace elements.
- Launching continuous campaigns to remove encroachments on the river column and hold violators accountable to reduce losses and ensure access to the prescribed water quotas.
- Continuous cooperation and coordination with IUCN UNDP and UNESCO on the development of dams and dam monitoring programs and the use of modern technology in controlling water releases.
- Continuous coordination with UNESCO in the preparation of national reports on World Heritage sites that were included in 2016 to preserve and sustain these sites within international standards.
- Coordination with the Ministry of Foreign Affairs for the purpose of urging the Turkish and Iranian sides to hold a meeting to discuss the water situation and the common problems of rivers in order to overcome the water scarcity crisis.
- The Ministry continues to follow up with the Ministry of Foreign Affairs to approach the competent authorities of the Turkish and Syrian sides to inform us of the reasons for the decrease in the discharges achieved for the Euphrates River while providing us with discharges at the Turkish-Syrian border periodically due to their importance in preparing our operational plans.
- Securing water quotas for the marsh areas in coordination and cooperation with the rest of the Ministry's authorities by coordinating with the concerned authorities to provide water quotas with periodic monitoring of water discharges and levels.
- Monitoring and removing abuses and consumption along the paths of rivers feeding the marshes through the committees formed between the departments of marshes and wetlands projects in the southern governorates and the directorates of water resources in those governorates and taking the necessary measures against violators.
- Delivering potable water by providing basin tanks to the inhabitants of the marshes and adjacent villages.
- Installing and operating desalination plants in those areas and changing the suckers of some plants from the secondary rivers due to their low discharges and levels.
- Submit project proposals related to wastewater treatment and recycling, in addition to other environmentally friendly projects.
- Clean energy (solar energy) is used in the operation of water level monitoring stations and in the operation of cameras at the natural component management site (Hawizeh Marsh) in Maysan Governorate, as well as the intention to complete the use of clean energy in the rest of the sites.

MINISTRY OF TRANSPORT

MARINE POLLUTION

- Follow-up to the implementation of oil spills control
- Periodic and continuous recovery of submersions

AIR POLLUTION

- The use of low sulfur fuel from the year 2020 for the ships of the company for maritime transport under the Ministry of Transport.
- Using energy-saving LED lamps in the Ministry's headquarters building and its authorities instead of the regular lamps.

- Coordination with Toyota to test hybrid cars for a period of (2) months and send a report to the General Secretariat of the Council of Ministers in order to exempt hybrid cars from customs and taxes and in coordination with the Ministry of Environment, and this has already been done.

CLIMATE CHANGE

- Completing the requirements of the funicular train project, which is one of the important projects for reducing emissions and reducing traffic momentum, as the train is electric, with a capacity of (30,000) passengers per hour, and a speed of (80) km per hour with a length of (20) km linking Karkh and Rusafa from the Alawi area to the Shaab area, passing through (12) secondary stations.

- Initiate the replacement of fossil fuels and the gradual shift towards the use of clean fuels and the modification of cars to work on liquid gas LPG.

MINISTRY OF ELECTRICITY

Axis one

One of the requirements of the work of electric power plants (thermal and gas) in particular is the presence of laboratories to conduct tests on the quality of fuel used in the operation of the stations to conform to the ideal specifications for operation, as well as the quality of water required by the operation of thermal plants, as well as laboratory tests for oils involved in the generation processes, and laboratories also process the treatment of water entering and used in the operations.

Axis tow

Production and energy balancing: It includes annual data on the production of electrical energy from the system's generating stations, energy import lines from neighboring countries, energy produced by investors, fuel consumption, cost and calorific value, and the available capacities of the stations.

- Annual Statistics: It includes annual data on the energy produced from generating stations, the approved fuel mix and the contribution ratios of each type, statistical data on the number and types of stations and their geographical distribution and generating capacities, data on the activity of transmission networks in terms of energy received from production and exported to distribution networks and network losses, as well as statistical data on the lengths and number of transmission lines and their types, the number of secondary stations and their capacities, as well as for the distribution sector as well as the energy sold according to the types of consumers, their percentages and network losses, and energy budget data from production and even the consumer, in addition to data reflecting the financial and administrative activity of the Ministry.

- System Report: It includes daily data on the operation of generating stations (according to their types), their generating capacities at work, which are out of service, the reasons for that (lost capacities), as well as energy import lines and investment stations, peak loads (required and equipped) according to governorates and their loads according to the hours of the day, programmed shut down of generating stations, lines and secondary stations, accidents that may occur, and maintenance data in generating stations and transmission lines and their causes.

Axis Three

The Ministry of Electricity takes into account in its plans the goals and objectives of sustainable development and in line with Iraq's Vision 2030 (the future we aspire to), especially in the fields of green economy and sustainability of environmental resources, as well as contributing to achieving the seventh goal of the sustainable development goals (ensuring access to affordable, reliable and modern energy for all), as the Ministry works to ensure the provision of electrical energy to all citizens through:

- Increased use of natural gas. The participation rate in the fuel mix reached (63%) in 2021.

- Conversion of gas stations to work in the combined cycle, where the capacities involved in the work reached (2133) MW.

- Work to increase the share of renewable energy in the energy mix, which currently stands at (2%), mostly from water resources.

Axis Four

The effects of climate change are evident on the electricity sector, especially the high temperatures in most regions of Iraq in the summer, where the temperature reaches fifty degrees Celsius or more during the season. This increases the burdens of the system and this is clearly shown in the low efficiency of gas generating stations whenever temperatures rise, which reduces the hours of processing electrical energy for citizens, noting that the gap between demand and processing is still large and the growth in demand continues as well as the continued warming phenomenon, the demand for electrical energy will rise significantly in the coming years, which will cast a heavy shadow on the state, social security and economic growth, and the shrinking green spaces in Iraq are increasing exacerbates the crisis of the electricity sector because of its negative effects on the demand for electrical energy and the process of generating it.

Axis Five

The Ministry of Electricity is committed to the adaptation measures agreed upon in the updated National Contributions (NDC) document which are as follows:

- Using a method for (nature Base solution) by afforestation of the lands surrounding the power plants, the Ministry aims to plant (73,875) trees in the vicinity of its generating stations, and approximately (5,000) trees have been planted in several sites with the preparation of their sustainability requirements, and in coordination with the Ministry of Agriculture in the use of drip irrigation systems for sustainability, and work is currently continuing with the inclusion of all production stations in the future.

- Improving the efficiency of transportation and distribution and following modern technological methods that help to adapt to high temperatures.

- Changing the specifications of electrical equipment used in the electricity sector in line with the increase in temperatures, by changing the specifications of electrical equipment used in the electricity sector. The Ministry of Electricity works through specialized technical committees to update its technical specifications in line with developments in the field of energy efficiency on the one hand, and on the other hand, it works with the technical committees in the Central Organization for Standardization and Quality Control to issue energy efficiency labels for household appliances.

Axis Six

As mentioned earlier, the Ministry of Electricity takes into account the sustainable development goals, the contents of the Paris Climate Agreement and Iraq's Vision 2030 when preparing and updating its plans, and in this regard we include below the most important means adopted by the Ministry to achieve the aforementioned goals and within the mitigation path in the national contributions document, as follows:

- Greenery: Afforestation of lands surrounding power plants, the Ministry aims to plant (73,875) trees in the vicinity of its generating stations, and nearly (5,000) trees have been planted in several sites with the preparation of the requirements for their sustainability.

- Conversion of gas stations from simple cycle to combined cycle: In order to achieve higher efficiency in the field of electric power generation in gas generating stations, the Ministry has worked starting from 2015 to convert simple cycle gas stations to combined cycle, and it is hoped that the total capacity of combined cycles (through the completion of private investment projects and direct invitations), which will be added to the electric power system, will reach (8995) MW by 2025 according to the Ministry's central plan.

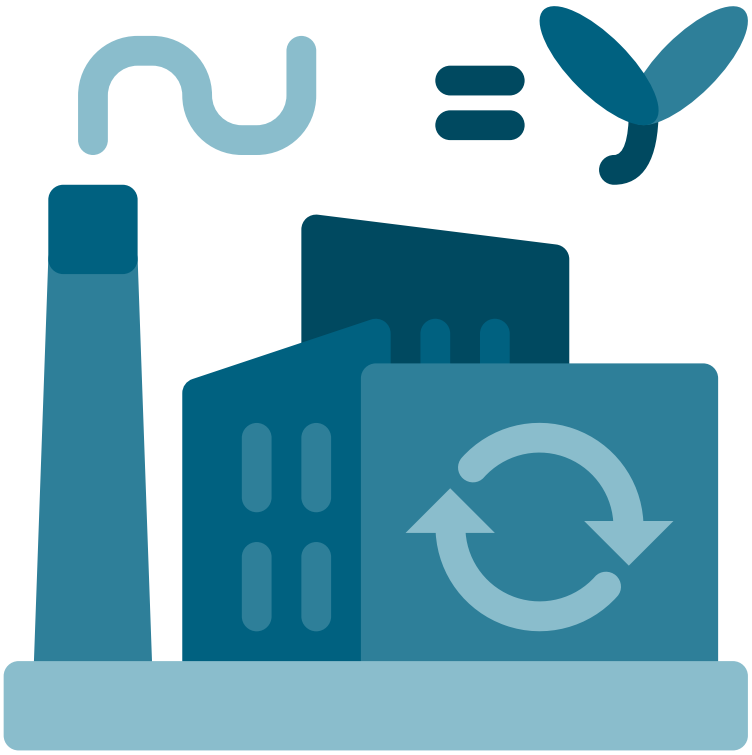
- Increase the proportion of natural gas in the fuel mix: The Ministry of Electricity, in cooperation and coordination with the Iraqi Ministry of Oil, was able to raise the percentage of dependence on natural gas in the fuel mix in the Iraqi electricity sector from (30%) in 2015 to (50%) in 2019 and to (63%) by 2021

- Raising the efficiency of the gas generation units: The Ministry signed with an international company to implement (40) air cooling systems, which amounted to 772 megawatts.

- Increasing the proportion of renewable energies in the energy mix: It has been planned to move towards using renewable energy projects, as contracts have been made with reputable companies in this field to implement these projects to produce electrical energy using solar cell technologies to reach 12 kilowatts during the year 2023.

Axis Seven

Causes	Pressures	Status	Effects	Response
Air Axis: Governmental and Private Power Stations and Generators	Electricity supply across Iraq is insufficient due to the growing population›s demand. Therefore, they rely on private generators to secure their energy needs.	Air Emissions: Soot Lead Sulfur dioxide Nitrogen monoxide Carbon monoxide Hydrocarbon Particles	Photochemical reactions with the atmosphere produce secondary pollutants, carbon monoxide reacts with hydroxyl radicals in the atmosphere to produce greenhouse gases, carbon dioxide, and methane. Variety of related health effects	Law No. 27 of 2009 regulates air pollution to protect the environment. Regulation No. 4 of 2012 and Regulation No. 2 of 2018 regarding ambient air quality limits Orientation towards adding a combined cycle system to simple-cycle stations Conversion of liquid fuel production plants to natural gas to reach 63.7% of the total fuel participation rate Solar Energy Investment Opportunities Project
Water Axis: Ministry of Electricity	Wastewater from power plants	Water Axis: Ministry of Electricity Wastewater from power plants Wastewater from different power plants generally contains a range of industrial waste from different sources and of a different nature. Industrial wastewater can contaminate water bodies by contaminating petroleum derivatives such as polycyclic aromatic hydrocarbons.	Increase indiseases such as diarrhea, cholera and typhoid due to pollution of river water used for drinking and irrigation. Water pollution in Iraq also contributes to increased algal growth in water bodies. Changing the physical and chemical properties of the nature of water.	Law No. 25 of 1967, Law No. 2 of 2001, and Law No. 3 of 2012. The Ministry of Electricity to reduce the pressure on water bodies by taking measures 1. Orientation towards a closed cycle system in condensate cooling instead of an open system in modern stations 2. The establishment of gas stations, which reduce water consumption, which represents approximately 60% of the total stations in Iraq compared to thermal plants at 26%, which leads to reducing the percentage of water consumption generated in generation operations, as it represents a project to convert the type of fuel used from liquid to gaseous and this step means the complete preservation of water, as liquid fuel, especially heavy fuel, needs chemical treatments before use and before discharging it to the river, so the problem of water pollution has been solved. Improving the wastewater treatment system and oil separators for thermal plants on an annual basis within the annual rehabilitation program.



MINISTRY OF OIL

- Associated Gas Investment Projects in Oil Fields
- (79) LPG gas filling stations were established in Baghdad and the provinces instead of using gasoline
- Modernizing existing projects by adding advanced production units that are characterized by production efficiency and low gas emissions, or updating some existing units by adding equipment that contributes to reducing gas emissions from them
- Improving petroleum products to ensure cleaner combustion when used by introducing hydrogenation and chemistry and stopping the injection of improvers with a negative environmental impact of gasoline.
- Conducting preventive maintenance work for all units to ensure the safety of the work of the torches and achieve complete combustion to reduce emissions to the lowest possible extent.
- Equipping oil companies with modern environmental laboratories and detection devices for gaseous pollutants to follow up and evaluate the environmental situation continuously
- Completion of a number of projects in the field of renewable energy (solar energy) with a total capacity of (394.35) kW
- Reducing surface water consumption during injection operations through the joint seawater investment project.

MINISTRY OF LABOR AND SOCIAL AFFAIRS

- The Ministry of Labor and Social Affairs/The National Center for Occupational Health and Safety works to protect and improve the internal environment within the various work sites, and due to the interaction between the internal and external environment, the improvement of work sites will necessarily contribute to protecting and improving the environment in general, and the outputs will be sound work sites that do not negatively affect the external environment. The most important measures taken in this area:

- Preparing a draft national policy to promote the reality of occupational health and safety to protect workers and property in addition to protecting the means of production and the environment in a way that contributes to promoting the principle of sustainable development and access to an environment free of pollutants and harmful residues left by factories and all sectors by controlling pollutants within the work environment by adhering to safety standards in it and that the main objective of the policy: Providing a safe and healthy work environment for all economic sectors, preserving the economic resources of the country, especially the human resources, providing a safe and decent work environment, protecting workers from occupational risks represented by occupational diseases, accidents and work injuries, and the commitment of all sectors to apply occupational health and safety requirements and amending the law on occupational health and safety in line with achieving the objectives of the policy and increasing community awareness of the health and preventive aspect and the concepts of occupational health and safety.

- Quality control and quality assurance procedures for laboratories and field tests in the center: A joint program has been working with the Ministry of Health on quality control measures and documented the work with a certificate at the time, and the program is currently suspended since the events of the Corona pandemic, and there is no specific mechanism to resume work currently, and it is hoped that joint programs will be found with the relevant organizations and ministries in the coming years.

- Achieving the largest possible number of field and advisory visits and expanding the geographical area of visits and within the powers of the Center to identify and assess risks, measure pollutants and compare them with the threshold limits set in advance by the International Labor Organization, as well as record the impact of pollutants on the environment, especially the oil sectors and some industrial projects to prepare reports and recommendations for evaluation and corrective measures for the work environment and send them to the concerned authorities for adoption and treatment.

- Conducting professional laboratory tests for workers and withdrawing air samples from the work environment to examine the lead element and suspended particles for the purpose of informing the concerned authorities to find appropriate solutions to reduce the concentration of pollutants in order to preserve the health of workers.

- Mechanism of disposal of laboratory waste: It has been cooperating with the Ministry of Health/Baghdad Health Department/Rusafa/ Pollution Control Division to approve the burning of medical waste in the amount of (30-35 kg) per month in the incinerator of the model center in Bab Al-Moadham, noting that the work of this mechanism was stopped during the Corona pandemic due to the lack of auditors and therefore the lack of medical waste, and work has been resumed again with the approval of the Ministry of Health to destroy medical waste in the incinerators of Al-Rashid Hospital, and work is continuing in this approach for the coming years.

– Green Practices

- The designs of the residential complex project, which was established by the Department of Retirement and Social Security in terms of green spaces, afforestation and materials used in construction that contribute to the protection and improvement of the environment.

- The project of the National Initiative to Support Energy and Reduce Emissions in cooperation with the Ministry of Environment, where the Ministry worked to form a ministerial team from various disciplines and a plan was developed to implement the initiative by supporting afforestation campaigns, the required areas and the quality of the plants to be planted, and an on-site inspection was conducted to convert the Ministry's building into an energy-saving building using solar cells, and the gradual transition to clean and renewable energy by obliging the Procurement Committee to adopt energy-saving lighting and approve economic electrical appliances that carry an efficiency label Energy, in addition to approving the inventory form of buildings and meters.

- The Ministry/Department of Labor and Vocational Training adopts in the training curricula environmental preservation standards such as (Sound Professional Practices Unit for the maintenance of refrigeration and air conditioning devices to preserve the environment and the ozone layer). The training curricula also include training units for occupational safety, in addition to that there are inspection committees in the labor inspection department in the department with joint committees with the Federation of Trade Unions and the National Center for Occupational Health and Safety in field inspection on the decent work environment and security in various projects, in addition to focusing on professions that fall within the context of the concept of green economy and in line with the goals of sustainable development in vocational training programs and loans to support small projects and educate job seekers about this direction.

– In light of the challenges that the country has gone through as a result of the Corona virus crisis and the resulting negative effects on employment opportunities and unemployment rates, our Ministry is working to achieve the first goal of the sustainable development goals by granting soft loans to open small income-generating projects and training job seekers in various training courses and according to the requirements of the labor market, in addition to including the poorest families with social benefits, taking into account the living conditions that society suffers from as a result of the high unemployment rate and environmental conditions such as the pandemic Corona where our Ministry worked to pay a cash grant to the unemployed during the pandemic.

MINISTRY OF EDUCATION

– Implementing and benefiting from the environmental waste recycling program in schools.

– Rationalizing the consumption of electrical energy and moving towards the use of clean energy.

– Rationalization of water consumption.

– Rehabilitation and capacity building for all workers in the environmental aspect, including

technical supervisors, health coordinators and agricultural engineers in the Ministry of Education.

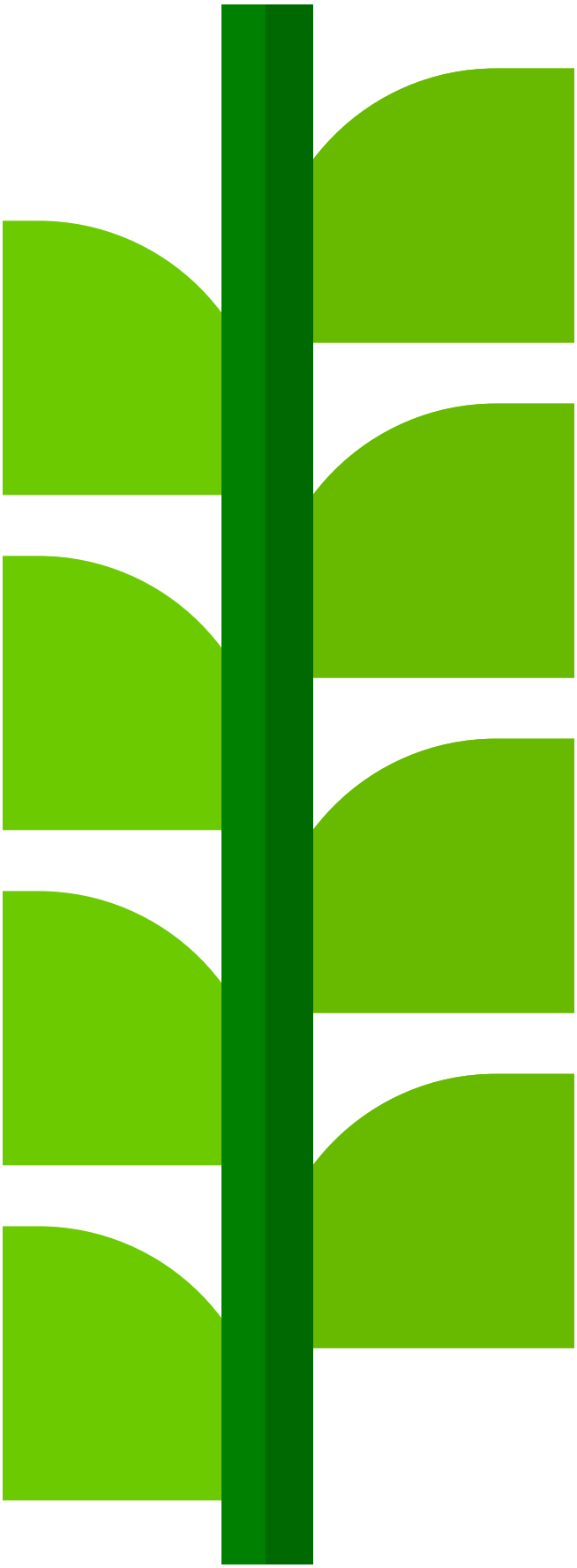
- Preparing feasibility studies to convert buildings into energy-efficient using solar energy.
- Highlighting environmentally friendly studies and research that serve renewable and green energy and benefit from it.
- Adequately include the concepts of the environment into the curricula, whether in terms of scientific content or images, directly and indirectly, in all curricula and for all school stages, as this inclusion is a key educational goals that our Ministry seeks to achieve, especially after the adoption of the Iraqi Constitution (2005) and modern educational philosophy (2008) and the general framework of the Iraqi curricula (2012) as the inclusion of concepts related to it is an indicator of the achievement of the National Strategy for Education (2012). Therefore, the Ministry is working to consolidate them by carrying out educational projects in cooperation with governmental and non-governmental organizations.

MINISTRY OF ENVIRONMENT

- Reviewing and updating water quality laws through the modernization of the river maintenance system No. (25) of 1967 simulates the nature of Iraq's water and its preservation from pollution.
- Monitoring and evaluating the water quality of the Tigris, Euphrates and Diyala rivers by preparing a quarterly report showing the impact of low water levels on water quality using the water quality standard of our ministry (WQI) and submitting it to the attention of the Board of Advisors in the Presidency of the Council of Ministers.
- Preparing a monthly bulletin to assess the water quality of the Tigris, Euphrates and Diyala rivers using the water quality standard of our ministry (WQI) and submitting it to the Prime Minister's Office.
- Inclusion of a program for evaluating the concentrations of heavy elements of the Tigris, Euphrates, Diyala and Shatt al-Arab within the government program.
- Implementation of the Sustainable Land Management Project to improve sustainable livelihoods in degraded areas in Iraq.
- Implementation of the National Program to Combat Sand and Dust Storms in Iraq (2015-2020).
- Preparing the national report of Iraq on the precautionary measures and emergency plans taken by the ministries of the Iraqi government for the purpose of reducing the damage caused by natural and man-made disasters for the year (2020).
- Preparing the national report on the precautionary measures and plans taken by the Ministry of Environment and ministries in combating the Corona pandemic.
- Work is ongoing to calculate the losses and damages resulting from disasters annually.
- Establishing an annual database on air pollutants from all sources of pollution, with a plan to ensure comprehensive coverage and periodic monitoring of ambient air quality in all governorates.
- Forming a ministerial committee to review the instructions currently in force in line with the development in the number of towers and modern systems, with periodic examinations to monitor the work of these towers, take the necessary measurements in Baghdad and the provinces, compare the results with the determinants currently in force, and prepare an environmental reality report.
- Monitoring noise pollution and continuing work on issuing instructions to implement the Iraqi Noise Control Law No. (41) of 2015 in cooperation with the relevant authorities, with the continuation of action plans for monitoring noise pollution levels to identify the causative sources, as well as the rehabilitation and modernization of the monitoring system to ensure the largest possible coverage in Baghdad and the provinces.
- Continuous monitoring by the supervisory teams in the Ministry of Environment by conducting field inspections and imposing legal measures (warning, fine, closure) against projects that violate environmental determinants until the violation is removed.

MINISTRY OF HIGHER EDUCATION AND SCIENTIFIC RESEARCH

- Carrying out research for environmentally friendly projects in the field of solar energy and green buildings.
- Implementation of a volunteering campaign to plant the vicinity of Al-Mustansiriya University with good varieties of palms, amounting to 225 seedlings.
- Increasing the area of vegetation cover by implementing afforestation campaigns to plant trees of different types in university sites.
- Conversion of lighting in many universities to environmentally friendly lamps (LED).
- Implementation of waste sorting in many scientific departments in colleges.
- Expanding the use of solar energy within many colleges and replacing electric water heaters with solar energy.
- Introducing the curricula of emerging energies within the teaching curricula of students.
- Work is continuing to implement the project of planting one million trees in higher education institutions.
- The use of drip or sprinkler irrigation systems inside to irrigate green spaces.
- Wastewater treatment and reuse on campus.



CHAPTER FIVE:

GAP ANALYSIS AND RECOMMENDATIONS

5

GAP ANALYSIS AND RECOMMENDATIONS

1. The environment and its natural resources face many challenges and pressures due to the irrational use of these resources and as a result of the abnormal conditions experienced by Iraq, as well as the implementation of development plans in all sectors without paying attention to the environment or introducing environmental considerations when planning or implementing various development projects, and in general, environmental pressures are associated with a set of driving factors, which are formed from a set of natural or human influences that directly or indirectly cause a change in the environmental system. Direct drivers also affect environmental processes, including climate change, pollution, land changes and overexploitation of resources, while indirect factors include demographic, economic, social, political, technical, and cultural factors.

2. The process of drawing a clear picture of the challenges and pressures suffered by the Iraqi environment depends on the accuracy and continuity of access to data related to environmental issues, and as a result of the lack of a central environmental database, the dispersion of environmental information and data is noticed, and this requires raising interest in environmental statistics and increasing monitoring and control centers, which must be under the auspices of the Iraqi Ministry of Environment as the supervisory authority in this field.

3. After the establishment of the Ministry of Environment to assume leadership of environmental legislation, which is a serious and basic step and a major development for the purpose of transforming the traditional view that was prevailing in the circles of environmental work in Iraq, as environmental work turned into an institutional work with a more comprehensive view, as there became a Ministry specialized in implementing the legal provisions related to environmental protection in its various fields. It is worth noting that the Ministry of Environment, during its work for previous years, has prepared many programs, projects and strategies with national effort or international support, so future work to prepare a strategy to protect and improve the environment in Iraq must be in line with the outputs of these programs or projects and the strategies implemented or future ones, for example, but not limited to the need to harmonize with Iraq's Vision 2030, which is a comprehensive framework for the development process in Iraq associated with achieving sustainable development goals, and working to create a sustainable environment in harmony with the National Development Plan for the years 2018-2022, which is the most important step in the sustainable development journey in Iraq towards a future in which it aspires to be an advanced country at the economic, political, cultural, social and environmental levels. The same applies to aligning with the requirements of the international community to confront climate change, which resulted in Iraq's submission of its Nationally Determined Contributions in October 2021 to the United Nations Framework Convention on Climate Change (UNFCCC) and a pledge to reduce greenhouse gases by 17% (up to 2% by 2030 unconditional and 15% by 2035 conditionally).

4. In view of the importance of Iraq and its natural resources, it is necessary for the Iraqi Ministry of Environment to give the utmost focus to building and developing the environmental work strategy to be a guide for all stakeholders, whether in the public and private sectors or civil society organizations, which aims to address the basic problems facing the environment in Iraq during the next five years, and that the preparation of the strategy is within the limits of determining the basic programs to address environmental problems and leave it to stakeholders from the various government sectors or the private sector, community organizations, and civil society in the implementation of projects compatible with these programs.

5. Surface water is the main resource in Iraq and consists of the water of the Tigris and Euphrates rivers and their tributaries and the Shatt al-Arab, and there has been a significant decrease in water resources due to dams and irrigation and development projects that were established on these rivers in neighboring countries to secure their water shares and use them in irrigation or hydroelectric power generation, which affected Iraq's water share in quantity and quality. The

effects of climate change have also caused a decrease in the quantities of water received into its rivers, and it is clear that the quantities of water used or needed by various human activities in Iraq are much greater than the quantities of water received from rivers, the main source of water in Iraq, and thus the water sector in Iraq is one of the most vulnerable sectors in the face of climate change.

6. The storage levels achieved in dams and lakes (reservoirs) on 1/10/2020 compared to the same date for the year 2019 were 50.47 billion m3 for the year 2019 and 44.60 for the year 2020, which means on the one hand that the increase in the amount of water used compared to the amount of water received may have already been covered from the reservoirs' water. However, it is also noticeable from the above figures that the quantities of water stored amount to more than half of the quantities of water received for the two years in question, which may mean the need to review the data.

7. The bulk of the water used is withdrawn from the agricultural production sector, up to 85% of the uses of all other sectors. It is necessary here to focus on the use of modern technologies in agriculture or water distribution systems for agricultural uses, with the importance of applying efficient programs to rationalize the use of water in the agricultural sector that consumes the most water resources, with the importance of meeting food security priorities, as well as reducing the percentage of surface or groundwater use in agriculture and compensating for the shortage of alternative non-conventional water sources.

8. It is necessary to apply an integrated water resources management approach at the level of the State of Iraq by targeting estuaries, watersheds and main water harvesting sites in Iraq.

9. The distribution of water use by governorate indicates that the share of Nineveh governorate is the lowest, reaching 1.7% of the total water used in Iraq. Wasit governorate has the highest share at 15.6 percent, meaning that Wasit uses water almost 15 times that of Nineveh, despite its population being almost half that of Nineveh and its area smaller. This example calls for knowing the reason for the differences between governorates in the quantities of water used and addressing this if necessary in the strategy.

10. Although the amount of water supplied for domestic use does not constitute a large percentage of the total water use in Iraq, data from 2020 indicate that the percentage of water loss is 20% during transportation in the water distribution network, which requires measures to reduce the quantities lost.

11. Statistics of water quantity and quality indicators, especially with regard to drinking water services, indicate an increase in the number of potable water production stations with an increase in the quantity of drinking water and domestic use produced compared to 2017 and 2020 by 6.8% and 14.5%, respectively, but no increase was recorded in the percentage of the population served by potable water networks, and this may be due to the increase in the population growth rate, which led to no increase in the percentage of the population served despite the increase in the number of stations, which requires this to be taken into account when planning. Noting that one of the most important problems of not rationalizing water consumption is due to the weak awareness among citizens, as indicated in the reports issued by the relevant authorities.

12. Although the water used for drinking and domestic use constitutes only a small percentage of the pressures on river water resources, it is very important to reduce water waste resulting from lack of awareness, lack of control, weak activation of laws and quantities of water lost when transporting in networks, as water scarcity will pose a major challenge in light of population increase and economic, industrial and service growth facilities, which will constitute an added environmental pressure on the quantity and quality of water in the aquatic bodies and its ecosystems and biodiversity.

13. According to the drinking water quality reports recorded in the governorates for the years 2017 and 2021, drinking water purification projects in the governorates of Nineveh and Salah al-Din recorded the highest acceptable rate in the examination of turbidity, salt concentration, bacteriological examination and residual chlorine at 100% during 2017 and 2021. While drinking water purification projects in Dhi Qar governorate recorded the lowest acceptable rate in the examination of turbidity, at 20% and 4.07% during 2017 and 2021. While drinking

water purification projects in Basra governorate recorded the lowest acceptable percentage in testing the concentration of salts, at 11.08% and 15.25% during 2017 and 2021, respectively. These data are very worrying and when formulating the strategy, priority solutions for these areas must be developed based on these data, whether solutions related to human health as an essential part of ecosystems or the health of other components of these systems.

14. Most human settlements in Iraq lack basic sanitation systems and 61% of the villagers use areas close to their homes for sanitation directly, and since more than a third of villages use water directly from the river or swamps without treatment, the current sanitation situation raises serious public health concerns as outbreaks of waterborne diseases are frequent and the provision of wastewater treatment services is crucial. This risk is compounded by data indicating that most hospitals and factories dump their waste directly and without treatment into rivers.

15. The figures indicate a very high pressure on water resources because to draw so much river water for various uses and then pollute the small amount of water that remains simply means that not enough healthy water is left for humans, aquatic organisms and healthy aquatic ecosystems.

16. The enormous magnitude of the pressures on the water sector as an essential part of the environment can be easily generalized to the magnitude of the pressures exerted on other parts of the Iraqi environment, such as pressures on air quality, biodiversity, forests, natural rangelands, agricultural lands, and added pressures arising from climate change. This requires the National Environment Strategy to develop radical, realistic and applicable solutions based on priorities determined by the data contained in this report, whose main function is to provide the necessary information for the strategy.

17. It is of the utmost importance that these priorities be aligned with other national strategies and plans, both those related to development and those related to the environment, pollution, biodiversity, adaptation and mitigation of the effects of climate change. This requires great and continuous work at the national and local levels and a continuous mechanism to follow up the development of these data and the mechanism to follow up the implementation of the strategy over the next five years.

18. The continued overuse of land, water and natural resources without taking appropriate measures resulted in a decrease in plants, which constitute an important element of the biological cycle of the soil, which in turn maintains and improves the physical properties of the soil against erosion and desertification factors, and this was helped by the prevailing hot and dry weather conditions, which are accompanied by dry winds in the summer and the absence of rain, in addition to the presence of sandy desert on the edges of the sedimentary plain, so it is necessary to encourage agro-ecological practices that increase the amount of organic matter in the soil (organic carbon stock).

19. Strengthening soil quality monitoring programs to build a database on land quality and determine the suitability of land for various human uses, with the importance of protecting and restoring pastoral areas to ensure the protection of plant biodiversity and achieve food security.

20. The failure to take the necessary measures, enact regulations and legislation, reorganize the use of land, water and natural resources, prevent harmful practices that put pressure on environmental components such as overgrazing, logging, hunting wild animals and rationing irrigation to stop this harmful encroachment of millions of tons of quicksand, which in turn has led to an increase in the area of desertified land or lands threatened by desertification.

21. Iraq is facing a serious desertification problem, which has been represented by an increase in the areas of land affected by salinity, the significant deterioration that has occurred in vegetation cover, and the increase in areas covered by moving sand dunes that came as a result of land degradation and wind erosion. Although Iraq is known for its water resources, the desert covers a large percentage of its area, while the phenomenon of desertification is now besieging non-desert lands, as it threatens the fertility of its land and reduces its productivity, and creeps rapidly towards the green fertility line west of the Euphrates, and puts great pressure on the rural population and forces them to leave their villages and places of origin.

22. There is an actual need to preserve forest areas and natural pastures, which constitute an estimated 4% and 9.2% respectively of land use

in Iraq, where forests are one of the indicators of the abundance of vegetation cover, as the total area of forests in 2017 and 2020 is estimated at 5.4 and 2.8 million dunums, respectively, a decrease of 48%, which is a serious decrease of up to half within a short period of 4 years, which requires the development of quick and effective solutions.

23. The population of Iraq for the year 2020 has reached (40,150,174) million people compared to 2021, where it reached (41,190,658) million people, with a growth rate of 2.59%, so the rate of increase in the population must be taken into account with the percentage of need for services and the amount of pressure on the Iraqi environment that all of this poses, provided that this is done in the context of indicators of climate change, biodiversity, cultural heritage and ecosystem services and in coordination with the relevant national plans and strategies, as well as the need to take into account the proportions of urban and rural population and the population of each governorate when drawing up plans and health, educational services and other activities and linking this with the pressures that the environment suffers from in each governorate currently with the expected pressures on population growth and the associated growth in services, as this contributes to setting clear and implementable priorities and goals according to the region.

24. One of the important indicators is the clear rise in temperature rates and the frequency of dust storms with a decrease in relative humidity rates and rainfall during the past years, and therefore when preparing the national strategy for the protection and improvement of the environment, it is necessary to work according to the plans approved by the Climate Change Center at the Ministry of Environment and the Center to Combat Desertification in the Ministry of Agriculture to develop solutions related to adaptation and mitigation of the effects of these changes for the next five years.

25. One of the most important outputs that can be deduced from the preparation of the basic state of the environment report, which can be adopted to build the national strategy for the protection and improvement of the environment in the Republic of Iraq, is the need to focus on five main programs distributed to all targeted sectors, the most important of which are:

Environmental Protection, Improvement and Sustainability Program

- The climate change program through hard and continuous work to reduce greenhouse gas emissions and to contribute to reducing climate change, mitigating its effects, increasing immunity and adaptability to its negative effects.

- The good governance program, which is based on providing clear and rational governance capable of managing the environmental file, contributes positively to the integration of environmental considerations into the initial planning stages of the proposed projects, works to influence the relevant policies and strengthen the legislative framework to ensure that the needs of the strategy are met.

- The Networking and Partnerships Program, which aims to strengthen and ensure the ability of the Ministry of Environment to coordinate with a wide range of relevant sectors and institutions to achieve national priorities and international commitments including relevant sustainable development goals and environmental agreements, and to develop sustainable communication channels at the national, local and international levels.

- A program to spread environmental culture to ensure the promotion and raising of the level of knowledge and technology among all societal sectors and at various levels of the importance of the environment and its preservation and its direct link to public health, animal health, plants, and food.

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