TAKING ACTION ON WATER SUSTAINABILITY

GREENING THE KURDISTAN REGION OF IRAQ: WATER, FOOD, ENERGY, AND BEYOND

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Executive Summary

Many regions around the world are grappling with a stormy and turbulent future due to the devastating effects of climate change. The Middle East, given its most water-scarce condition ranks number one on the climatic risk landscape. Focusing on Iraqi Kurdistan (KRI), extreme weather events flood the environment with high risks of environmental degradation. Lack of effective policy regimes to connect the dots between water, energy, food, and other incremental factors with a lasting effect on the environment has exacerbated the already degraded environment of the KRI. Most importantly, the current status of water resources highlights the need for sustainable practices and effective water management. Measurable progress on the front lines of the environment can happen by adopting an integrated development of water, energy, food, and means of transportation policies. Identifying this key gap in policy drafting by the Kurdistan Regional Government (KRG) is of paramount importance to understand the politics of resource mismanagement, which is mostly due to KRG's approach to the problem and dealing with environmental issues in isolation from each other.

This policy paper introduces an innovative approach to improve water management practices by integrating Water Sensitive Urban Design (WSUD), given critically low levels of fresh water supply in the last two decades in the KRI. Implemented across the developed world, WSUD is a nature-based solution that helps the natural water cycle to blend in the built environment. Implemented in Melbourne Australia, WSUD helps improve the water quality, enhance water security through stormwater harvesting and reuse systems as well as reduce urban heat island effect through installing green roofs and permeable pavements.

Introduction

The story of our environment where local issues intersect globally stands at a critical juncture. Beset by climate change, our environment calls for more adaptable and sustainable environmental practices to reverse the effects of a warming planet. The ever-expanding cities need a healthy cycle of water, food, energy and beyond to continue as the hub of our modern lives. Environmentally weak communities hardly pass the tipping point of resilience when challenged with imminent environmental shocks. A fierce battle is intensifying in the wake of a warming planet coupled with water, food, and energy scarcity. However, such a battle is not equitably distributed among the different regions of the world. Environmentally strained regions, such as the Middle East,[1] are confronted with environmental shocks of inconceivable scale due to climate change.

Flash floods, dust storms, water insecurity and recurrent draughts are just a few of the urgent environmental issues that suffocate the region. According to the World Bank, Iraq faces a 25% fall of fresh water supply[2] and the degradation of water quality in its groundwater and rivers. A devastating wave of climate change coupled with lack of smart water management practices and a centralized institutional architecture account for the water scarcity issues. In addition to that, Iraq depends on water resources that originate from outside its territory by 60.8%[3] which as of late has reduced the Tigris-Euphrates River water levels as damming projects[4] are ongoing by neighboring countries.

Environmental Problems in the KRI

The Kurdistan Region (KRI) wrestles with separate battles of its own as water constraints pose challenges to the Kurdistan Regional Government (KRG) in addressing water-related issues that affect vulnerable communities in the Region. Impacts of climate change and misguided water policies rank first on the risk landscape of the Region. With a longer-term environmental strategy in place to address the current crises, the KRI could be on the path towards a more sustainable future. A climate-neutral environment[5] (emitting less and absorbing more) involves incorporating innovative approaches into the built environment. From a climate management perspective, adopting sustainable practices in the KRI could be the most relevant vision with an enduring effect on the future of the region on a larger scale. The identity of the built environment of the KRI is degrading with the changing seasons. High temperatures, pollution, and issues surrounding water and other energy resources strain the KRI communities who must change their societal ways to cope with these issues.

The growing urban outskirts of KRI cities also leads to erratic urbanization growth, which in the long run could potentially undermine good environmental practices. As of late, air and water pollution, restrictions on water use, and increased incidence of flash floods send a wavering shock to these communities. Looking at these community issues from a completely different viewpoint requires shifting policies- one that merges the larger environment with sustainable local practices. While these incremental measures must embody climate change adaptation strategies, the use of new methods and technologies thrive as the center stage of climate solutions. This policy paper provides a coherent image of what sustainable practices are observed worldwide and how that blends in with the material crises on the Region's climate risk landscape. Water-related issues stand as the key discussion point given its environmental footprint on multiple sectors, such as agriculture and industries.

Nonetheless, the purpose of this policy paper is to provide a concise analysis of significant policy shortcomings in the Kurdistan Regional Government's approach to addressing the collective array of environmental issues in isolation. Water policy fails when other factors influencing the built environment, such as energy, food, and transportation, are not considered. Improving an integral policy regime where the synergies between water, energy, food, and transportation are collectively considered is the only feasible way to face the front lines of climate change.

Environmental Risk Areas

The Changning structural forces of climate change have proven to be interrelated and mutually reinforcing in the KRI. This is manifested with extreme weather events that pollute the environment, disrupt the water cycle, and add vulnerability in energy resources. Models that integrate the nuanced interactions between people and the built environment, especially in urban areas, will be critical to building a policy regime to avert the risks of extreme weather events. Such policy regimes must recognize urbanization as central to climate change strategies and building a sustainable urban future. Although the individual priorities of KRI cities could change according to the impacts of climate change and policymaking at city-levels, they all share certain common environmental challenges, and not all of them are caused by climate change.

The urban heat island effect, air pollution, food and water insecurity depict an image of serious and interconnected crises. Climate change may be the primary cause of these extreme weather events. Nonetheless, misguided policies, as well as, to a greater extent, government and community disregard or denial of climate change, contribute to the deteriorating environmental condition.

Drawing lessons from sustainable cities worldwide, in line with the eleventh and thirteenth sustainable goals[6] of the United Nations could provide an equitable platform to bank on for marshaling resources use in mitigating climatic shocks and better environmental policymaking in the KRI. For this to happen, fostering dialogue should center around the convergence of climate change and urban agendas. Establishing this linkage between climate change strategies and urban development planning is of crucial relevance to policy drafting in KRI. Diagnosing KRI's most pressing environmental issues is a start to provide eligible solutions. Troubled interaction in urban centers with the natural environment has come to define the way of life in the KRI cities and places. Water policy has not incorporated the other defining factors that have an equal impact on water and the environment into its policy regime either. From this thematic standpoint, KRI must bring water security at the center stage of policymaking in relation to other key environmental factors to improve quality of life at all scales as per the individual needs of KRI urban centers.

Water Resources in the KRI

Background: Iraqi Kurdistan have an abundance of Surface and underground water, and natural springs. Annual high precipitation rates contribute to surface and underground water supply, though vary across geographical locations. Daily water production is estimated at 3 million and 100, 000 cubic meters[7] distributed via 20 water stations, 5412 wells, and 861 Springwater wells in the KRI, according to official sources from the KRG. The annual rainfall rate is between 300 and 1000 mm,[8] with Sulaymaniyah Province usually receiving the largest share according to data provided by the KRG's General Directorate of Meteorology and Seismology at the Ministry of Transportation and Communications. Water demands of

various sectors are categorized over the agricultural, industrial, touristic, and the public sector.

Iraqi Kurdistan currently has 23 low, medium, and high dams and 118 ponds with the capacity to store 10 billion cubic meters of water.[9] The most prominent water initiative undertaken by the KRG to address water scarcity issues in the region is the construction of dams and ponds. These dams serve as sources of supply for various purposes, including electricity generation, irrigation, and tourism. Given the severe weather conditions that have plagued the KRI over the past decade and the declining condition of its water infrastructure, it is unlikely that the construction of dams could alleviate water scarcity issues.

Issue: recently, dramatic water loss has occurred across Iraq and the KRI as a result of decreased water levels brought on by damming in neighboring countries. Expected water loss in the two main sources of surface water, Euphrates and Tigris rivers, may reach a level between 50-80% by the year 2025,[10] according to UN estimates. With accelerated urbanization and population growth, water has become an increasingly scarce resource in the KRI. In urban areas, there is widespread overuse and mismanagement of water in all sectors and among urban communities. Over the past decade, the impacts of climate change have resulted in rising temperatures and frequent periods of drought followed by abrupt dust storms. Deficient water infrastructure and lack of policy regime contribute to the water scarcity issues as well. Insufficient awareness of water-related and other relevant environmental issues, and even denial of climate change by KRI communities, have contributed to the acceleration of water loss in the region.

Overreliance on underground water, particularly for agricultural and industrial purposes, runs the risk of its depletion. This pattern is reinforced by the unauthorized drilling of wells and the use of traditional irrigation methods. Underground water ranks the second source of

the water supply chain for some communities in the KRI, such as Erbil. 1240 to 1270 government water wells[11] throughout the city support the Erbil community, particularly in the scorching summer months when there is no precipitation. According to the KRG Department of Media and Information, in the past two decades, climate change has resulted in a steep underground water withdrawal in Erbil to a depth of 700 meters below the surface and 400 to 500 meters in some other geographical locations in 2023.

Flooding represents another extreme weather phenomenon with the ability to move buildings off their foundations, wash away cars, and in some cases, kill people. Due to climate change, KRI has witnessed record-low rainfall from526.3 in 2012 to 347.1 mm in 2022.[12] However, sporadic heavy rainfall has caused significant damage to the infrastructure of low-lying areas, especially in Erbil which is most affected by deadly flash floods.[13]

Most importantly, **watercourse pollution** intertwined with climate change and lack of adequate sanitation infrastructure underscores extreme levels of reduced water quality. Statistics from the KRG's Water Directorate indicate that only about 10 to 20% of the polluted water are cleaned in the Region. This represents major health risks if a significant portion—about 80% of sewage—is combined with the water supply. Sewage water pollution is a wide-range problem in KRI. For instance, the Tanjaro River, located in the south of Sulaymaniyah, is polluted by the wastewater discharged from residents of the locality and commercial facilities, such as factories.[14] The accumulated contaminated water originates from various sources, including factory waste, byproducts of oil refineries, and cleaning products dumped into the river. These remains ultimately migrate into the lower reaches of the Sirwan River and the Tigris River, where they impact a significant number of communities who rely on these waterways. The absence of sewage and wastewater treatment plants has serious impacts on the food chain and contaminated soil and water reach irrigation channels.

Water governance failure reinforces water-related issues surrounding urban overuse considerably higher than the consumption level for middle-income countries worldwide. According to the World Bank, daily consumption per capita stands at 162 liters while in the KRI it reaches 375-400 liters (estimated for the year 2011), as per statistics from the KRG's Ministry of Planning (MoP). In addition to its inability to formulate effective water policies aimed at reducing daily water consumption, the KRG has also been unable to resolve water loss concerns arising from unauthorized private connections to the public infrastructure and leakages. According to information provided by the Ministry of Municipalities and Tourism (MoMT), the loss of distributed potable water has reached between 50 to 60 %. Issues at the policy-level are part of the water problem where limited information and data impede any attempts to survey, map, or monitor water supply and management to devise an effective water policy in the KRI.

Connecting Water, Energy, Food, and Transport

In KRI, effective water governance at the policy level has been hindered by the absence of well-structured, up-to-date, and accurate data to aid in the surveying, mapping, and monitoring of water-related issues. The primary concern regarding the KRG's approach to water management is that it isolates water-related issues from other critical environmental concerns that require equal attention. Talks should center on how reform and investments in sectors such as water, energy, transportation, and food can work together to make significant environmental progress. With climate change putting an increasing pressure on KRI, integrated policies across these key sectors are crucial to reaching resource security and overall sustainable development. Connecting the dots between water, energy, food, and transport[15] to the bigger environmental theme will lead to better, faster, and more efficient outcomes.

Making advances on environmental issues requires exploring synergies between water, energy, food, and transport given that each of them mutually influence one another. Transport plays a critical role in enabling better outcomes for agriculture, water, and energy sectors. World Bank reports show evidence that efficient, safe, and green transport systems lower costs, reduce food prices, and contribute to food security. Thus, lack of reliable and smart transport systems is part of the equation just as much climate change puts constraints on water supply and agriculture, affecting food production and the overall economy.

Besides, Complementary investments and policies in energy and transport are crucial for the decarbonization of economies while innovative projects focus on desalinating water with renewable energy,[16] creating synergy between water and energy sectors. This leads to joint investments with transport sectors aiming to optimize resources, such as generating electricity from wastewater and biofuels. When these environmental factors are reimagined and put together in one equation, governments could efficiently pool financing and use resources more efficiently. The KRG could benefit from an integral policy regime to address water issues alongside energy, food, and transport[17] for a more sustainable and efficient resource management as briefly indicated in Table 1:

Sector	**Interactions and Influences**
Water	• valuing water infrastructure for: • water storage, use, reuse or supply augmentation. • drinking water, sanitation and related human health aspects. • as an input to production and socioeconomic activity, such as food and agriculture, energy and industry, business and employment.
Food	• water systems integral to maximizing agricultural production: • valuing water as an input to food and agriculture is crucial for sustainable food production. • water scarcity and mismanagement impact agricultural efficiency and food security.

Energy	• water is essential for sustainable energy production: • maximizing industrial production and energy generation • water infrastructures rely on energy throughout its value chain, groundwater extraction, transportation, purification, distillation, distribution, collection and wastewater management and treatment.
Transport	• Efficient and sustainable transport systems are dependent on water resources: • Water for transport: cooling and energy generation • Transport infrastructure for water: investing in agriculture and water security is not sufficient to achieve food security, for instance. Integral policies in logistics networks and supply chains are needed.

Source: UN, World Bank.

Lessons from Sustainable Cities: Water and More

A long-term water policy would require considering the sensitivities of water resources and the wide impact water has on other environmental issues and vice versa. Unsustainable water use in urban areas, agriculture, and industry could be mitigated and adapted to a sustainable-based approach. Sustainable cities use a variety of scientifically proven techniques tailored to the needs of communities. These approaches have been the efforts of years of devising and developing effective water policies in shaping the identity of communities and their relationship with water and other natural resources, as it is an integral part of the everyday life of these communities.

Breeding sustainable cities that center around environmentally sensitive water planning in the KRI cannot be divorced from the study of the water infrastructure already in place. Water management and making good places in urbanized areas is a priority in cities that practice sustainable development. Taking action on sustainability is a pivotal step in light of the data available which expects the biggest global challenges to be climate related. Extreme weather events[18] are the number one global risk in the World Economic Forum Global Risks Perception Survey for 2023-2024.

Specifically, for urbanized populations in less developed countries, it is a challenge to continue development without depleting or damaging the natural resources, according to the UN Department of Economics and Social Affairs. One of the key areas integral to the identity of cities Is water that could be taken as a priority in the design process. A good environment with water and a favorable climate[19] is one of the prerequisites for a city's existence. It is questionable how the KRI cities can be at a level to meet such international standards considering the existing water crisis at urban centers. Water sensitive places require water cycle study from the master planning stage to inform layout and design. Retrofitting Water Sensitive Urban Design (WSUD) is a practical and sustainable solution to address the water crisis in the KRI and bring about the much-needed reform. WSUD improves city life quality while addressing flooding, pollution, and water scarcity issues and building sustainable urban greening infrastructure. In addition to lessons from sustainable cities[20] depicted in Table 2, Water Sensitive Urban Design system is explained in detail below.

Main Themes	**Cities**	**Sustainable Practice**
Water	Melbourne, Victoria, Australia	Healthy waterway strategy since 2000s: • improved water quality • enhanced water security: stormwater harvesting and reuse systems • biodiversity and urban greening • reduced urban heat island effect: green roofs and permeable pavements
Transport	Gothenburg, Sweden Portland, Oregon, US NEOM, Saudi Arabia	65% of the transport uses renewable energy. 25% of workers use public transport, 8% use bicycles for transport. The city will be carbon positive, and powered by clean energy, artificial intelligence, machine learning and predictive analytics.
Food	Helsinki, Finland	Urban farming with allotments across the city, some dating back to 1918. Residents grow food on rooftops and in sack gardens.

Energy	Copenhagen, Denmark	Uses energy supplies in small and sustainable ways. Home to the world's largest and most successful heating systems. Introduced district cooling using the cold water of the harbor.
	Zurich, Switzerland	It has taken strong measures to reduce its carbon footprint and focus on energy efficiency. 80% of the energy utilized by the city comes from renewable sources.

Table 2: Examples of sustainable cities worldwide. Source: Going Green, White and Case,[21] Neom.[22]

Why WSUD?

Water Sensitive Urban Design is a process of planning urban environments to support healthy ecosystems, lifestyles and livelihood through integrating urban planning with the management, protection and conservation of the urban water cycle, according to Australia's National Water Commission, where it has been practiced.[23] WSUD represents an alignment between science and technology to better urban water management practices. Although challenges with existing urban areas in the KRI, such as retrofitting, could be an impediment to adopt WSUD, in the long-run WSUD ensures water security for local governments throughout KRI urban centers. To successfully integrate WSUD, in addition to building political support at provincial levels, environmental impact assessments should be a natural part of the code for sustainable development in the KRI.

According to CIRIA[24] research on WSUD,[25] this approach provides integrated solutions in three main areas: (1) flood risk management, (2) sustainable water use and supply, and (3) the improvement of water quality. The WSUD process is sometimes called sustainable urban drainage system (SUDS), with the former considering the whole water cycle. This system is where climate action and sustainable development meet through establishing an effective

urban form to address issues surrounding drinking water, stormwater runoff, waterway health, sewage treatment and water reuse and recycling,[26] as showcased in the visual below.

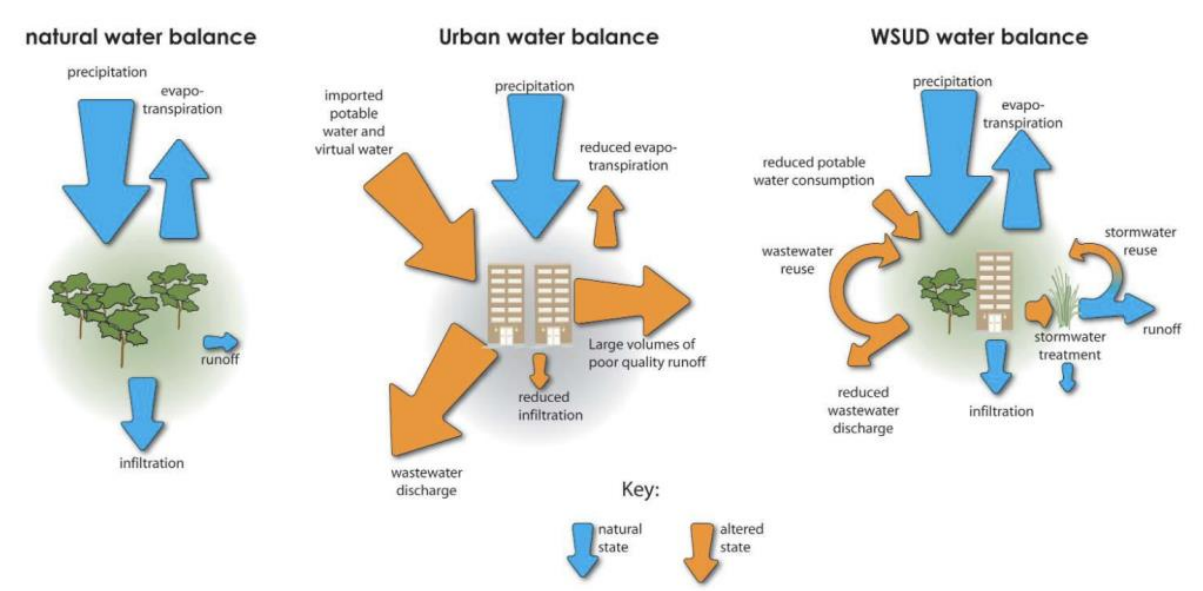

Figure 1: The multiple benefits of WSUD. Source: Susdain.

WSUD Implementation and Benefits

Transforming KRI urban environment through WSUD starts with first rehabilitating the water infrastructure by repairing ponds, parks, waterways to increase their sustainability and climate resilience. What is more important is the application of WSUD as a component of nature-based solution that takes insight from the natural environment collectively, namely soil, water, and plants in response to the diverse environmental, economic, social and climate challenges. A key component in this approach is the application of multi-edge treatment to create access to the natural water cycle.[27] The main purpose of WSUD should be to mitigate flooding, runoff harvesting, water reuse, heat mitigation, and recreational use with added ecological value, as per standardized projects by the Asian Development Bank.

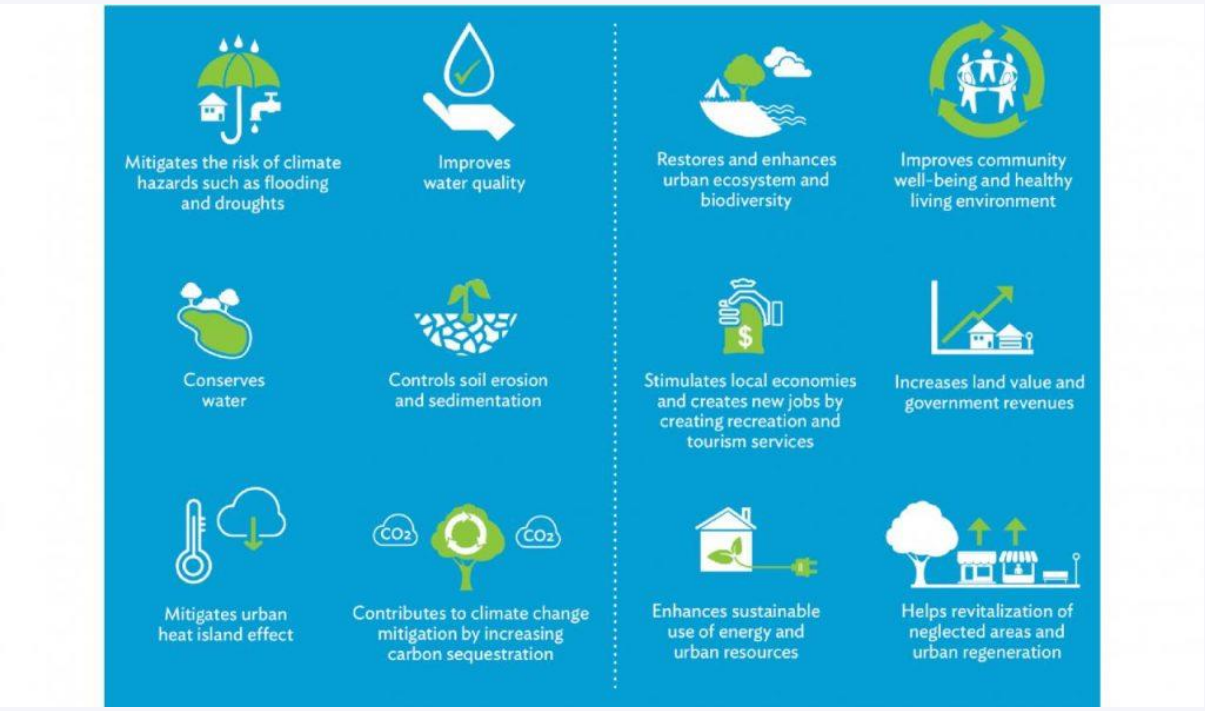

Figure 2: multiple benefits of WSUD. Source: Asian Development Bank.

3 Challenges for the KRI

A volatile geopolitical environment and the absence of an integrated policy regime, both exacerbated by political polarization, threaten to aggravate climate change in the KRI. Addressing environmental issues requires collaborative initiatives and localized cooperation among government leaders, business sectors, and civil society. Declining trust between government stakeholders could factor into dysfunctional policy responses to climate change and the wider array of environmental issues. Above all else, measurable developments can be achieved through the implementation of a comprehensive and inclusive participatory strategy towards sustainable environmental practices. Nonetheless, material obstacles to the environmental policy regime continue to impede constructive reform at every level of local governance. Globally, some of the widespread challenges to environmental reform include:

1. insufficient professional skills and knowledge
2. organizational resistance
3. risk aversion
4. lack of political will
5. limited regulatory incentives
6. unsuitable institutional arrangements
7. a need to establish new cultures across multiple organizations, professions and tiers of government.

Conclusion and Recommendations

Overall, water scarcity and climate change pose substantial threats to Iraqi Kurdistan. Inadequate policies linking water, energy, and food, among other factors, have exacerbated the region's environmental degradation. To address these challenges, integrated development of water, energy, food, and transportation policies and sustainable practices are required. It is imperative that the Kurdistan Regional Government remedy the situation of mismanaged resources and embrace a more comprehensive strategy towards environmental issues. Water Sensitive Urban Design, which has proven effective in enhancing water management practices in different parts of the world, represents a prospective solution. The KRI can mitigate the effects of climate change, improve water quality, and bolster water security through the implementation of innovative strategies such as WSUD.

ENDNOTES

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ABOUT

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