



# Converting Climate Change Threats in Iraq to Opportunities: A Guide to the Green Paper

A common threat provides the basis for a common reaction that would, by its nature, allow for codependency and cooperation instead of continued competition for regional hegemony.

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Sulaymaniyah, Iraq, Pak city, Block A2, Ap. No. 8.

Telephone: +964 53 322 33 65; Website: [www.natureiraq.org](http://www.natureiraq.org)

This publication is produced by a core team of Nature Iraq led by Dr. Azzam Alwash (Lead Author) and Abdullah Rajeeb Al-Khafajy (Co-Author).

Nature Iraq is an Iraqi non-governmental organization registered in Iraq, accredited to the United Nations Environment Programme (UNEP) and Iraq's first and only Affiliate to BirdLife International. We work to protect, restore, and preserve Iraq's natural environment and the rich cultural heritage it nourishes.

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# Table of contents

About us .....	5
Introduction .....	6
The Programs .....	10
1. The “Garden of Eden” reforestation program .....	11
2. The “Green Parks” program .....	17
3. The “Cleansing of the Rivers” sewage program .....	19
4. The “Twin Rivers/Rafidain” water-management program .....	21
5. Smart Growing Beds .....	24
6. The Shatt Al Arab Grand Barrage ....	26
7. The Vintage Building program .....	28
8. Waste-to-Energy (W2E) program .....	30
9. Gas Capture program .....	31
10. Green Energy program .....	32
11. National Carbon Trading Platform ...	34
A Regional Framework .....	35
Closure .....	43



# About Us

Nature Iraq is an Iraqi non-governmental organization registered in Iraq, accredited to the United Nations Environment Programme (UNEP) and Iraq's first and only Affiliate to Birdlife International, and the only Middle Eastern member of the Waterkeeper Alliance.

## The Message

Inspired by a love of nature and a desire to see a secure, healthy, and socio-economically viable future for Iraq, we at Nature Iraq work together, determining and monitoring the current state of Iraq's environment. As this information is analyzed, we compile and install various sustainable projects that we hope will ensure the protection, restoration, and preservation of Iraq's natural environment and the rich cultural heritage it nourishes.

## The Community

Our staff comprises a diverse group of extraordinarily dedicated and deeply concerned scientists, birding photographers, environmentalists, administrators, interpreters and translators, logistics experts, IT and communication specialists, and a few "experts in general." Our in-house staff members represent numerous sects and segments of Iraqi society, including a few Iraqi expats. Our staff is augmented by hundreds of international and Iraqi consultants who work behind the scenes.



# Introduction



# Preface

Climate change is manifested in a plethora of ways in Iraq and the region:

- The rising frequency and severity of dust storms.
- Temperatures are increasing in Iraq and the region (3 to 5 degrees Celsius compared to the 1960s).
- Snowfall and rainfall patterns are changing temporally, which is being exasperated by dam building, rerouting of rivers, and uncoordinated management of the limited water resources both inside Iraq and regionally.
- Dam building on the headwaters of our twin rivers has reduced the amount of water reaching Iraq, adversely affecting agricultural production, given the reduced flow in Shatt Al-Arab.
- The salt wedge of the Gulf is migrating up the southern portion of Iraq, causing salinization of the lands on both sides of Shat Alarab and causing Basrah to suffer from a lack of drinking water.
- The degradation of biodiversity and vital ecosystems.

The Iraqi Ministry of Water Resources estimates that the country will face a shortfall of 10.8 billion cubic meters of water by 2035 if no action is taken to modernize irrigation. For thousands of years, irrigated agriculture was sustainable because floods washed away the salts formed from evaporation and provided a layer of silt and clay that renewed the farmlands' vitality every year. As a result of dam construction upstream, there are no longer any floods that historically sustained irrigated agriculture; consequently, 54% of our country faces severe land degradation, while 39% of it is suffering from desertification.

Iraq is among the most at risk from climate change impact; according to the UN Environment Program, Iraq is the 5th most vulnerable globally to decreased water and food availability and extreme temperatures. These factors pose a long-term threat to the living conditions of millions of Iraqis, the economy's long-term sustainability, and Iraq's national security. This vulnerability is also based on the fact that Iraq has lost its traditional economic basis of farming and trade and has become addicted to income from oil exporting activities. This stream of income is destined to be reduced as the world shifts its energy source from fossil fuels to sustainable energy sources.

Most of the countries in the region have developed a sovereignty fund that is to be used to convert the local economy to service future generations. Iraq has been engaged in devastating wars, sanctions, and twenty years of instability. This is further complicated by a rapid increase in population numbers and a complete dependence of Iraqis on government jobs that produce little added value to the state economy. Employment is a disguised unemployment and is nothing more than a way for the government to redistribute the oil income through patronage. What remains of the surpluses are wasted by corruption and useless white elephant projects.

The effects of climate change are compounded by the lack of urgent action on the part of Iraqi policymakers and the continuation of wasteful practices that assume water availability is unlimited and energy and resource conservation are unnecessary.

**Addressing climate change must become a national priority for Iraq.**

The Mesopotamian Revitalization Initiative published by the Iraqi Presidency in September 2021 was reviewed and approved in principle by the ministerial council as the basis for developing a Green Paper that would guide the governmental action plan to prepare Iraq for the economic changes that will take place around the world, and to adapt and mitigate climate change, both in Iraq and in the region. Due to the political impasse, little has been done in the form of coordinated action since November 2021. Some of the projects have been initiated by some of the ministries (namely the ministry of oil), but no real action has been taken to write the Green Paper.

The bulk of the project concepts in the initiative call for political decisions, government activities, and even cross-border collaboration, which is a preview of politics and political leadership. This booklet is NOT an attempt to draft the green paper. Instead, it is an effort to elaborate on some of the projects mentioned in the initiative and demonstrate how the private sector, supported by government policy and foreign investors, can take the projects and implement them inside Iraq while laying the foundation for cross-border cooperation and the expansion of the projects WHEN the political will exists.

# Vision For Change

The Mesopotamia Revitalization Initiative is based on eleven substantive schemes to bring about real change. It is designed to align and reinforce the Iraqi government's broader climate goals, underscore and strengthen its commitment to the Paris Agreement, and offer regional solutions for common climate-related challenges.

To be successful, we will need a national effort. The Mesopotamia Revitalization Project will require the collaboration of the following stakeholders:

- The Parliament of Iraq to set the laws needed.
- The executive branch led by the Prime Minister and the cabinet; it will necessitate the empowerment of all relevant ministries to design and implement a series of policies and laws; it will demand the establishment of new, specialized institutions tasked with specifically addressing climate change related issues; and it will combine state spending with funding from Green funds, private capital markets, and international donors to finance the massive new investment envisaged.
- The private and NGO sectors shall take advantage of the ideas presented in the initiative.

This booklet provides a road plan (one of many, obviously) with as much detail as possible to start educating the public about the existential threats of climate change and to prove hope and practical steps that, if undertaken, can transform the threat into an opportunity for the private sector to develop a supportive green economy.

# Mesopotamia Revitalization Project The 11 Programs



# 1. The “Garden of Eden” reforestation program

Iraq has seen its 36 to 38 million palm trees that existed in the 1970s reduced to some 12 million palm trees due to war, neglect, and outright destruction by the former regime. The forests of Kurdistan also were partially denuded over the past 40 years, as the sanctions caused many villagers to resort to using trees for firewood.

As such, Iraq has huge potential to restore and expand its palm and forest biosphere. This initiative would provide an effective way of

- Capturing and harvesting greenhouse gas (GHG) emissions.
- Stabilizing the soil.
- Decreasing salinization and desertification.
- Contributing directly and indirectly to bolstering the Iraqi economy, especially in the crucial agricultural sector, by creating new jobs and providing a springboard for industrial expansion.

The plan can convert the trees planted into carbon credits that Iraq can sell on the voluntary carbon market.\*

As a centerpiece of the Mesopotamia Revitalization Project, the plan proposes that Iraq begin an immediate national effort to replant forests in southern and western Iraq (palm and citrus) and in Kurdistan (local species such as Kurdish oaks and walnuts). The initial goal would be to plant 20-30 million palm trees within two years, restoring previous losses. In the longer term, the program aims to plant 1 billion trees across Iraq by 2030 and regularly replenish saplings to replace interim losses. If we can exceed the 1-billion target, we will not only be replacing what we lost in the past decades but also create the infrastructure to generate agricultural products such as dates, citrus, and vegetables through the use of the shaded lands below the planted trees. This agricultural production can be converted into an industrial food production base that will reclaim Iraq's traditional position as the region's bread basket.

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\* A popular term for a trading system through which countries may buy or sell units of greenhouse-gas emissions in an effort to meet their national limits on emissions, either under the Kyoto Protocol or under other agreements, such as that among member states of the European Union. The term comes from the fact that carbon dioxide is the predominant greenhouse gas, and other gases are measured in units called "carbon-dioxide equivalents. ([UNFCCC, \[n.d.\], Glossary](#))

To succeed in the forestation effort, we need to create the infrastructure needed to generate the seedlings, grow the saplings, make cocoon pots<sup>\*</sup>, identify proper areas where there are no agricultural contracts and suitable groundwater close to the surface of the ground, establish an administrative structure that preserves and protects the rights of the developers of the forested areas, devise a watering system for areas needing irrigation, and create a credit system and the incentives for the young entrepreneurial Iraqis to take this program from an idea to an industry.

Following is a description of the steps needed;

**Generating the seedlings:** This is not a trivial issue given that the desired species of dates have traditionally been generated through the plantings of shoots transplanted from a productive palm tree to assure that the mature tree will be producing desired and valuable dates. To accelerate the production of shoots of desired qualities, scientists have been using tissue culture to generate seedlings quickly and in large enough quantities from the growth cells of desired plant materials. The problem with planting transplanted shoots and tissue culture-created shoots is that the genetic materials of the resulting date palm farms are limited (essentially, the entire farm will be sisters), which will result in little resistance to diseases. Similarly, Kurdish Oaks and Walnuts generated from tissue culture have limited variation in genetic materials.

We would like to suggest a less expensive approach to creating the seedlings that can be used to reach the billion trees goal while assuring a proper genetic variation that allows the planted trees to continue to exist even if there is a massive attack by bacteria or plant disease. This method is intended as a supporting and accelerated way to the traditional techniques and the new scientific methods rather than a replacement. This is especially important as the primary goal of the forestation effort is to take advantage of the carbon credits to stabilize soils, stop desertification, and create a shaded area for the more lucrative production of vegetables and citrus products.

Given that our intention is mainly to sequester carbon and not to simply produce dates, oaks, walnuts, etc., we suggest encouraging the creation of seedlings from ordinary pits of palm trees or walnuts and oak seeds. We intend to augment the genetic materials through palm date pits from the UAE, Oman, Jordan, SA, California, Morocco, etc. We can also import Kurdish oak and walnut seeds from Iran and Turkey. To educate and spread the ideas quickly, we will create videos on youtube in Arabic showing how to convert the seeds into seedlings, plant them in small fertile soil pots, and take care of them until they reach an age where they can be planted out in the open.

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\* A donut-shaped water container made from recycled cartons with a hole in its center for a seedling, covered by a lid to reduce water evaporation, forming an ideal environment for a plant nursery. ([Better Life co.](#))

The seedlings can be created in the tens of millions and be ready in one to two years through the participation of a few individuals. The following link (<https://www.wikihow.com/Plant-Date-Seeds>) shows the steps in a written format. Still, we should ensure that the materials are available in verbal and visual formats as a large percentage of farmers and young generation Iraqis do not know how to read and write. Further, we need to replace the pots shown with modified recycled plastic bottle containers (2 liters or 1-1/2 liter size and discarded/used yogurt containers that can be salvaged from plastic materials currently being discarded and is adding to the incredible amount of trash that is being generated in Iraq. As stated above, we can argue the seedlings created by entrepreneurs from palm, walnut, and oak seeds with seedlings grown using tissue culture to create the genetic variety and ensure a reasonable minimum product from good quality palm dates.

The creation of the seedlings can become a cottage industry for entrepreneurs to create nurseries that would magnify the generation of seedlings with very little investment beyond their own time (sweat equity), and they can sell their products to those who do not want to spend a year or two growing seedlings into saplings. Each group of five or so young people can probably create 5000 saplings a week for a total of 20,000 saplings a month. Hence to plant a million saplings a month, we will need about 50 small groups of young individuals, and if we are to upscale to 10 million saplings a month, we will need 500 groups, and 100 million a month is going to need 5,000 groups. Spread all over Iraq, producing continuously. This equates to 25,000 to 30,000 jobs and tons of plastic containers recycled.

Forestation without irrigation: Given that the water resources of Iraq are increasingly limited given climate change, dams outside the country, and slow modernization of the irrigation of existing parcels of farmland, we need to make sure that we do not add additional load demand on the surface water by creating additional demand for irrigating forested areas. We suggest the use of cocoon planters ([https://www.youtube.com/watch?v=ZGG6O\\_NmQgM](https://www.youtube.com/watch?v=ZGG6O_NmQgM)) which are made of recycled paper pulp to allow the planting of saplings about half a meter deep with a reservoir of water that would enable the saplings to live but stress the saplings enough to allow the natural programming of the DNA to push the rootlets down to find the saturated vadose zone above the shallow groundwater. In the subsequent sections, we will discuss how the lands where shallow groundwater can be readily reached.

Creating cocoon planters is another opportunity for entrepreneurs to start a recycling business where the raw materials are discarded paper and cartoons that currently fill the streets and the dumps and are mostly burned! These raw materials can be shredded using hand-cranked, manually operated shredders (<https://www.youtube.com/watch?v=ohLYdtIULEU>) and solar water heaters ([https://www.youtube.com/watch?v=nC\\_Ql5qVs4Q](https://www.youtube.com/watch?v=nC_Ql5qVs4Q)) to convert the shredded paper into a pulp as well as hand-cranked mixers and centrifuges to make the paper pulp into a paste that can then be used as molds to create cocoon planters. These planters will be used to plant saplings and keep them alive for a year to a year and a half, where they can then decompose, creating a trough around the root of the tree that can be used later to enhance the production of the fruits through the use of plastic bottle irrigation (cheap method to create drip irrigation systems during the growth of the dates to maturity).

It should be noted that a prime source of water that can be tapped into is naturally treated sewage water. Iraq currently dumps about 5 million cubic meters of sewage water a day into the Tigris and Euphrates. This is a source of water that can be reused for irrigation instead of being dumped into the rivers as a single source of pollution that periodically overwhelms the fish population through depletion of oxygen in hot summer months when the flow of water is reduced. A subsequent section will describe how to create areas for sewage to be treated naturally and recycle the water for irrigation in a community farming area.

Selecting suitable acreage to plant: Over 5,000,000 Hectares (World Bank, 2020) of hectares of arable farmland can be used to plant trees. However, we must keep in mind that there is limited water availability in Iraq. As such, we need to identify areas with proper conditions to grow trees close to the natural conditions. Trees in the wild grow without irrigation. This usually happens through the roots of the trees growing into the vadose zone (the saturated zone between the ground surface and the groundwater table). This zone's thickness depends on the grain size of the soils and is generally thicker the more clayey the soils are. The sedimentary plane of middle Iraq is essentially comprised of clays and silts. As such, the zone is rather thick and allows for planting palm trees with ease, provided that the saplings are stressed enough so that the rootlets will push deeper at a young age to find the vadose zone.

There are modern techniques that can use Satellite images in various bands that can be used to easily identify the appropriate areas in Iraq suitable for planting tree saplings without the need for irrigation augmentation. The Satellite imagery can be used with groundwater well data currently in existence with the ministry of water resources and drone data to further refine the maps. These maps can be further enhanced by adding a GIS layer that includes data from the ministry of agriculture showing where there are existing contracts to use the lands for agricultural production. These lands can then be divided into 5 hectares of farm plots that can be assigned to those young Iraqis willing to participate in the forestation program.

It goes without saying that if there is funding, modern irrigation techniques can be mobilized. However, that requires a direct investment of the Iraqi government into this program. The above steps are envisioned with minimal interference and dependence on government sources due to the natural swinging of the oil income and the increased demands on the infrastructure of the Iraqi state, which does not have the bandwidth to have yet another demand put on the limited sources.

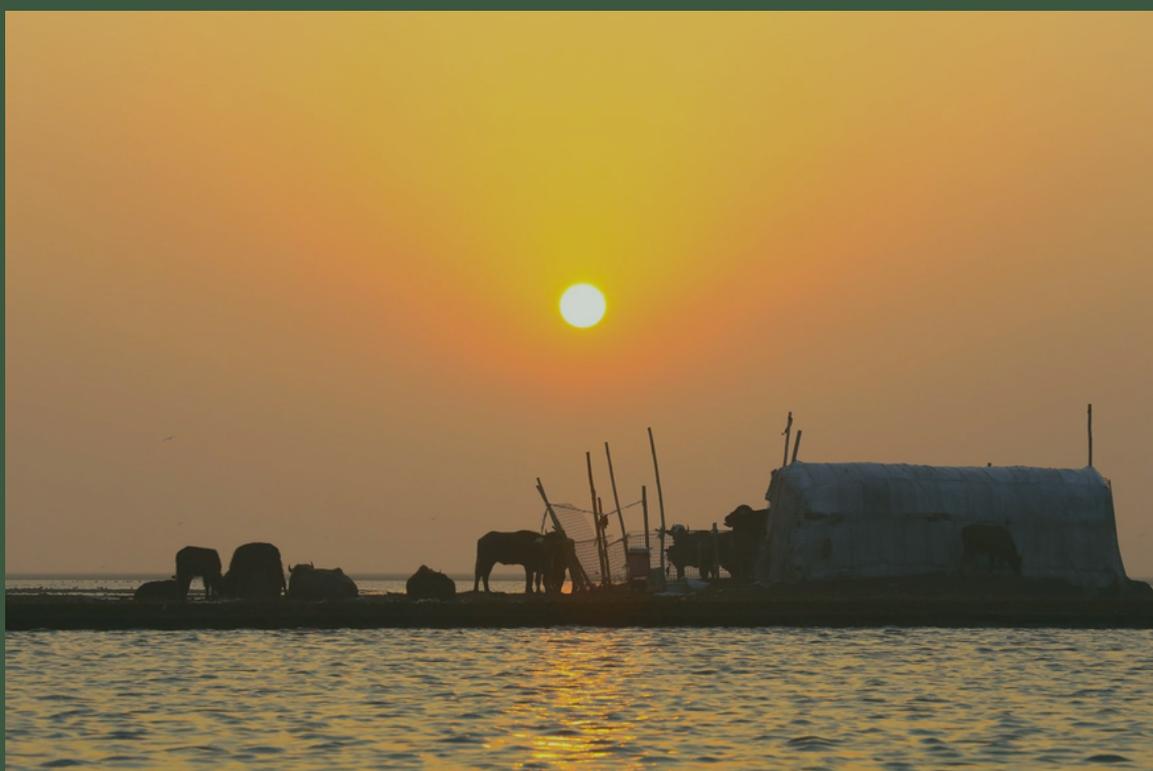
Selling the accumulated carbon credit: Each date palm tree can create about two tonnes of sequestered carbon credit which sells today at the voluntary market for about 50 to 60 dollars per ton. With 125 palm trees per hectare, a credit of about 10,000 dollars per hectare can be generated every 5 to 7 years (the assumption embedded is that the male and undesirable palms will be harvested), provided the tree is not burned but instead turned into soils through natural decomposing methods or low energy shredders (PV operated that do not generate CO<sub>2</sub>). Additional credits can be accrued if the trimmed fronds are verifiably turned into soil or products. There is a need to create a system for measuring, verifying, and auditing the carbon credits trusted by the carbon market to sell the credit. Indeed, this credit can be used by the banking system in Iraq as collateral to lend operating capital for young entrepreneurs to start their farms.

The space between the palm trees can be used to plant citrus trees as farmers of the past used to, as the date palms will provide the needed shade during the summer and the warmth and shelter from freezing temperatures during the winter. Beehives will be required to bring pollinators for the date palms and the citrus trees. More space available can be used to install and operate smart agricultural growing beds that can provide household vegetables and protein for the families taking care of the farms. A subsequent section will introduce detailed plans on how to build a smart agricultural growing bed that limits evaporation to plant leaves and stems and thus saves 90 percent of the water currently lost due to evaporation from the soil surface.

The reforestation program will have direct benefits beyond Iraq. The program should be integrated with regional initiatives, such as the 50-billion-tree project announced by Saudi Arabia and the UAE. Iraq's tissue-culture research and sapling production can also be combined with those efforts. While it can be funded through carbon sequestration schemes as part of the mitigation measures, it further strengthens the climate adaptation front, as the benefits derived from stabilizing soil with vegetation will contribute to a decrease in regional dust storms and other climate phenomena at home and in neighboring states.

Funding for the Garden of Eden program will come from a mixture of state revenue, international donors, regional and international investors, and green funds. As a first step, Iraq should work with the World Bank and UN agencies to complete and fund a comprehensive technical planning, programming, and financing strategy to underpin the reforestation program.

We must also promulgate legislation to create a special fund to issue loans to farmers participating in this project. The fund needs to be seeded by government money, combined with annual contributions from international oil and gas companies as part of their social responsibility initiatives. Further, a legal framework is needed to take advantage of ordinary farmers' carbon credits without government red tape interference.



## 2. The “Green Parks” program

A national (green) park is an area set aside by a national government to preserve the natural environment. A national park may be set aside for purposes of public recreation and enjoyment or because of its historical, environmental, or scientific interest. Most of the landscapes and their accompanying plants and animals in a national park are kept in their natural state.<sup>1</sup>

The United States, for example, has 63 national parks, which are congressionally designated protected areas operated by the National Park Service, an agency of the Department of the Interior. National parks are designated for their natural beauty, unique geological features, diverse ecosystems, and recreational opportunities, where hunting and extractive activities are prohibited by law.<sup>2</sup>

The “Green Parks” program will augment the reforestation program by preserving natural areas around Iraq. “The Key Biodiversity Areas of Iraq” book has identified over 80 sites of importance from the point of view of flora and fauna. Each of these sites is worthy of being considered for designation as a National Park. These sites should be managed as an endowment for future generations of Iraqis, especially since a majority of park areas in various areas in Baghdad and the provinces are being converted to malls and commercial projects by “investors” with the aid of government institutes. The conversion of the key biodiversity areas to national parks will help comply with Iraq’s international obligations, such as the UN’s COP15 Biodiversity Conference (December 2022, Quebec) and the Convention on International Trade in Endangered Species (CITES), to preserve natural sites.

Further, there is a need to preserve the green park areas in Baghdad and other large cities in Iraq. As a first step, this project proposes that Baghdad Municipality and associated government agencies designate a new Central Park for Baghdad, which will link the old Muthana Airport, the adjacent Zawra Park, and the Washash Army barracks. Beyond the benefits of air standards in Baghdad, it will provide a place where families can enjoy nature and as a refuge for birds and wildlife. This idea must be legislated expeditiously as the green areas of Muthana airport land are being divided into “investment” properties making the creation of a contagious park difficult.

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<sup>1</sup> national park. (n.d.). Retrieved from [Britannica.com](https://www.britannica.com)

<sup>2</sup> Andrea Sachs, August 24, 2016, The Washington Post, What does the National Park Service consider a national park?, ([washingtonpost.com](https://www.washingtonpost.com))

In addition, all new residential projects and developments should include green park space covering a minimum of 25% of their area. Wherever possible and appropriate, vertical garden space should be incorporated and incentivized to improve air quality. The planning departments and investment commission, as well as those in charge of enforcing building codes, should incorporate this requirement as a minimum in the process of reviewing and approving building projects.

Every town and hamlet in Iraq should have a public green area that is shaded with indigenous trees, and the space in between the trees should be used as a community garden where benches can be installed. The water for irrigation (if groundwater is not shallow enough) can be from treated sewage water as described in the sewage treatment plan described in the subsequent sections. These green areas can be added to the forestation program mentioned above, and public campaigns can be used to plant the areas with saplings as part of children's education programs where children and high school, as well as college students, are given the responsibility of planting saplings and taking care of the planted saplings. In ten years, these areas will become oases of biodiversity for birds and a veld for the local communities alike to be used as a recreational area on hot summer days and mild winter days.



# 3. The “Cleansing of the Rivers” sewage program

Dumping raw sewage directly into the Tigris and the Euphrates rivers is an ongoing environmental disaster. Over 5 million cubic meters of sewage water are dumped daily into our rivers, resulting in pollution and disease. This number peaks around the two to three weeks period when pilgrims visit Iraq in an annual ritual commemorating the martyrdom of Imam Hussien in Karbala. Over twenty million visitors from Iraq and the region head to Najaf and Karbala annually, creating a peak flow of sewage into the Euphrates river that invariably overwhelms the stability of the biological processes and results in the depletion of oxygen in the river (especially in the summer months when the temperatures are high and the flow of the Euphrates is low due to irrigation demands upstream).

The practice of dumping sewage was sustainable when the flow of the Tigris and Euphrates was unhindered, and the input was minimal. However, with the increasing population accompanied by a reduction of water flows due to dam building and flood management, it has become unsustainable and no longer is “dilution a solution to pollution.” There is little hope that the Iraqi government budget will have the necessary funding any time soon to design, build and operate adequate numbers of sewage treatment plants. As such, it is important to start thinking outside the box and create new interim natural-treatment systems to mitigate the immediate threat of dumping sewage into the waters and supplement longer-term sewage management efforts. These natural-treatment schemes are not as efficient as modern sewage-management mechanisms, but they would nonetheless improve water quality and allow it to be safely reused for agriculture and are easier and less expensive to build and operate.

Natural wastewater treatment systems are biological treatment systems that require no or very little electrical energy; instead, they rely on entirely natural factors such as sunlight, temperature, filtration, adsorption, sedimentation, biodegradation, etc., to treat wastewater or fecal sludge. They utilize naturally occurring physicochemical and ecological processes in removing pollutants from wastewater. The processes involve interactions of microorganisms, aquatic plants, substrates (media), solar energy (temperature and light), and wind.<sup>3</sup>

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<sup>3</sup> Zacharia, A., Outwater, A. H. , Deun, R. V. , 2020, 'Natural Wastewater Treatment Systems for Prevention and Control of Soil-Transmitted Helminths', in K. Summers (ed.), Water Quality - Science, Assessments and Policy, IntechOpen, London. 10.5772/intechopen.92654.

These processes are important for the removal of both physicochemical pollutants and biological (pathogenic) pollutants. Natural wastewater treatment systems have low maintenance and operational costs, low energy consumption, and low mechanical technology. They are, therefore, ideal for sustainable sanitation services, especially in low- and middle-income countries.

These schemes can be implemented quickly in small villages (where they are ideal), as well as in medium-sized cities with agricultural lands in their vicinity. This program will be an added-value program to the Garden of Eden Reforestation program, as the natural-treatment schemes include the planting of green reed beds and other natural flora that can absorb the nutrients in the sewage and use the water to grow plants that will absorb and sequester carbon dioxide. These projects can be funded through the Green Climate Fund or the Adaptation Fund, Redd+ funds.

## **Eden Again Park**

Chibaish, located in the middle of the former marshes of southern Iraq, has grown from about 6000 people in 2003 to about 75000 now. The city had grown because people started returning to the marshes when they were flooded as it was easier to live in the town and use boats to quickly be inside the marsh to fish, gather reeds and herd the buffaloes. The city built a sewage collection system; however, there is no treatment plant. The sewage is pumped twice a day into the marsh. Since the area around the outlet is supplied with nutrients from the sewage and water, the reed growth is exceptionally thick, and the sewage water is dispersed.

A group of NGOs is attempting to build a system to treat the water and contain it and use it to create a park. The following links show the intended designs and results. This project can be replicated throughout Iraq with very little interference or need for funding directly from the government. The social responsibility clauses in the oil contracts can be activated, and the international oil companies can be engaged to sponsor the building of these parks all over Iraq.

<http://www.natureiraq.org/wastewater-garden-project.html>

## 4. The “Twin Rivers/Rafidain” water-management program

This section concerns governmental actions needed to facilitate large shifts in the water management culture. NGOs and international donors can help in the awareness aspects to help politicians make the politically difficult decisions proscribed herein.

Mitigating heightened water-resource threats demands improvements in irrigation efficiency across Iraq’s agricultural sector and the modernization of its water-management strategy. Iraq’s current water-management plans were developed during an era when few dams were built on the headwaters of the Tigris and the Euphrates, and floods annually threatened the country’s major cities. Flood-control lakes (such as Tharthar and Habbania) are used to store water, but because these reservoirs are relatively shallow with large surface areas, they result in significant water evaporation. Further, water in Iraq is moved using mostly unlined canals with gravity providing the energy to move, and given the slopes, the flow is rather slow. Furthermore, there are tens of thousands of fish farms dotted around the Euphrates and Tigris, increasing the surface areas from which water is evaporated. Currently, at least 8 billion cubic meters of water evaporate per year, and more will be lost as temperatures increase due to climate change. This is like the flared gas in southern Iraq and Kirkuk. A wasted resource that should be harvested and controlled for the benefit of future generations of Iraqis.

Introducing modern techniques to improve water management and resource preservation through near-term measures is critical to Iraq’s future. If implemented quickly, it could reduce total water demand for irrigation by 30% to 40% over the next 3-5 years. This can be done by incrementally changing the farm support system from the current program, which supports farmers through buying wheat at double to triple its international price, to giving support in the form of subsidized modern irrigation equipment (drip irrigation systems) and in four to five years, the alternative farm support system would result in reduced water waste.

Further, to continue supporting the farmers, we suggest that their produce be insured against market fluctuation and encourage them to get into long-term supply contracts with food processing plants. These plants should be encouraged by inviting investors and large companies (specifically Turkish and Iranian investors). This will create a market for farmers other than the fresh food market and provide jobs and income to Iraq from selling food products.

Another method of continued support to farmers is to encourage converting small land holdings to palm tree (or native oaks and walnut in the north) plantations, with the space between the palm trees converted to hypotonic and smart agricultural plantation techniques described in project 5 below. This will reduce water evaporation losses and create an organic farming product that yields higher prices in the markets of processed and fresh food.

Meanwhile, reducing irrigation-related water waste will help reduce drainage water problems and address salinization risks on farmland. Shifting from unlined gravity canals to either large-diameter pipes or concrete-lined canals shaded with photovoltaic panels that could be used to generate local electricity would further lessen evaporation losses and generate sustainable electricity.

The modernization of irrigation and water management would support the development of the light industry to fabricate plastics and irrigation equipment and produce plastic pellets needed as feedstock for this manufacturing. The Iraqi government could support this growth by creating public-private partnerships to modernize existing industrial facilities in Iraq.

This transformation will need to begin with the relevant ministries and agencies in Iraq working with specialized international organizations to develop a comprehensive plan to guide the Twin Rivers/Rafidain Water-Management Program and the ancillary manufacturing industries. This effort should also propose the legislative and regulatory changes necessary to frame this transformation.

While the measures described above will significantly reduce waste, they will not solve the water management problem in Iraq or the region. Like the rest of the issues facing modern Iraq, the problem of water resources is multilayered. There are many separate administrative bodies governing water use and planning for the future. There is a lack of coordination between the KRG and the Federal government, and a historical mistrust with Iran and Turkey.

It took centuries to create this lack of trust, but as long as there was plentifulness of water, the problems did not come to the surface. Now, however, given climate change, increasing population coupled with the predicted reduction in oil income, we have a little over a decade and a half to bridge the gap. As difficult as bridging the gap is, it is even more difficult with the ongoing regional struggle of political instability and conflict.

The climate change threat is an incentive for all the nations in the region to act together as it is a threat to all of us, and no nation can deal with the effects of climate change alone. We need to act together. This existential threat can be converted into an opportunity to cooperate and create co-dependence and economic integration regionally to benefit all the region's people. An approach that would make water management, trade, energy, and agriculture the skeleton on which this co-dependence is created. With wise leadership, we will be able to create an atmosphere of cooperation that will yield less border control and allow the free market to capitalize on the region's natural resources, including human talent. The approach is discussed in a later part of this publication.



# 5. Smart Growing Beds

Flood irrigation causes salinization of the soil due to the saturation of the upper portions of the soil with irrigation water which would then, through capillary action, bring the salts to the top of the soil. Once the water evaporates, the salts are left as an efflorescence which accumulates if not flushed away by floods, causing the soil to become "sabkha ."Over 90 percent of evaporation losses on a farm are a result of water evaporating from the soil.

Plastic covers have been used on farms to keep the soils moist, prevent evaporation, and limit irrigation to the plant opening. This is a method that is useful in areas where the temperatures are moderate. We present herewith the details of a growing bed that can be installed in gardens and in the shaded areas between palm trees that are to be planted as part of the forestation program.

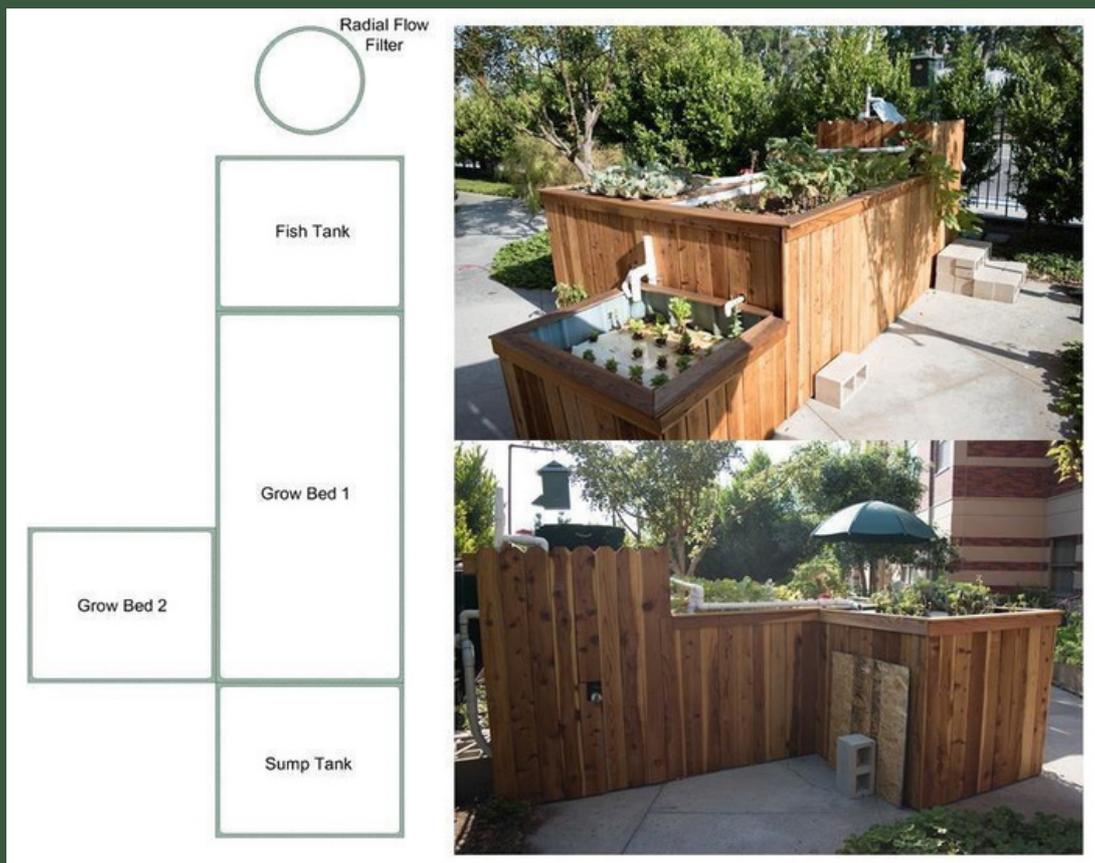
The system is simple from the engineering and biological point of view. However, it may need training for the farmers in the initial stages to keep the balance of chemicals in the system well adjusted and the nutrients adequately supplied to promote proper plant growth. The system is comprised of a fish tank and two growing beds. One growing bed with a constant fixed growing media, and the second has a floating growth media that is used as a flush tank to support the oxygenation of the roots of plants growing within the first tank.

The fish in the fish tank are fed worms and vegetal matter from a compost trunk. The compost trunk is filled with leftover food from the household, rotting vegetables, and other materials essential to growing worms. The worms are harvested and fed to the fish, which then uses the protein to grow; eventually, the fish will urinate and defecate, converting the water in the tank into nutrient-rich irrigation water. The fish tank is set at an elevated position and a water pipe, with an adjustable valve, connects the fish tank to the bottom of the growing bed that has a fixed growth media. The growth tank has a fixed growing bed composed of baked clay balls that are varied in size but do not have much capillary action that will allow the roots of the plants to become wet without allowing the water to reach the surface of the growing bed as the water level rises in the growth tank. When the water level reaches the middle of the clay balls, a bell valve embedded in the growing media will connect, and a siphon will be created, flushing the water into a flush tank that has a floating growth bed. The periodic flushing of the tank with the fixed growth media allows for the wetting of the roots of the vegetables without causing rotting, and the repeated cycles (every half hour) accelerate the growth of the vegetables.

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The fixed growing media tank can be used to grow vegetables that usually rot when continuously wetted, while the flush tank can be used to grow vegetables that do not mind having soggy roots. The plants can be planted more densely as the watering is from below. Given that there are no weeds, there will be no need to use herbicide chemicals, and pests can be controlled using natural biological methods.

It is of note that the clay balls should be of varying diameters and rough in texture to allow the growth of bacteria that will convert the water born nutrients into chemicals that the plant roots can absorb. Further, it is important to keep the growing bed slightly acidic (6.8 to 7 pH). The flush tank is emptied back into the fish tank either by a hand-cranked pump or a small powered pump (1/4 horsepower). The following shows a schematic figure of the growing system.



# 6. The Shatt Al Arab Grand Barrage

Elevation models indicate that the average temperature worldwide has increased by about 1 degree Celsius, and sea levels worldwide have increased by 20 to 30 centimeters in the past century, half of which occurred since 1993. It is predicted that the water levels will continue to increase even if the world somehow stops adding CO2 to the atmosphere. Some models show that water levels will increase by 6 meters, but with moderate control over CO2, the levels will increase by 3 meters! It is important to note that cities situated in areas affected by tidal action will be affected worse than the “average” increase in seawater, as the mean sea water level negates the elevation changes due to tidal actions. As such, cities (like Basrah and Fao) in southern Iraq will be affected by the rise in Gulf water by the migration of the salt wedge up through Shatt Al Arab, Khor Abdallah, and Shatt Al Basrah. Given that the marshes in some areas are lower than seawater (Hammar marsh - main flow canal of the Euphrates before 1954), the marshes will likely become saltwater or brackish water marshes. Obviously, this would affect not only the aquatic environment but also negatively impact agriculture along the southern portion of Iraq with increased salinization and seawater intrusion into the groundwater.

Plans should be revived for installing a control barrage at the mouth of Shatt al-Arab, similar to the Thames Barrier. This Shatt Al-Arab Grand Barrage project would allow the flow of seawater to be controlled by closing the gates of the barrage during high tide and opening it during low tides, allowing salinity and pollution to be managed. It would also have the additional benefit of helping to protect the heritage cities of southern Iraq from the adverse effects of climate change in addition to stemming erosional patterns. Opening the gates during low tides will release the polluted waters that are dumped into Shatt Al Arab now. If the source of the polluted water is eliminated, it will be possible to hold the clean water and raise the level of Shatt Al Arab to allow for its use for irrigation purposes. While the flow of the salt wedge up Shatt Al Arab can be controlled with a barrage built at Ras Al Bisha, it is important to note that the expected wave action will create an erosional effect on the seashore that needs to be addressed. As such, in addition to building a barrage, the entire coastal area of the northern gulf needs to be fortified against erosion with the planting of erosion resistance native species of mangroves aided by an embankment that contains high (blue moon) floods. The mangroves should also be added to the carbon credit of Iraq.

This project would also have regional benefits. Any effective barrage would need to be located at the section of Shatt Al-Arab shared with the Islamic Republic of Iran. As such, the design and construction of the project will require bilateral cooperation and coordination, and this effort could provide the foundation for a wider resolution of the dispute over water rights in Shatt Al-Arab. Cooperation should also include Kuwait, as the northern extent of Kuwait will be affected by the same phenomena.

Furthermore, land connections would encourage trade and regional cooperation. The barrage will be a bridge that will connect the people of the region, not just Iraq with Iran, but also incorporate the larger region, including Kuwait, Saudi Arabia, and the Gulf states. The barrage should include a lock to continue navigational use for small and medium ships. Moreover, in the distant future, when the goals of cooperation and integration of the economies are reached, we should see that the market forces will push the three countries to create an administrative structure that controls and coordinates the shipping activities of the ports in the northern gulf as one administrative unit to allow for the efficient use of the resources. The port facilities would need to be serviced with train routes connecting the northern gulf with the Mediterranean through Syria and with eastern Europe through Turkey.

Regional construction companies could be encouraged to bid for the project, thereby bringing them into the Iraqi market. The construction cost of the Shatt Al-Arab Grand Barrage is estimated at around \$1 billion. Given the high figure, we propose that Iraq should study various funding mechanisms, including public-private partnerships, joint financing with the Islamic republic, support from international financial institutions, and access to financing from international and green investment funds. Further, given the futuristic nature of the project, we see a natural investment opportunity for future wealth investment funds of the region.

In addition, similarly to the Thames barrier, the new Shatt Al-Arab barrage could become a tourist attraction for visitors interested in the history, environment, and wildlife of the river, as well as construction sites enthusiasts from Basrah Governorate, Iraq, and the world, the government could promote the project by inviting international media agencies to produce reports and documentaries on the new mega project in the Middle East. The revenue from touristic visitations and recreational activities could partially fund the project's construction and maintenance costs.

# 7. The Vintage Building program

Traditional Iraqi architecture allows for thick exterior walls and small windows that facilitate cross ventilation but limit direct sunlight entrance to the inside of the structure to early morning and late day. Also, an interior courtyard allowed for a “Bernoulli” effect to pull cross ventilation currents from outside through the rooms and up through the “hot” air stack in the courtyard. It is of note that most houses had a semi-basement and tall ceilings. All these features were developed over millennia of living with the region’s environment, which traditionally was very hot in the summer and very cold in the winter. Needless to say, the construction cost included upfront design features that dealt with the environmental conditions, making the building more expensive to build but also cheap to “operate” given that it is designed with the environmental conditions in mind.

When electricity was introduced to Iraq, air conditioning became possible. As such, architects began ignoring the traditional building method in favor of modernity. This included installing large windows that allow more sunlight but, of course, increase the need for air conditioning to make the building temperatures suitable during the extreme heat conditions in summer and winter. The tall ceilings were eliminated as there is no need for cross ventilation. This also reduced the cost of building upfront but increased the operating costs in the long term as we departed from building in accordance with our direct environmental conditions.

Over the past forty to fifty years, the electricity supply never kept up with the increasing demand. This made blackouts a natural feature of living in Iraq. While the houses are designed for 60 amperes of three-phase electrical supply at 220 volts, 50 hertz, and subsidized cheap national grid electricity, the 24/7 service is only possible during low-demand months (spring and fall). Most houses are connected to “local generators” that supply a reduced electricity average at premium prices. To supplement the local generators, most homes of the middle and upper class have a large standby generator that they use when their needs exceed those provided by the local generator during the national grid blackout periods.

Reintroducing traditional building techniques and encouraging energy efficiency in urban areas will reduce Iraq's energy needs and carbon footprint. Urban areas in the major cities and towns are responsible for the vast majority of GHG emissions, energy demand per capita, and resource consumption, at significantly higher rates than in rural areas. With urbanization rates at over 70% and urban growth at over 2.5% annually, adopting solutions to promote cleaner and more efficient building and energy-use methods is critical for Iraq.

As a first step to addressing these looming challenges, Iraq must introduce new energy efficiency and construction standards legislation to reduce long-term energy use. In particular, we must encourage the construction of new low-cost housing in Baghdad and other major cities in Iraq that draw on heat-management lessons from traditional old architecture techniques and use mass-compacted earth technology to reduce energy consumption, delivering modern-style structures with smaller CO<sub>2</sub> footprints. Government agencies and local municipalities should study appropriate measures to retrofit government buildings and encourage introducing renewable energy solutions, including photovoltaic electricity production, using solar heaters to heat the water, and energy-efficient building processes.

Introducing new building standards and energy-efficiency measures will have a potential multiplier effect on the Iraqi economy: new investment in brick-building will be required to supply the local construction market with mass-compacted earth technology bricks; retrofitting will generate new jobs in the construction sector, and in the longer term, Iraq can use this initiative to develop a local photovoltaic industry to satisfy local demand. New jobs will be created in all these sectors, encouraging investment by the local and international private sectors.

To expedite the implementation and adoption of the measures discussed in the efficiency building program, incentives should be built in. Tax breaks for developers, builders, and manufacturers should be incorporated into the taxation code. These initiatives could be funded by converting carbon credits accrued to the Iraqi government from GHG-reduction funds into tax subsidies. A program along these lines should be designed and implemented by the Ministries of Finance and Environment in conjunction with international agencies.

# 8. Waste-to-Energy (W2E) program

Modernizing Iraq's urban waste-management systems that capture and reuse fugitive emissions will reduce Iraq's carbon footprint and provide a potential renewable energy source. The Iraqi government and local municipalities should build on a recent initiative launched in Sulaymaniyah, where local cement factories coordinated with local authorities to build a fourth-generation modern dump that captures the methane generated from the decomposition of biological materials and uses plastic waste to reduce the energy demands of its kilns. Similar schemes could be introduced in urban areas across Iraq as part of a national waste management and emissions-reduction initiative.

The Modern Waste Program could be funded through several channels. Public funds could be made available at the local level, but public-private partnerships could also be considered where private-sector ventures are involved. Support and funding from the Green Climate Fund and other climate-finance institutions should also be studied, as should bilateral support from national investment funds.



## 9. Gas Capture program

The oil-and-gas sector is the major contributor to GHG emissions in Iraq. Fugitive emissions from the sector alone account for over 40% of total national emissions, largely due to high levels of associated gas flaring (Iraq ranks second in the world in total flaring, behind Russia). Venting and fugitive emissions along the oil-and-gas value chain also contribute to these overall numbers.

Iraq must introduce immediate measures to reduce flaring, eliminate venting, and improve energy efficiency in the oil and gas sector to reduce emissions and increase government revenues. Iraq did sign the Methane Pledge preceding COP 26 and has begun revisiting proposals to capture flared associated gas to utilize it for power generation locally or export it to neighboring states. Opportunities to utilize this gas in the value-added petrochemical industry can also be explored in the longer term. Iraq should also implement measures to eliminate venting and fugitive emissions from oil-and-gas production by introducing modern monitoring mechanisms (remote sensing using drones aided by satellite imagery from companies such as planet.com, which has a satellite constellation in low orbit that creates a daily picture of the entire globe). Iraq should document the effort and convert the captured methane into carbon credits as the damage caused by releasing unflared methane lasts eight decades in the atmosphere and has a multiplication effect to the equivalent volume of CO<sub>2</sub>. The integrity of Iraqi hydrocarbon infrastructure should be audited to account for the venting losses converting that to carbon credit.

As a first step towards implementing this program, Iraq agencies should review existing commercial proposals by foreign oil and gas companies for gas capture, utilization, and monetization. As part of this effort, Iraq should consider reviewing existing upstream contracts to create more incentives for associated gas capture and more energy-efficient and environmentally friendly production methods. Iraq should also study regional initiatives linked to associated gas capture and improved production methods to shape its program.

It is of note that Europe, following the Russian military operations in Ukraine, is looking for alternative gas sources. Iraq can not only provide that gas, but also it can act to allow gas from Qatar, Saudi Arabia, and Kuwait to be transported in pipelines to Turkey and eastern Europe, all the way to Germany. Even if Russia gets back into the production and provision of gas, the gulf countries can use the infrastructure to transport green hydrogen in the future, as described in the Green Energy Program.

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# 10. Green Energy program

The solar energy potential of Iraq and the region is multiple of that of countries to the north. Iraq is already seeking to develop its solar energy potential, with bids solicited two years ago to create a 755-megawatt plant in the central Euphrates region. Further solar ventures are also being planned with foreign investors, and the ministerial council approved in June 2021 offering 12,000 megawatts of PV for investors' bids.

Iraq should link these initiatives to a more ambitious Green Energy program designed to shift Iraq's energy-use patterns, enhance its energy efficiency, and establish the foundations for new revenue streams over the next two decades.

As an initial step, Iraq should accelerate investment in expanded solar-energy production to meet rising electricity demand and reduce emissions. As part of this initiative, Iraq will need to invest in modernizing its transmission and distribution network, allowing it to collect solar energy from the south and deliver it to the north during the day and hydroelectric energy in the opposite direction at night. New IPP models will also need to be introduced, where the electricity is purchased by the Iraqi government at a preset rate. And in the long term, these renewable sources will replace retired thermal generation plants.

The program must also seek to encourage and incentivize private homeowners to install photovoltaic panels for residential electricity generation and smart meters to reduce overall energy use. Campaigns to promote energy efficiency should also be introduced. One of the most useful tools to encourage the reduction of wasteful usage is to increase the tariff on households that use too much energy. A threshold should be established to subsidize the poor and households that do not use air-conditioning, but the tariff should increase steadily for houses using energy above the threshold. Smart meters should be installed to encourage the distribution of electricity demand over the day and thus encourage homeowners to conserve energy during peak demand hours.

Iraq should also consider leasing out lake surfaces for photovoltaic energy production. Similar programs have been introduced successfully elsewhere, such as in Malaysia. There may be inefficiencies associated with installing photovoltaic panels on floating frames, but reducing evaporation due to the cover provided would be a sufficient compensation. Thus, we can connect the water and electricity sectors together, as both are needed for Iraq's future. In fact, if there is an overproduction of photovoltaic energy during the day, large-scale electrolyzers can be used to convert the water into oxygen and hydrogen. The hydrogen produced will be green hydrogen, and it will be a useful alternative to store energy for night use (instead of batteries) by using hydrogen cells to convert the hydrogen back into water which can be used for consumption either by irrigation or domestic use.

If technological advancement solves the hydrogen transportability challenge, Iraq and the region can export electricity in the future, day and night, through the creation of photovoltaic forests that will generate more than the region needs during the day while converting unsold electricity into hydrogen that can be used at night or even seasonally (less production during the winter due to shortened daylight hours). In the longer term, Iraq's Green Energy program should be designed to be a source of income and to promote regional links. Transmission networks should be established to export any excess power generation north and south and transport solar electricity from the Gulf to Turkey and Europe. Storage mediums such as hydrogen and ammonia should also be developed in the longer term, providing more industrial potential and attracting regional and international investment.

Electricity production using sustainable sources can be the business of the future for the entire region, and Iraq will be vital to transporting that energy to Europe through Turkey. If the countries of the region have a common economic interest in stabilizing Iraq to allow for the uninterrupted transmission of electricity, then there will be an incentive for all the forms of political regimes of the region to work together to keep Iraq stable.



# 11. National Carbon Trading Platform

Since Iraq will be largely dependent on external funds to finance the aforementioned projects, it is important to establish a governmental body concerned with setting the necessary regulations and proposing legislation to the Council of Representatives to facilitate a legal framework for foreign investments by countries and heavy industry institutions willing to offset their carbon emissions through buying carbon credits from Iraq.

The new governmental body shall be an independent agency, similar to the Independent High Electoral Commission (IHEC). It should be in close contact and collaboration with the relevant UN agencies, the OECD, Emission Trading Systems like that of the European Union (EU ETS), similar national carbon market platforms such as those of China and India, and organizations or companies that are involved in carbon trading or carbon offset projects.

Iraq must provide the ideal atmosphere for international experts in environmental sciences, engineering, and finance, as well as scholars and business pioneers, to set up the required complex infrastructure and emissions calculation tools such as emissions modeling software, greenhouse gas inventory tools, and other types of data analysis tools, following global standards and protocols, such as the Greenhouse Gas Protocol or the Carbon Offset Integrity Standard, to ensure the accuracy and integrity of the carbon credit calculations., and seeking global recognition and accreditation.

By leveraging the prospective carbon credits generated from Iraq's quest to combat climate change, we can receive billions of dollars in funding from implementing environmental projects as according to the World Bank, more than two-thirds of UN member states plan to use carbon markets to fulfill their Nationally Determined Contributions (NDCs) to the Paris Agreement. Chile, Ghana, Jordan, Singapore, and Vanuatu, among other countries, are already building end-to-end, state-of-the-art digital infrastructure to back their participation in global carbon markets.

# A Regional Framework



Iraq, Saudi, and Iran have lived on oil wealth for the last 70 years but have wasted much of it in countless wars and continued instability. The Gulf countries of Kuwait and Emirates lost their source of funds in the forties when Japan invented pearl farming. The shipping industry began using WWII surplus liberty ships that negated the need to stop in small ports between Mumbai (formerly called Bombay), Basrah, and Abadan. They learned the lesson, and when the oil wealth came, they created future generations' wealth funds; Dubai, in particular, created a vision based on trade, tourism, and being a global transportation and port management hub. As the second decade of this century passed, Iraq and Syria appeared to be going backward, not facing the realities of this coming century. Iraq, in particular, seems to be determined to remain unstable, with the political classes putting their interests above the interests of the nation in building a stable economy.

The Mesopotamia Revitalization Initiative is a set of projects designed to address Iraq's needs, but it is also applicable to the regional countries facing similar climate-change issues. Regardless of the political disagreements between the countries in the region, Climate Change is a foe that will affect the entire region negatively. We must face that together as it is a regional, nay Global, threat.

Iraq is at the center of this region historically and metaphorically. As such, we should capitalize on our historic role to help Iraq and the region by promoting economic and political cooperation and stability in the Middle East, which will inevitably result in co-dependence and mutual economic benefits. Simply put, the blueprint for Iraq's future is rooted in its history as a bread basket for the region and an essential link in the trade route between east and west and north and south.

The steps mentioned in the above projects focus on creating the necessary conditions for peace and stability, and it will reinforce this ambition in three ways:

- Water security. Issues of water scarcity, and their impact, are not confined to Iraq. Water security has been a growing risk in the Middle East for the past half-century, and the dangers associated with limited water availability and reduced flows are rising. The gulf waters increased salinity will soon make desalination uneconomical for people in the Gulf states. It need not be said that lack of water will result in major population displacements, be it in Syria, Iraq, Iran, or elsewhere in the region.

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  - As such, we must reach out to upstream countries (Turkey and Iran) and create codependent economic ties that would result in sharing the region's wealth equitably now and well into the future.
  - In addressing its water-management challenges, Iraq can potentially act as a model for the region and draw on regional initiatives. Moreover, it would provide a starting point for much-needed discussions on water-sharing with its neighbors upstream and downstream. The water efficiency initiatives, when properly implemented, will allow for water to be available to share with downstream users, and the same efficiency schemes can be used upstream. Increased links and co-dependence will build the trust bonds needed to encourage co-management of the water resources for the benefit of the entire basin and not only Turkey, Iran, Iraq, and Syria. Co-dependence will dictate and yield naturally to commonwealth and cooperation.
  - Food security. Prior to the political calamities of the late 20th and early 21st centuries, Iraq was a regional breadbasket. The country's abundance of natural resources and its climate allowed for year-round agricultural production, creating a surplus of produce that could be exported. A long-term goal of Iraq's efforts to improve water availability, salinity levels, and land preservation is to restore agricultural production to levels where it can again play this key role in the future, taking advantage of its strategic location at the center of north-south and east-west trade routes.
  - Land security. Threats of desertification and associated meteorological risks are not confined to Iraq; they threaten the Middle East as a whole. Already the incidents of dust storms have negatively affected Iraq and its neighbors. This is not because of Iraq alone but a regional degradation and worldwide phenomenon. By addressing its land-management challenges, Iraq can provide lessons for the wider region. It will also allow cooperation and coordination of land-management initiatives across the Middle East. The ultimate result of the reforestation program is not only carbon sequestration but also a suppression of dust storms and the stemming of the losses due to desertification.
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In the longer term, the Mesopotamia Revitalization Project is designed as a foundation for more extensive climate adaptation measures that will drive economic growth and regional integration. Our ambitions should be grand. Given its strategic geographic position, Iraq can develop as a critical commercial artery linking the Gulf to Europe. The opportunity exists for Iraq to develop as a “dry canal,” transforming itself into a transport route for energy, trade, natural resources, and digital technology. We should begin immediately, while the projects are being implemented in Iraq, to discuss the water management issue with Turkey (eventually Iran and Syria). Following is a summary of the proposed strategy for dealing with the negotiations with Turkey.

Negotiations with Turkey can not focus only on water. Instead, we must negotiate with Turkey on water, trade, transportation, energy, security, and food. This negotiation should not be left to second-tier officials to meet and discuss ad nauseam the minutiae of historical events and victimhood etc. We must recognize, as Iraqis, that we have a strong position when it comes to energy, transportation, and food; however, there is no doubt that we have a culture that does not respect the scarcity of water. How can we not have such a culture when historically we are a flood plane that suffered from floods for thousands of years?!. Only recently have the conditions changed with dam building upstream, and a culture of 8000 years does not change overnight, at least not willingly. The steps described in the Mesopotamian Revitalization Initiative are not intended to have Iraq become independent of Turkey and Iran as far as water is concerned. Rather, they are intended to reduce the water demand and thus postpone water bankruptcy. The population growth will require additional shares of water to address both domestic and agricultural needs. The water issue will come to the point of tension sooner or later.

We must also recognize that while Turkey has not signed the international treaty on transboundary rivers, it has complied with the requirement and spirit of the agreement by deed and not just words. In contrast, Iran has yet to address international law requirements. Turkey began filling the Ilisu dam in the summer of 2018, while Iraq was yet to prepare itself. During the filling phase, the Tigris river was so low in Baghdad that people began walking across the river. In the summer of 2018, the Iraqi government appealed to Ankara, and the Turks mobilized the largest crane in Turkey and opened the gates of the diversion tunnel (at the risk of creating a hydro-hammer effect). Thus Turkey proved by action and not words that they intend no harm to Iraq and are willing to share the waters equitably with Iraq. Nevertheless, given that climate change will make conditions uncertain from year to year as to the thickness of snow and how much rainfall takes place, they suggest that we must come to an agreement based on percentages and not direct numbers.

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Given the lack of trust between Iraqi technocrats and the Turks, as they simply can not agree on how much water is getting into Iraq, we need to start a process of building trust. To that end, there are ongoing efforts to measure the flow of the Tigris and Euphrates on a daily and hourly basis to establish a mutually accepted set of numbers. Further, Iraq has managed to install over 300 remote measuring stations at key points of the Tigris and Euphrates. As such, the scientific basis now exists to manage Iraq's water resources or at least monitor and document water use.

We present herewith an idea that, if properly implemented, can bolster the trust between the two nations and create an economic incentive to promote future cooperation. The idea is focused on Mosul Dam and Ilisu Dam. Both dams are of similar reservoir sizes; however, Mosul dam has been classified by the US arm corps of engineers as the most dangerous dam in the world. Much money has been spent on grouting the dam's foundations since it entered service, but it remains dangerous. Despite assurances from the government personnel, the dam operational rules only allow for a 70% filling capacity. Disregarding a study completed by the Ministry of Water Resources in 2012 indicating that Iraq does not need new dams; but rather needs better water management, the ministry has embarked and is insisting on going on with the building of the Makhoul dam.

Notwithstanding that there is no need to build the Makhoul dam, we believe it is more important to deal with the issue of the Mosul dam. Instead of continuing to grout its foundations (to the tune of over 100 million US dollars per annum), we can propose an agreement with Turkey to lease the Ilisu dam and operate its gates based on the needs of Iraq as opposed to hydroelectric generation. It is important to note that we must stipulate the Jazra Dam will not be built as it is intended to redirect the waters of the Tigris for agricultural purposes. The cost of leasing can simply be paying Turkey for the electricity that the dam generates (based on take or pay) as well as a certain amount of leasing fees to be agreed upon as Turkey has to pay off the 1.7 billion dollars debt it incurred in building the dam. Iraq does need electricity and will need electricity for the long term. However, Iraq can not afford to continue to try to keep the Mosul dam stable. As such, the 100 million dollars spent on grouting can be partially saved, and a portion can go towards paying the leasing fees. This will make about 1 billion cubic meters of water available instead of getting evaporated from Mosul dam lake or percolated into the groundwater. Mosul dam can be repaired more efficiently when the hydrostatic pressure of the lake is diminished. We can keep the Mosul dam on standby in very wet years or in case of increased tensions with Turkey.

The fees for buying the electricity of Ilisu dam can be paid in the form of subsidized energy delivered to Istanbul. The pipeline to deliver to Istanbul should be built over capacity with a mind to a future deal that allows Iraq to sell gas to Europe passing through Turkey. This will probably be unacceptable to Russia as it would be bringing in a competitor to the European market, but of course, Europe would be more than willing to pay for this infrastructure given their complete dependency on Russian gas, which has created a massive challenge for Europe as Russia attacked Ukraine.

The agreement should include giving Turkey the right to send transit goods to the Gulf through Iraq. Both countries can work on improving the transportation infrastructure to enable fast and safe passage of trucks to the gulf. Road and rail routes utilizing electricity and hydrogen technology could be developed, including the necessary supporting infrastructure. These lines could be used to connect the ports of Fao, Kuwait, and Abadan to Europe and would offer an alternative route for surplus freight that can not be shipped to the Suez Canal (alternatively, a trade agreement could be reached with Egypt to establish a common north-south transport company). Transport lines for energy exports from the Gulf region and overland digital connections could also be included.

If (or when) this first step in reaching an agreement on operating Ilisu is successful, other dams can be included in the agreement with the objective of eliminating storage in Tharthar Lake, Habbania, and other shallow lakes and thus making 8 billion cubic meters of water available for the use of both countries.

To include Iran in the project, we suggest looking at connecting lake Van in Turkey with Lake Urmia in Iran in exchange for environmental flows to the marshes of southern Iraq. The cost of connecting Van to Urmia can be paid for with power generation statins that can take advantage of the vertical elevation distance between the two lakes. It should also be noted that we can use rail lines between Iran and Iraq to bring Iran into the cluster of nations benefiting from the dry canal and, as such, have the incentive to keep Iraq stable. The dry canal will be used in the future to transport goods and sustainable energy generated in the south of Iraq, Iran, and Saudi Arabia.

Some will object to the idea of leasing Ilisu on the basis that this gives Turkey the upper hand in controlling Iraq's water. The answer to them is that we are not giving Turkey anything it does not currently have. Furthermore, Turkey has proved by deed that it does not intend harm and is complying with international law. The point that should be made, however, is that the idea of building Iraqi dams on the headwater of the Tigris and Euphrates goes back to the Royal era of Iraq (chapter 6 of the Friendship treaty between Iraq and Turkey).

## **Implementation**

Designing and implementing the Mesopotamia Revitalization Project's various initiatives will require appropriate institutional arrangements. It may involve the passage of dedicated legislation to create the legal and investment environment to promote the envisioned changes.

### **a. Institutional arrangements**

The success of the Mesopotamia Revitalization Project will depend on adopting a whole-of-government approach that links appropriate ministries and agencies in a coordinated fashion. A number of critical institutional moves will be needed to kick off the project:

1. The Minister of Environment in the Iraqi cabinet should be a deputy prime minister for environmental affairs with special duties to oversee the development and implementation of the plans and strategies to deal with climate change and the protection of the environment.
2. Empower the Nationally Declared Contributions Committee, tasked with designing Iraq's commitments under the UN Framework Convention on Climate Change with the executive agency to develop and coordinate Iraq's climate policy.
3. Establish an Independent Climate Advisory Committee, headed by a respected scientific or business leader, to advise the Iraqi government on climate-change strategy.
4. Following the lead of international banking institutions in considering CO<sub>2</sub> reduction measures, all projects funded by the Iraqi government or where Iraqi banks issue loans should incorporate a CO<sub>2</sub> reduction measure in compliance with Iraq's obligations under the Paris Agreement accords.

## **b. Legislation**

The executive branch should consider putting to the Council of Representatives a set of laws to underpin and facilitate the Mesopotamia Revitalization Project's various initiatives and to establish the necessary institutional structures.

## **c. Awareness and education**

The Iraqi government should consider launching a nationwide public awareness campaign to inform and promote its climate and energy-efficiency policies, using social and traditional media, and encouraging changes in individual habits. Local education campaigns to promote water and land management, and the benefits of modern irrigation and farming methods, should also be considered.

## **d. Stakeholder engagement**

To build widespread awareness and support for the Mesopotamia Revitalization Project, Iraq government agencies, including the Office of the Presidency, should consider a broad stakeholder-engagement campaign, targeting both the targets of these initiatives and national groups engaged in promoting green policies and energy transitions (such as Green Iraq).

## **e. Funding and technical support**

In order to ensure the success of the Mesopotamia Revitalization Project, Iraq should seek support from specialized international agencies and funding bodies to design, implement, and finance its climate-adaptation efforts. Institutions such as the World Bank, the IMF, UN agencies, and the EU have significant experience assisting programs worldwide, and Iraq can benefit tremendously from this knowledge. Moreover, various financing options exist through specialized funding agencies and green investment funds dedicated to supporting climate adaptation initiatives. Support from these bodies will be critical, especially in the early phases of the project.

# Closure

Nature itself gives us the most wondrous images of resilience, coexistence, diversity, and endurance. We have seen with our own eyes how lockdown measures imposed by many nations due to the COVID-19 pandemic have led to a dramatic fall in air pollution and a temporary recovery of the Ozone layer due to reduced emissions and Green House Gases, a live example of how mother earth is capable of healing itself. If we don't prepare timely and efficiently to combat the threats of climate change, it will render life impossible in many of the cities and towns of Iraq and the region, these deadly consequences will result in human migration waves that have never been witnessed in history, and the new generation of climate migrants will not go to India or China, but will likely congregate on the shores and between the borders of western countries similar to what happened after the 2011 events in Syria, but with a much higher magnitude. The threat of climate change, if tackled wisely, could become a historical opportunity for political stability and economic prosperity between Iran, Turkey, Iraq, and the other countries of the region, similar to the dynamics between the United Kingdom, France, and Germany in the wake of the second world war, which led to the later establishment of the European Union.



