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REPORT

Conservation of Oasis Ecosystems in the MENA Region under Water Stress

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Introduction[1]

The MENA region is characterized by its dry climate, coupled with a lack of freshwater resources and high temperatures.[i] This makes the region vulnerable to the increasing impacts of climate change such as droughts, floods, and desertification. Oases, which are usually formed around natural springs or wells and consist of cultivated areas, palm trees, and traditional settlements, are a vital ecosystem in the Middle East and North Africa. The region hosts the largest number of oases in the world, 66 % of which are located in drylands.[ii] It is estimated that the region has a total of 690 oases: with 180 oases in Algeria, which has the highest number of oasis ecosystems, followed by Oman and Morocco with 168 and 166 oases respectively.[iii] The total area covered by oases in the MENA region is estimated at 1 million hectares of land.[iv] By contributing to water supply, food security, economic development, biodiversity and other aspects, these ecosystems are of great importance for local communities and the ecological balance – even more so under the increasingly tangible effects of climate change in the region.

At the same time, however, these ecosystems are endangered due to the impacts of climate change, particularly water scarcity, but also unsustainable agricultural and water practices as well as the effects of urbanization.

[1] This report is based on the inputs and discussions during a regional dialogue programme on oasis conservation in the MENA region, which took place in June 2023 in Amman, Jordan.

Oasis ecosystems as drivers for socio-economic development

With their breadth of functions, oasis ecosystems play a vital role on national and regional levels in the MENA region with regards to:

- **Water supply:** Oases are typically located in desert regions where water is scarce, making them an important source of water for both people and agriculture.
- **Agricultural and food production:** The presence of water in oases enables agrarian production, which represents a key economic activity in the region, with an estimated fifth of the region's population depending on agriculture for their livelihood.[v] Oases have historically provided a fertile ground for the cultivation of crops, such as dates, olives, and other fruits and vegetables.
- **Biodiversity protection:** Oases in the region support over 400 plant species, 130 bird species, and 50 mammal species, including rare and endangered ones[vi].
- **Cultural heritage and identity:** Oases have played an important role in the cultural heritage of the MENA region. They have been places of gathering, exchange, and trade for centuries, and are closely linked to identity creation for local populations.
- **Tourism:** Oases are also a popular destination for tourists, thus offering an avenue for the development of sustainable economic opportunities surrounding oasis ecosystems.

The continuous functioning of oases as drivers for socio-economic development in the region can be showcased along several examples:

Capitalizing on the potential for agricultural production and related economic development, Moroccan oases have promoted date production, which represents an essential part of Morocco's economy. The country has an estimated number 6.6 million palm trees with a daily production of 1,000 tons of dates covering 60,000 hectares.[vii] In order to maximize the positive impacts of this agricultural production, relevant institutions in Morocco have advanced efforts in order to create new dynamics for agricultural development, which also include the aspects of human and rural development in agricultural strategies for oases.

Another example for the socio-economic development function of oases is the Tafilalt oasis in Algeria, which has been developed into an eco-tourism destination. The manmade oasis was built with the help of the government and the local community, featuring 1,050 households for the local population to reside in and is visited by 6,000 people annually .[viii] The oasis as an eco-tourism spot has helped in the development of the oasis on different levels. Ecologically, the residing local community are required to plant 3 different types of trees, which helps in the sustainability and development of the ecological system.[ix] Economically, all revenues coming from tourism are being allocated to the development of the oasis. The development also involves economic opportunities for the local community to improve their livelihoods. To increase awareness around oasis ecosystems, tours and lessons are given to visitors and locals to increase their knowledge regarding the cultural and historical functions and long-standing importance of oases.[x]

Egypt's Siwa Oasis furthermore showcases the role of innovate start-ups in oasis conservation, in this case by turning challenges facing the oasis, namely heatwaves and forest fires, into a business model and economic opportunities for the local community. Having witnessed regular fires affecting the oasis through the damaging of palm trees and date production,[xi] members of the local

community came up with a method, which recycles the palm trees' waste into three main products: shredded and compacted wood that can be used to make small boxes, treating date seeds and mixing it with coffee mix that could be consumed and turning organic waste into biofuel creating various economic and employment opportunities.[xii]

Climate change induced and man-made threats to oasis ecosystems

Climate change has been affecting ecological ecosystems worldwide, and oases are no exception to this. Extreme weather events have been taking its toll on these ecosystems mainly due to increases in temperatures and fluctuations in precipitation levels.[xiii] Flash floods induced by heavy rains have damaged agricultural production, for example in the Moroccan oases, reducing agricultural output and affecting food security. Moreover, droughts have increased the pressure on water resources, which has led to the over-extraction of groundwater aquifers and the establishment of illegal wells.[xiv] Wildfires, as mentioned above, are another example of incidents affecting oases. Taking the example of Tighmert oasis in Morocco, fires in 2019 had led to the loss of 16% of the total area of palm trees. In the following year, fires caused damages to around 80 hectares of the oasis area. Beyond climatic conditions, human activities have also contributed to these wildfires, through the littering of waste and debris, which present additional fire hazards.[xv]

Another instance of man-made threats to oasis ecosystems lies in unsustainable agricultural practices, which are causing the degradation of agricultural lands and are affecting water and soil quality, thus impacting agricultural output.[xvi] Pollution due to the overuse of pesticides and fertilizers in agriculture have negatively impacted the ecosystems, disrupting hormonal systems of people and the wildlife (animals and plants) – with the further danger of fertilizers' run-off affecting other water resources connected to the oasis.[xvii]

In addition, the unsustainable management of water resources, particularly the overexploitation of available water resources for agriculture and household supply, endangers oases ecosystems in the region. The Azraq wetland in Jordan, historically recharged by four main springs, diminished to only 10% of its original size after these springs dried up in the early 1990s due to extensive overexploitation of the groundwater resources for both domestic use and groundwater-based agriculture (as well as decreasing recharge from upstream sources due to dams).[xviii] In Tunisia, the increasing capacities for renewable energy production – at first glance a positive development – has been misused in some cases to pump and overexploit available water resources through illegal wells. These wells are estimated to extract around 250% over safe yields from oasis groundwater[xix]. Beyond endangering water resources and oasis ecosystems, this also presents a waste of renewable energy, which could otherwise be utilised in a more productive and sustainable manner.[xx]

Furthermore, the rapid urbanization and expansion of urban areas within and surrounding oases have led to the replacement of green and agricultural lands with new buildings, diminishing the available arable land within it and posing a threat to the existence of oases.[xxi] In the example of Oman, this threat can be clearly showcased, with the rate of change surrounding the oasis outpacing the rate of adaptation – leading to a situation in which the ecosystems are lagging behind and are thus facing dangers for their preservation.

Oasis conservation approaches in the MENA region

Being faced with this myriad of threats, conservation efforts of oases ecosystems can be seen throughout the MENA region, both relying on traditional methods of conservation and innovative approaches.

Regarding traditional conservation approaches, the case of Oman with its so-called Aflaj system, a traditional water management system for oases that is still being used today, can provide an interesting example. The Aflaj system presents a holistic system, combining four main axes – environmental, socio-economic, engineering as well as culture and heritage – in an interlinked manner. By balancing the different aspects, this approach allows the ecosystem as a whole to work in harmony – since failure in one causes the failure of the whole ecosystem.[xxii] When managed and maintained properly, the system ensures water being supplied and used in the right place, time and amount while maintaining a constant "cash flow" to ensures continued supply, management, maintenance and wages.[xxiii]

The Aflaj system furthermore shows adaptability in response to changing surrounding ensuring its stability. This system prioritises domestic use of water to the local community and then utilising water recycling and water reuse to support the agricultural sector. Another example of the system's adaptation is response to drought conditions by adjusting the water flow in the crop system based on the availability of water resources in each season.[xxiv] This dynamic approach enables efficient water management in response to varying environmental conditions such as droughts.

Learning from this historically developed sustainable management system and using its adaptability to take into account new challenges due to climate change and demographic changes as well as new potentials offered by technology, the Aflaj system can serve as successful model for oasis conservation, which leverages the ecosystem's environmental, societal and economic benefits.

Morocco has put the emphasis in its oasis conservation efforts on governmental policies, to promote the protection and sustainable development of oasis ecosystems as public policy priority, both at the institutional and civil society levels. To this end, oasis preservation was institutionalized through the *Agence Nationale pour le Développement des Zones Oasiennes et de l'Arganier* (ANDZOA).[xxv] The agency seeks to include all stakeholders in order to develop an integrated program for oasis regions composing of different sectors operating at the national level. Simultaneously, it seeks to increase awareness among visitors and citizens about the importance and fragility of these ecosystems. Most importantly, the agency has been acting as the technical arm for the government in implementing national strategies regarding oasis conservation and development.[xxvi]

The central strategy in this regard is the National Strategy for the Development and Rehabilitation of Oases in Morocco (*Stratégie Nationale pour la sauvegarde et la protection des oasis marocaines*), which was developed by the government in 2002. Based on an analysis of the major challenges to Moroccan oasis, the strategy focuses on issues of water management, agriculture, tourism, urban policy and cultural heritage within the broader context of sustainable development and is developing specific models for different oases. One of the main programmes within the strategy is the Sustainable Development Programme for the Tafilalet Oasis, which aims to reduce poverty and desertification, strengthen the regulatory and legal framework, address the degradation of the oasis and enhance the valorisation of natural and land resources.[xxvii] Through its implementation, the programme has improved living conditions for more than 22,000 people of the local community and has created 1,777 job opportunities in addition to maintaining the oasis' ecosystem.[xxviii]

Beyond the National Strategy for the Development and Rehabilitation of Oases, the Green Morocco Plan (*Plan Maroc Vert*) and Green Generation 2020-2023 Strategy (*Génération Green 2020-2030*), underline the role of agriculture in oasis ecosystems, which is considered as a driving force for development in these areas.[xxix] The Green Morocco Plan focuses on two main pillars that are relevant to agriculture in oasis ecosystems: making the agriculture sector an investment-driven

economic field and the support of solidarity agriculture that aims to improve the income of agricultural farmers and to reduce vulnerability in rural areas, enabling small farmers to access financing and subsidies, in addition to benefiting from agricultural training and consulting.[xxx]

Looking towards innovative approaches for oasis conservation, Tunisian oases are adopting the circular economy concept in order to react to the challenge of diminishing agricultural output in oasis caused by increased salinization of freshwater resources.[xxxi] By cultivating fish in large aquariums filled with salty water, the fish can regulate the water quality for later use in irrigation. This innovative approach not only improved agricultural productivity but also created additional income streams within the oasis, contributing to local economic development.[xxxii] The above-discussed business model of recycling damaged palm trees into different products to create revenue stream in the Siwa Oasis in Egypt is another example for innovative solutions used in oasis conservation in the MENA region geared towards incorporating ecological and socio-economic benefits.

Challenges and successes in conservation efforts: the case of Al Azraq wetland

The Azraq wetland is located in the Eastern desert on the Azraq basin. This wetland was and still is known as a major station for migratory birds, fauna and flora diversity and the origin for Al Sarahni Fish. In 1977, the wetland was officially declared as protected area under the Ramsar Convention, and in 1978, the Azraq wetland reserve was established under the Royal Society for the Conservation of Nature (RSCN).[xxxiii] The wetland historically was recharged by four main springs. These springs however dried up in the early 1990s due to extensive overexploitation of the groundwater resources for both domestic use and groundwater-based agriculture, as well as decreasing the recharge from upstream sources through building of several small dams and wells digging. As the natural flow in the wetland stopped, the water catchment area decreased by 90% of its former size. In the mid-1990s, the Royal Society for Conservation of Nature (RSCN) started a rehabilitation project, through which groundwater was artificially pumped to the water catchment. Through these restoration efforts, 10 % of the original size of the wetland has been restored.

The wetland has helped improve the social and economic aspect for the local population of Al Azraq as it is considered as an important touristic spot, it provides job opportunities for locals and incentivizes women to engage in handcrafts and products that are sold in the wetland shop.[xxxiv] According to the RSCN annual report for the year 2022, Al Azraq wetland contributed to around 400,000 Jordanian Dinars to the local community's economy[xxxv]. It also contributes in enhancing the environmental awareness among pupils and university students as it is taken as an example to show the importance of preserving and conserving ecosystems in the desert.[xxxvi]

The conservation efforts of the Azraq wetland and ecosystem are, however, hindered by water allocation and sector priorities, climate change effects and the decrease in transboundary recharge as the pumped recharge is not constant and varies based on the urban and rural domestic demands. Although there is a slow conservation rate, birds continue to migrate, Al Sirhani fish species still exist and the community is increasingly attached with the wetland as they recognise its importance from social and economic perspectives.

Recommendations

Through the expert discussions and lessons from existing oasis conservation efforts in the MENA region, several recommendations were identified. At the same time, the experts stressed on the diverse nature of different oasis ecosystems, which needs to be taken into account when developing policy interventions for their conservation and development. The following aspects and recommendations should thus be perceived as pointers towards potential entry points:

1. Institutionalize oasis management through a dedicated national agency, which is mandated to act as a technical arm for the implementation of governmental and international policies, strategies and plans for oasis conservation. By centralizing the efforts in one organization, the agency can serve as key actor to facilitate and coordinate all related efforts and to translate policies and regulations and implement projects on the ground. The existing model of ANDZOA as dedicated national agency can serve as example in this regard. The feasibility of this approach, however, largely depends on the available capacity by the government and the resources to be dedicated to such an agency.

2. Develop dedicated policies on oasis conservation and management through the relevant ministries in concertation with the national agency responsible for oasis ecosystems (where applicable) within the overall legal and regulatory framework. Having policies specifically targeted towards oasis conservation and management within an established framework acknowledges the importance of oases as part of ecosystems and national economies. This plays a crucial role in protecting and preserving them through effective governance, regulation schemes as well as targeted support.

3. Adopt a participatory approach in policy formulation and project implementation for oasis ecosystems by actively engaging all relevant stakeholders, particularly local environmental leaders and communities. Empowering the local community in policy- and decision-making discussions and establishing regular channels for dialogue and consultation to include their perspectives, expertise, and ideas is essential to ensure a sustainable management of oasis ecosystems, particularly given the distinctive features of different oases.

4. Support the creation of business incubators directed towards sustainability of oasis ecosystems in order to attract youth to entrepreneurship geared towards environmental, economic and social development in oasis environments. The incubators could be a method of fostering innovative approaches and attracting climate finance dedicated to restoration and development of oasis ecosystems.

5. Leverage oasis ecosystems for circular economies which unlocks economic, social, and environmental opportunities through promoting resource efficiency, waste reduction, and the integration of sustainable practices for the oasis ecosystems. This approach fosters economic growth through the development of green industries, while also addressing social and environmental challenges, such as job creation, community resilience, and biodiversity conservation.

6. Support comprehensive data collection on oasis ecosystems to provide up-to-date information necessary to inform policy formulation and evidence-based decision-making. This data should be monitored, validated and easily accessible to policy makers and stakeholders. Different forms of data collection and research, including master and doctoral theses on oasis ecosystems, could contribute to establishing such data bases that could be centralized for access through the dedicated national agencies.

7. Foster formats and platforms for regional and international exchange between experts and local communities to exchange and cross-pollinate experiences, particularly with a view to changed conditions under climate change. Such exchange on shared challenges, best practices and successful conservation models are of great importance to avoid repeating mistakes that have occurred in other countries as well as the foster regional cooperation. On the international level, platforms for exchange dedicated to oasis conservation can serve to amplify the challenges faced by oasis ecosystems and their communities, which are so far not receiving adequate attention in international discussions on sustainable development within the context of climate change.

8. Introduce the concept of the preservation of ecosystems, such as oases, at the early stages in the educational sector through school science curriculum in countries with such ecosystems, in order to increase awareness and knowledge around the topic. This creates a generation that is aware and keen of the importance of oasis ecosystems and their preservation.

About the dialogue programme "Conservation of oasis ecosystems in the MENA region under water stress"

The dialogue programme "Conservation of oasis ecosystems in the MENA region under water stress" was jointly organized 2023 by the West Asia North Africa Institute (WANA) and the Regional Programme Energy Security and Climate Change in Middle East and North Africa of Konrad-Adenauer-Stiftung (KAS-REMENA) in Amman from 5-7 June 2023. The dialogue brought together experts, policymakers and practitioners from the MENA region (Morocco, Egypt, Algeria, Oman, Tunisia and Jordan). The main objectives of the dialogue were to promote exchange of knowledge and best practices on traditional as well as innovative approaches for sustainable management of oases ecosystems and to identify potentials for regional cooperation for the protection and enhancement of oases ecosystems under conditions of water scarcity and climate change.

The attendees of the dialogue ranged from stakeholders from international and regional organizations, such as the Food and Agriculture Organization (FAO) of the United Nations, the Consultative Group for International Agricultural Research (CGIAR), the Regional Center for Renewable Energy and Energy Efficiency (RECREE), the International Union for Conservation of Nature (IUCN), the Stockholm International Water Institute (SIWI), to governmental agencies such as the Jordanian Ministry of Water and Irrigation and Ministry of Environment, and the Moroccan Ministry of Territorial Development, Urbanism and Habitat (*Ministère de l'Aménagement du Territoire National, de l'Urbanisme, de l'Habitat et de la Politique de la Ville*), the Moroccan National Agency for the Development of Oasis and Argan Zones (ANDZOA), Jordanian NGOs such as the Royal Society for Conservation of Nature (RSCN), and Eco Parc Tafilalt Ghardaia in Algeria, as well as academic institution such as the University of Jordan and the University of Nizwa in Oman and local representatives from Azraq wetland.

The first day of the dialogue was divided into four sessions: the first session was addressing the dangers for oasis ecosystems in the MENA region through different lenses ranging from climate change to unsustainable management. The second session gave concrete examples of oasis conservation models, among others in Morocco and Oman, and highlighted also innovative approaches of applying renewable energy and innovative solutions through the example of the Egyptian Siwa oasis. After that, a roundtable gathering various stakeholders from international and national NGOs, governmental bodies and the local community in Jordan offered an opportunity to discuss their role and efforts in conserving ecosystems and managing water resources. The final session of the day was geared towards approaches of utilising and re-valorising oasis ecosystems as drivers of socio-economic development, among others with examples from Algeria and Tunisia.

On the second day, the delegation of experts from Oman, Egypt, Algeria, and Morocco visited Al Azraq wetland to observe the ecosystem firsthand and learn about the progress as well as challenges of the restauration and conservation efforts. During an exchange with representatives of the local community of Al Azraq, among other local elders, political decision makers, entrepreneurs and farmers, the discussions focused on the historical development, challenges and opportunities of the Al Azraq wetland, as well as conflicts of interest surrounding water use. It also offered the opportunity for the delegation to share their knowledge and experiences from their respective oasis ecosystems with the local community, identifying several common challenges.

Throughout the programme, a resounding message was the need for heightened collaboration and knowledge-sharing among countries in the MENA region on the conservation of oasis ecosystems. Presenting important hubs for the mitigation of climate change, provision of food security, safeguarding of biodiversity and enabling socio-economic development, countries of the MENA region should work together towards preserving and sustainably maintaining these ecosystems.

About the KAS Regional Programme Energy Security And Climate Change Middle East and North Africa (KAS-REMENA)

The Regional Programme Energy Security and Climate Change Middle East and North Africa of Konrad-Adenauer-Stiftung (KAS-REMENA) is based in Rabat and implements cross-national projects with reference to the whole MENA region. Its objective is to sustainably strengthen the development and to support the stability of the MENA region in the face of climate change and its consequences. This implies as well to promote cooperation and partnership with the European Union. Instruments for implementing these objectives are cross-country and cross-regional dialogue platforms such as workshops, conferences and dialogue programmes with local, European and international experts. Moreover, policy papers and reports serve to illustrate concepts for regional cooperation around the topics of climate and energy and to raise awareness among decision-makers for integrated, cross-regional solutions concerning the availability and use of resources as well as climate change effects.

About the West Asia North Africa Institute (WANA)

The West Asia-North Africa (WANA) Institute is a non-profit policy think tank based in Amman, Jordan operating under the chairmanship of His Royal Highness Prince El Hassan bin Talal. The Institute works to promote a transition to evidence-based policy and programming to combat the development and humanitarian challenges facing West Asia and North Africa. The Institute has three main pillars: Sustainable Development, Human Security and Social justice all working under the bigger umbrella of human dignity.

The WANA Institute aspires to be a trusted source of knowledge, evidence and opinion, and to provide a forum for open debate for leading researchers and policy-makers in the region. Its mission is to empower the people of West Asia and North Africa with the tools, evidence and platform needed to secure social justice, safeguard human security and promote a green economy.

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Imprint

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