International Water Management Institute

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International Water Management Institute (IWMI)

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**Cover photo**

A farm in Wadi Al-Seer, Jordan. (*photo*: Wasudha Abeyrathna/IWMI)

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## Project

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## Collaborators

International Water Management Institute (IWMI)

International Union for Conservation of Nature (IUCN)

Centre for Environment and Development for the Arab Region and Europe (CEDARE)

Palestinian Hydrology Group (PHG)

Society for the Protection of Nature in Lebanon (SPNL)

## Donor

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# 1. Introduction

*Nature-based Solutions Offer Established Pathways to Climate Resilience in the MENA Region*

In the Middle East and North Africa (MENA) region, climate predictions and other trends indicate that investments in climate adaptation, water security, and related challenges must be made now to prevent catastrophic impacts on both society and ecosystems (World Bank 2023). Recent research predicts accelerated warming in the Levant and Nile Delta regions, where average temperatures are projected to rise approximately 20% faster than the global average (Bergaoui et al. 2024; IPCC 2023). The MENA region is expected to experience temperature increases of 2.5–4 ˚C, accompanied by significant reductions in precipitation and increased drought frequency and severity due to higher evaporation rates and shifting rainfall patterns by mid-century, under high-emissions scenarios (Lelieveld et al. 2016; UNFCCC 2022). These changes will require major adaptation efforts in agricultural practices, water management, and community resilience.

The region faces multifaceted challenges that make conventional approaches to agricultural and water management increasingly inadequate. Rapid groundwater depletion, land degradation, salinization of soil, high energy costs for irrigation, and recurrent droughts are placing immense pressure on both natural and built systems. Additionally, climate change is increasing evapotranspiration rates while accelerating fluctuations and variability in rainfall patterns, further reducing already limited water resources. The situation is further threatened in fragile contexts, where institutional capacity constraints and fragmented governance hinder effective intervention. Increased water scarcity will place a severe burden on agricultural communities, which then increases the probability of wider socio-economic challenges. Climatic stressors will exacerbate broader social challenges for women, hosting communities, and refugees and other vulnerable populations. As such, options for adaptation efforts must consider the need to support sustainable livelihoods in an inclusive manner (UNESCO 2024). These conditions underscore the urgent need for resilient, adaptive, and cost-effective solutions, making the case for Resilient Nature-based Water Solutions (RNBWS) both timely and compelling.

With local economic contexts in mind, it is clearly preferable that solutions are place-based, minimize upfront capital costs, and draw to a high degree on locally produced products and services. Utilizing Nature-based Solutions (NbS) – now widely recognized as best practice in many parts of the world – can offer a range of co-benefits when applied in a localized manner in the MENA region. These solutions can often integrate with, complement, or even replace conventional 'hard infrastructure', which is frequently costly and dynamically inflexible in the face of evolving climate and social pressures. While grey infrastructure typically has fixed capacity and a narrow functional scope, NbS are generally considered adaptable and capable of delivering multiple benefits over time. Their resilience, however, can be context-dependent, and ongoing monitoring and adaptive management are important to ensure effectiveness under changing environmental conditions.

Emerging case studies exemplify their growing value and potential, with increasing regional awareness and capability in implementing NbS. These interventions are recognized not only for addressing core water management challenges but also for delivering co-benefits, such as improved soil health, climate resilience, biodiversity, and community livelihoods, that conventional grey infrastructure alone may not provide.

RNBWS, a concept developed by IWMI through the Al-Murunah project, aims to address both the supply and demand sides of the water equation (Figure 1): enhancing water availability through NbS (e.g., wetland restoration, managed aquifer recharge) while also reducing water demand through improved agricultural water management (e.g., soil moisture retention, efficient irrigation techniques). This review aimed to rapidly identify common themes across regional and national NbS efforts, using a curated sample of existing projects as a lens into broader patterns and potential for scaling.

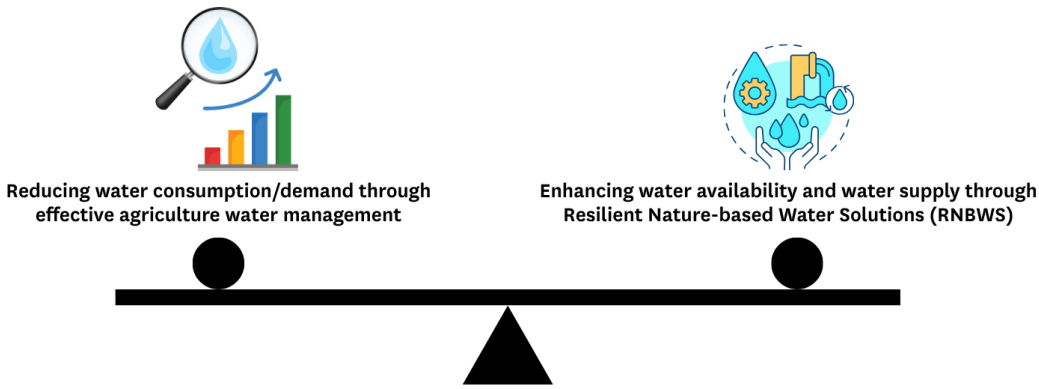



**Figure 1.** Supply and demand side of the RNBWS water equation

Emerging evidence demonstrates that prioritizing NbS tailored to local needs offers a solid investment strategy for enhancing future resilience and prosperity. This report summarizes insights from 23 recent NbS applications across four MENA countries and explores opportunities for mainstreaming such approaches. The Al Murunah project will produce additional analyses of NbS in the MENA region (e.g., Stifel et al. 2026), and this document aims to provide an initial, high-level summary of shared findings to date.

The use of NbS in agricultural contexts is frequently related to improving water management. The following diagram (Figure 2) illustrates how RNBWS responds to specific MENA regional challenges.

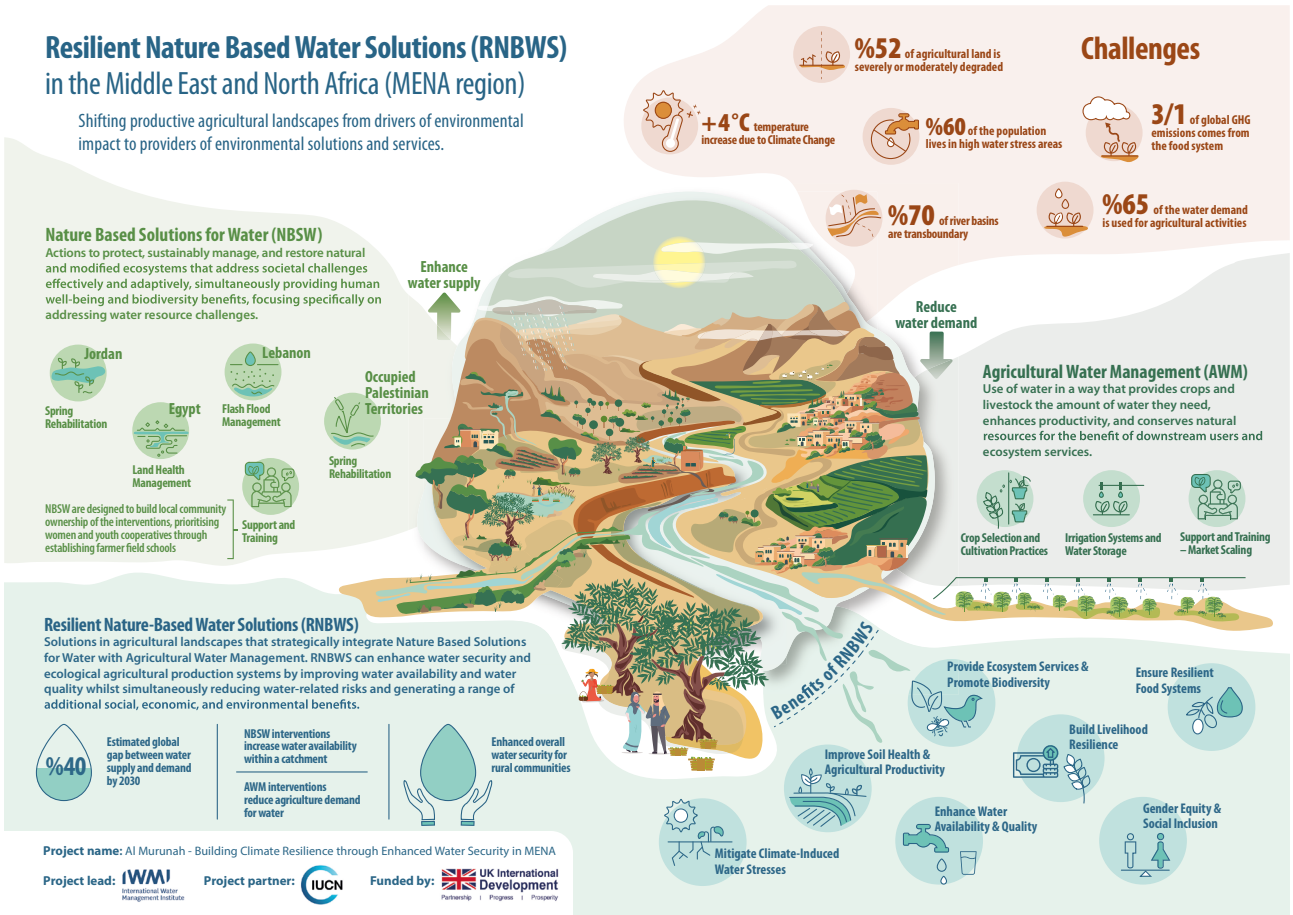



**Figure 2.** How does RNBWS respond to specific MENA regional challenges
*Source:* IUCN (2024)

# What are Nature-based Solutions (NbS)?

While there are multiple definitions of nature-based solutions (NbS) used globally, they all share the common themes of using natural systems to produce both human and ecosystem benefits. The International Union for Conservation of Nature and Natural Resources (IUCN) provides a succinct overarching definition:

*'Nature-based Solutions leverage nature and the power of healthy ecosystems to protect people, optimise infrastructure and safeguard a stable and biodiverse future.'* (IUCN 2025)

As NbS can incorporate a broad range of interventions, more detailed definitions – including an influential definition coined by IUCN in 2016 – establish specific categories of interventions that can constitute NbS. These categories are useful when comparing different NbS case studies. Two of these definitions, included in Box. 1 below, have been used to guide this analysis of cases in the MENA region.

| Box 1: Definitions of Nature-based Solutions | |
|---|---|
| **NbS Definition** (IUCN 2016)<br>*'Actions to **protect, sustainably use, manage and restore** natural or modified ecosystems, which address societal challenges, effectively and adaptively, providing human well-being and biodiversity benefits.'* | **NbS Initiative** (University of Oxford 2025)<br>*'Nature-based Solutions involve working with nature, as part of nature, to address societal challenges, supporting human well-being and biodiversity... They include the **protection, restoration, or management** of natural and semi-natural ecosystems...'* |

An additional category of NbS that is becoming more widespread is the use of 'created' or artificial natural systems, for example, constructed wetlands. The following diagram (Figure 3) summarizes the relationship between these strategies and the broad range of benefits that they can produce.




**Figure 3.** Relationship between NbS strategies and co-benefits.
*Source:* Seddon et al. (2021)

# 2. Evidence on Current NbS Applications in MENA

At present, there is limited academic literature documenting *explicitly framed* NbS case studies in the MENA region. However, recent scholarship indicates significant applications of NbS in the agricultural sector (Gebrael et al. 2024) and in wastewater management (Masoud 2023). Importantly, this gap in the formal literature does not mean the absence of NbS in practice. In fact, many long-standing, community-based, and Indigenous adaptation practices across the region, such as traditional water harvesting, agroforestry systems, rangeland stewardship, and communal irrigation structures, closely align with the IUCN (2016) and Oxford NbS Initiative definitions of Nature-based Solutions. These practices often deliver ecosystem restoration, water regulation, and climate resilience benefits, even if they are not officially labeled as NbS in academic or policy documents.

Documenting traditional systems comprehensively would require a dedicated cultural-ecological review, including historical sources, ethnographic evidence, and site-specific validation, none of which were readily accessible within the scope and timeline of this rapid review. Because many of these practices vary significantly across countries and communities, and because high-quality, standardized data on their current implementation status is limited, incorporating them meaningfully would have required a broader methodological framework than the one used here. While high-quality, systematically collected data on these interventions remains limited, anecdotal evidence and reports by international organizations (e.g., WOCAT 2025) indicate that both traditional practices and newer innovations are widespread and are generating meaningful environmental and socio-economic benefits across the region.

For this review, we focused on interventions for which partners could provide verifiable, up-to-date information. This allowed to ensure accuracy and comparability across case studies, and to draw conclusions that are directly supported by available evidence. Nonetheless, the study fully acknowledges that traditional systems represent a rich and significant body of NbS in the region, and their exclusion is not due to lack of relevance but rather due to practical constraints in data availability for this specific exercise.

As part of the Al Murunah project's effort to support the uptake of RNBWS, partner organizations undertook a semi-structured review of NbS case studies related to water security and other sectors in Egypt, Palestine, Jordan and Lebanon. The purpose of this exercise was to build a greater understanding of common themes across regional and national NbS efforts from a limited sample of known projects.

The interventions included in this review were identified through a purposive sampling process followed by an expert-informed selection process, drawing on partners and practitioners who held direct knowledge of ongoing NbS activities and could access supplementary information and data. This method was chosen because, across the MENA region, there is no centralized or comprehensive database of NbS interventions, and many relevant initiatives, especially community-led or small-scale efforts, remain undocumented in academic or grey literature. Leveraging expert insight, therefore, provided the most practical and reliable way to capture a cross-section of initiatives that reflect the diversity of NbS currently being implemented. While this approach offers sufficient evidence to identify common patterns, opportunities, and enabling-environment gaps, it also has limitations: it is not exhaustive, omits emerging or undocumented cases, and does not allow for a fully representative regional inventory. Cases identified illustrate a wide range of intervention types.

For the purpose of comparing and summarizing case studies within the MENA region, we chose to adopt the categories of interventions used by the Nature-based Solutions Initiative's case study platform (University of Oxford 2025). This global repository of NbS examples classifies cases based on the following intervention types:[1]

- Restoration – restoring the form and/or functions of natural or semi-natural ecosystems.
- Protection – site-specific protection of natural or semi-natural ecosystems.

[1] These definitions of intervention types have been abbreviated.

- Management – natural or semi-natural ecosystem management other than restoration or protection.
- Food production – using ecosystem functions and services to maintain or enhance food production.
- Created Habitats – establishing, protecting or managing new/artificial ecosystems.

Of the 23 case studies identified by Al Murunah country partners, just under half of the examples fell into the broader 'management' category, with the remaining 13 cases distributed reasonably evenly among the other categories. This suggests that there is good awareness regionally of diverse NbS strategies, and creativity and capability among professional circles in tailoring approaches to meet specific, place-based challenges. Noting the broad range of intervention types is salient for governments and those looking to fund future interventions as it suggests there is a sufficient baseline of understanding and capability within the region to be able to plan and execute a wide range of intervention types.

Figure 4 indicates the types of observed cases that fall within these categories.

| Restoration | Protection | Management | Food production | Created habitats |
|---|---|---|---|---|
| • Mangrove restoration<br>• Green infrastructure restoration<br>• Afforestation with native tree species | • Erosion reduction measures (gabion walls etc.)<br>• Evaporation reduction measures (eg. Dam lake covering) | • Riverbank filtration for drinking water<br>• Biological control for weed management<br>• Artificial aquifer recharge<br>• Wastewater/greywater treatment and reuse<br>• Rainwater harvesting | • Biological/environmental control for pest species<br>• Biological waste composting and fertilizer/ biogas production<br>• Climate-smart agriculture practice education (including climate resilient crop selection) | • Constructed wetlands<br>• Coastal green infrastructure |

**Figure 4.** Categorization of observed NbS cases.
Source: Authors (2026)

# Problems Being Addressed Successfully Through NbS

While the types of NbS approaches identified were quite varied among the case studies, the underlying drivers for these interventions illustrated one clear, dominant regional challenge: issues related to the climate-water-food nexus. The majority of interventions analyzed here were driven by either a loss of food production or the need to enable additional food production in the face of climate impacts and related water quantity and quality challenges. This was true both for threats to large-scale agriculture and the need to enable subsistence farming in a range of contexts. This finding is consistent with a recent academic literature review, which confirmed the bias toward focusing on the use of NbS in agricultural contexts across the region (Gebrael et al. 2024).

Unsurprisingly, challenges related to food production are natural entry points for considering NbS. In regions where water scarcity is the dominant constraint on agricultural productivity, NbS offer an opportunity to not only enhance water availability and soil health but also generate broader co-benefits such as increased ecosystem resilience, biodiversity, and reduced input costs over time. Unlike traditional engineering interventions, which often focus on single-function outcomes like irrigation infrastructure or chemical subsidies, NbS can support sustainable intensification by working with natural systems to maintain productivity under stress. The business cases for NbS in agriculture are often more tangible and politically attractive, particularly when they help secure marketable commodities and address critical food security needs, especially in fragile and conflict-affected contexts. Case-study evidence suggests that both governments and donors increasingly see food-related NbS interventions as high-impact and integrative, making them a preferred entry point for funding.

Across the case studies, gender, equality, and social inclusion (GESI) dimensions also emerged as a recurring cross-cutting concern, even where they were not the primary driver of an intervention. In Jordan's Zarqa Ma'in Basin,

the explicit targeting of Syrian refugees alongside host community members in job creation reflects a deliberate effort to address equity in access to livelihood opportunities (FAO 2023). In Lebanon, the Shouf Mountain project identified rights, empowerment, and equality as a core challenge, working to economically empower local farmers including women, while promoting social cohesion between neighboring communities (Lebanese Environment Forum 2025). These examples suggest that NbS in the MENA region are increasingly being designed with inclusion in mind, though GESI considerations remain underdeveloped as an explicit program objective across the wider dataset. Strengthening GESI integration from the outset in design, implementation, and monitoring represents both a gap and an opportunity for future investments.

After food production, managing community-level conflict, supporting improved public health outcomes, and managing wider environmental degradation (and the loss of their related ecosystem services) were the most common drivers for this sample of cases. A full breakdown of challenges coded can be found in Annex 1. It is worth noting that despite the disproportionate focus on food systems, there is a significant opportunity for future investments across a much wider range of regional environmental and socio-economic challenges.

Figure 5 illustrates the hydrological basin divisions across the Middle East and North Africa (MENA) region, displayed in semi-transparent pastel shades. Superimposed are the 23 NbS project locations, categorized according to the Oxford classification framework (Restoration, Protection, Management, Food Production, and Created Habitat). Each category is represented by a distinct colour, with the legend providing clarification. Basin boundaries are delineated in black, providing geographic context for the distribution of interventions. The map covers Egypt, Jordan, Lebanon, and Palestine at an approximate scale of 1:5,000,000.

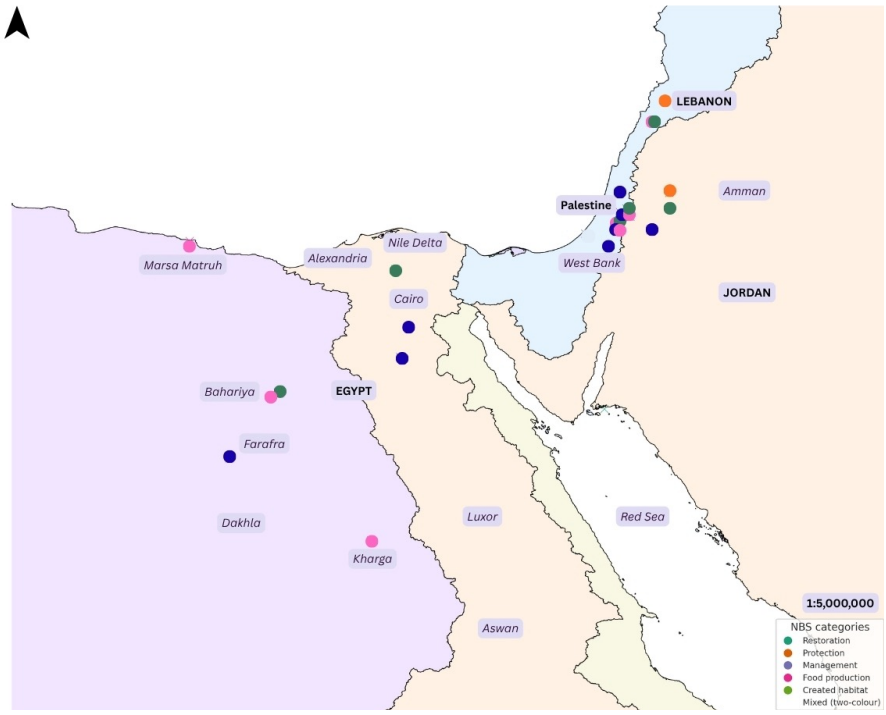



**Figure 5.** The geographical distribution of the analyzed case studies and their classification according to the Oxford NbS initiative. Source: Authors (2026)

*Note:* HydroBASINS delineation of the Nile: Delta sub-basin (beige), upstream Lower Nile/Western Desert basins (lavender), and Eastern Desert/Red Sea drainage (light yellow)[2].

[2] The HydroBASINS dataset applies the Pfafstetter coding system to subdivide river systems into nested sub-basins to ensure consistent global coverage of drainage areas and allows for upstream–downstream connectivity analysis. For the Nile, it distinguishes the Delta as a terminal sub-basin draining into the Mediterranean (beige), the upstream Lower Nile Valley/Western Desert catchments (lavender), and the Eastern Desert/Red Sea drainage (light yellow). This separation reflects the Delta's distinct hydrology compared to the upstream valley. HydroBASINS show distinct hydrological characteristics of a terminal delta from those of the upstream valley (e.g., distributary channels, coastal drainage, and local inflows)

Finally, it is important to note that despite the clear trends in primary drivers above, over 90% of the cases reviewed were attempting to address multiple challenges simultaneously. NbS are valuable precisely because they often can be designed to provide significant co-benefits to both people and ecosystems, and are uniquely positioned to tackle complex, multifaceted problems. This was clearly recognized in the cases identified by partners, which were effectively using the flexibility of NbS to design more holistic interventions, benefiting both biophysical and socio-economic outcomes at once. The case-study summaries below (Figure 6) provide several examples that illustrate this.




**Figure 6.** Number of simultaneous challenges addressed by a single intervention
*Source:* Elizabeth Stifel (2026)

# Evidence on the Value Proposition of NbS Interventions

## *Global Evidence on NbS Value Proposition*

Globally, evidence on the economic value proposition of NbS is growing, with an increasing number of studies illustrating the generally positive returns on investment across a wide range of NbS strategies, including river and wetland ecosystem restoration, urban green infrastructure, and the use of NbS in agriculture (Arfaoui & Gnonlonfin 2019; Bockarjova et al. 2022; Seddon et al. 2021). At a global scale, a 2024 report from the Green Growth Knowledge Partnership and the United Nations Environment Program estimated that the return on investment averages around 20:1 for every dollar spent on improving natural capital in pursuit of the Sustainable Development Goals (GGKP 2024)[3]. These returns, however, often reflect broad societal and ecosystem-wide benefits, which may not always accrue directly to individual investors or be directly comparable to returns from built water infrastructure or agricultural investments. This highlights the importance of considering both financial and non-financial benefits when assessing investment choices.

## *Regional Insights and Case Studies*

Evidence from other parts of the world can also offer valuable insights into the types of interventions observed in the MENA region. For instance, managed aquifer recharge (MAR), a solution that combines hydrological engineering with natural infiltration processes, has shown measurable success in the Ramganga basin of India. Research led by Paul

[3] While activities to improve natural capital are not always NbS, there is considerable overlap between these two categories of interventions.

Pavelic at IWMI demonstrated that MAR interventions in this basin enhanced groundwater recharge rates by 3–8%, contributing to the stabilization of groundwater levels and improving water availability for agriculture (IPCC 2023).

Some benefits of Nature-based Solutions (NbS), such as reduced infrastructure costs or improved agricultural returns, can be quantified in specific contexts, though their value often depends on scale, design, and local governance (Raymond et al. 2017; FAO and UNEP 2021; WWF and IUCN 2020). For example, riverbank filtration systems in Egypt delivered water quality outcomes comparable to conventional treatment at lower operational cost, while bio-waste management initiatives in Palestine reduced waste disposal pressures and generated energy or fertilizer for local use. Agricultural interventions in Lebanon, such as terracing and soil conservation, contributed to reduced erosion and improved water efficiency. However, economic comparisons with conventional solutions are still emerging and not always straightforward (TNC 2016; WWAP 2023). Other benefits, such as reducing social conflict within a community, are more difficult to quantify or monetize but are still highly valuable.

The costs of implementing NbS are also extremely scalable, which makes them potentially more accessible in some local contexts. In Palestine, the interventions reviewed ranged in cost from USD 50,000 for a small-scale bio-gas and hydroponic system to USD 15 million for a nation-wide climate-smart agriculture program. As such, investments at almost any scale can have a meaningful impact on local communities. Access to finance at the smaller scale does continue to be a challenge for local communities and is an area where future financing options could be focused to increase NbS uptake.

## *Funding and Project Complexity*

To assess the comparative implementation demands of RNBWS, *a Complexity Index* was developed based on five key criteria: technical requirements, environmental impact, scale of intervention, implementation and management challenges, and presence of multi-component solutions. These criteria are widely recognized in the literature as relevant for evaluating the adaptive capacity and feasibility of environmental infrastructure projects.

Technical requirements refer to the scientific and engineering sophistication necessary to design and implement the solution. Projects that demand specialized equipment, detailed hydrological assessments, or precise calibration typically score higher (Pahl-Wostl 2006). The scale of intervention reflects whether the solution operates at a household, community, or watershed level, acknowledging that larger scales often involve more coordination and governance complexity (UNEP 2022). Environmental impact considers the extent to which the intervention alters or restores ecological processes, contributing to ecosystem services (Cohen-Shacham et al. 2016).

Implementation and management challenges encompass logistical, institutional, and social barriers to project rollout, such as community buy-in, regulatory hurdles, and operation and maintenance requirements (WWAP 2018). Finally, multi-component solutions recognize that interventions integrating multiple functions (e.g., combining wastewater treatment with irrigation reuse or aquifer recharge) often require higher coordination and technical synergy, adding to overall complexity (Nesshöver et al. 2017).

This multidimensional approach helps decision-makers and stakeholders compare diverse NbS projects on a consistent basis, offering insight into the level of effort, investment, and support required for successful outcomes.

The analysis reveals a pattern where projects with higher complexity levels tend to align with larger funding volumes. Specifically, projects rated with a Complexity Index of 5 are primarily found in the highest funding category, above USD 10 million, demonstrating that highly intricate initiatives often demand substantial financial investment.

At the same time, a notable concentration of moderately complex projects (Complexity Index of 3) exists within the Below USD 1 million funding range. Projects such as Mangrove Restoration, Riverbank Filtration, and Biogas and Hydroponic

Combinations show that practical, medium-complexity solutions can be effectively executed with relatively modest budgets. This reflects an opportunity for impactful interventions that balance financial feasibility and technical challenge.

Furthermore, the analysis highlights that simpler projects with low complexity (rated 1 or 2) are consistently aligned with minimal funding needs. Examples like Greywater Treatment and Solar Energy for Water Pumping underscore how small-scale, low-cost initiatives can still deliver valuable results, particularly in community-focused or early-stage projects.

The overall pattern—that higher complexity tends to align with larger funding—is not without nuance. The relationship is not strictly linear, and some variation is likely explained by factors beyond technical complexity alone. Geographic context, for instance, plays a meaningful role: labor costs, institutional capacity, access to local materials, and the degree of community involvement all differ significantly across the four countries covered in this review, and can substantially affect how much funding a given level of technical complexity requires.

In Palestine, for example, the Constructed Wetland and UASB (Up-flow Anaerobic Sludge Blanket) project achieved a Complexity Index of 5 within a USD 1–3 million funding range, which is lower than comparable complexity projects elsewhere in the dataset. This may reflect the extensive involvement of local implementing partners (PHG), established community-based delivery mechanisms, and lower operational costs in the local context, rather than any inherent efficiency of design per se. Further unpacking of the cost drivers behind individual projects would be needed before drawing conclusions about design efficiency. What the data does suggest, however, is that funding constraints are not automatically a ceiling on ambition and that contextual factors, including geography, governance arrangements, and community capacity, warrant closer attention when planning and comparing NbS interventions across the region.

Figure 7 illustrates the scales of funding and project complexity across the case studies explored.




**Figure 7.** Project complexity vs. Funding categories.
*Source:* Wasudha Abeyrathna (2026)

*Note:* Bubble size reflects relative funding volume where known. Cases with unknown funding are shown as outline circles positioned at the median funding band for their complexity level. Complexity Index (1–5) is derived from five criteria: technical requirements, environmental impact, scale, implementation challenges, and multi-component design.

## *Economic and Governance Challenges*

While data on the monetized benefits and costs was not available for every case reviewed, several cases illustrated significantly reduced upfront costs when compared to estimates for applying hard-infrastructure solutions in the same context. In one case, using nature-based Riverbank Filtration Systems to improve the quality of drinking water along the Nile River translated to a 93% cost savings up front. The examples below show how NbS can offer more accessible interventions early on, though managing them across landscapes with broad community involvement can pose governance challenges. While long-term costs may be lower, securing financing for NbS often remains harder than for conventional infrastructure.

In order to build a more detailed understanding of long-term return on investments, future studies should seek further information on expected lifecycle costs and the longevity of the benefits expected from these interventions.

**Case Study A: Using nature-based filtration systems to address drinking water challenges in Egypt**

In several sites in upper Egypt, green infrastructure in the form of riverbank filtration (RBF) systems are being applied to improve access to clean drinking water for small communities. These installations use groundwater processes and vegetated systems to remove turbidity, bacteria, parasites and most other contaminants from community drinking water sources, without the need for chemicals. These systems help achieve water security, public health and environmental benefits and can be implemented at a significantly lower upfront cost compared to installing traditional filtration plants.

In the case of the city of Sohag, 25 RBF units were installed for approximately USD 335,000, while the costs to install a conventional treatment plant for local communities had been estimated at over USD 4.9 million. By applying the NbS strategy, the local government reduced the upfront capital investment required by 93%. The RBF units delivered comparable water quality to conventional systems for microbial and physical parameters and served a similar number of beneficiaries, making them a cost-effective and efficient alternative (Wahaab et al. 2019).

**Case Study B: Constructed wetlands for wastewater treatment in Palestine**

In Palestine, constructed wetlands have been piloted as a cost-effective and environmentally sustainable approach to wastewater treatment in rural and peri-urban communities. Conventional wastewater management in many parts of Palestine is challenged by limited infrastructure, high operational costs, and water scarcity, which creates a strong case for Nature-based Solutions. Projects implemented since the early 2000s have demonstrated that constructed wetlands can effectively treat domestic and greywater to standards comparable to conventional systems, particularly for microbial and physical parameters, while also requiring lower energy inputs and simpler operation (Masi et al. 2022; BERC n.d.).

Beyond water quality improvements, these systems provide multiple co-benefits. Treated water has been reused for irrigation, reducing reliance on freshwater withdrawals, and nutrient-rich effluent has helped substitute chemical fertilizers, lowering input costs for farmers (Haddad and Jumma 2018). Wetlands also help mitigate localized pollution, reduce health risks, and support ecosystem services such as habitat provision and groundwater recharge. While long-term monitoring is still limited, existing pilots in Palestine and neighboring regions indicate that constructed wetlands can deliver resilient, scalable, and community-appropriate alternatives to conventional wastewater treatment systems, positioning them as strong candidates for wider adoption within NbS portfolios.

**Case Study Overview**

Across the 23 projects implemented in Egypt, Jordan, Lebanon and Palestine, the case studies reviewed reveal a wide range of environmental and social benefits that frequently extend beyond the original goals of each intervention. The examples below draw on the full dataset summarized in Annex 1, with selected projects highlighted for illustration.

On the environmental side, many of the interventions have helped restore damaged ecosystems, improve biodiversity, and make landscapes more resilient. In Egypt, for example, restoring native mangroves along the coast has not only protected the shoreline from erosion but also brought back important wildlife habitats (SEA 2022; Waleed et al. 2025). In Lebanon's Shouf Mountains, reforesting hillsides and building terraces has reduced soil erosion and helped preserve biodiversity that was under threat (Alessio et al. 2022; IUCN 2025). Water-focused projects, such as the riverbank filtration systems in Sohag and the artificial recharge efforts in Gaza and Sanour, have helped communities access clean water in a more sustainable way (Osman et al. 2022; Shebl et al. 2022; UN-Habitat 2020). These systems use natural processes to purify water and are often more cost-effective and energy-efficient than traditional treatment plants.

The social benefits have been equally significant across the dataset. Many projects created jobs, supported local farmers, and strengthened community ties. In Jordan's Zarqa Ma'in Basin, hundreds of short-term jobs were created for both local Jordanians and Syrian refugees, helping improve livelihoods and boost community stability (FAO 2023). In Lebanon, farmers learned more sustainable ways to grow food and manage water, which not only improved their yields but also reduced pressure on natural resources. In some areas, like Anjar and Kfar Zabad, the projects even helped build better relationships between neighboring communities, showing how working together on environmental issues can also promote social cohesion (Lebanese Environment Forum 2025).

# 3. Conclusions

*Opportunities for advancing the application of NbS in the MENA region*

The case studies identified through Al Murunah's review illustrate that there is a wide range of current NbS interventions in the MENA region and signal a strong case for further investment. NbS are increasingly being applied across the region, and local capacity to design and implement them is steadily growing. Still, the evidence base is nascent, with many case studies relatively recent. These experiences demonstrate both the potential for scaling and the need for continued evaluation of their long-term efficacy and resilience. Expanding the use of NbS is a clear opportunity for efficiently producing a wide range of environmental and socio-economic benefits. Across the four countries involved in the Al Murunah project, the 23 case studies reviewed showed how environmental degradation and socio-economic wellbeing are inextricably linked in this region, indicating that efforts to restore, protect, and manage natural systems can quickly create tangible returns on investment for local communities.

Across the case studies, some common challenges stood out in the existing regional 'enabling environment.' These challenges include access to seed capital to initiate new interventions (particularly at the smaller scale), poor baseline understanding of environmental conditions, and a lag in developing policy frameworks that support these approaches. Once initiated, issues around GESI also hampered implementation. These are core challenges that government and donor communities can actively help address.

Regarding key opportunities for further investment, there is currently considerable momentum within the agricultural sector to apply NbS, and further investment here could support the mainstreaming of practices such as climate-resilient crop selection, pest management, improved soil, water, and waste management, solar-powered systems, and inter-cropping. While investments in the agricultural sector do yield valuable benefits, there are also many other challenges facing the region that NbS are well placed to address.

Emerging areas include using natural systems for water and wastewater filtration and reuse, reducing soil salination and desertification, and using green infrastructure for flood protection and other areas of disaster risk management. While expanding the range of challenges addressed through NbS can enhance social benefits, the agricultural sector remains a critical starting point for intervention in the region, given its potential and the severe constraints posed by water scarcity.

With improved upfront funding and promotion through local policies, the MENA region is well placed to mainstream NbS as standard practice. The evidence observed on the ground over the course of IWMI's Al Murunah project indicates that locally tailored NbS deliver substantial environmental, social, and economic benefits. These advantages make a strong case for routinely incorporating NbS into strategies for addressing water-related challenges in the decades ahead.

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# Annex: Summary tables of case study analysis.

**Table A1.** Summary Data on Intervention Types

| Country | Restoration | Protection | Management | Food Production | Created habitats | Total |
|---|---|---|---|---|---|---|
| Egypt | 2 | 0 | 3 | 2 | 1 | 8 |
| OPT | 0 | 0 | 6 | 2 | 1 | 9 |
| Jordan | 1 | 1 | 1 | 0 | 0 | 3 |
| Lebanon | 0 | 1 | 0 | 1 | 1 | 3 |
| Total | 3 | 2 | 10 | 5 | 3 | 23 |

**Table A2.** Coding of case study problems/challenges addressedTypes

| Type of problem/Challenge | Egypt | OPT | Jordan | Lebanon | Total |
|---|---|---|---|---|---|
| Loss of food production/need for new food production | 6 | 7 | 1 | 1 | 15 |
| Threat to livelihoods/local economies | 6 | 5 | 1 | 1 | 13 |
| Environmental degradation | 4 | 2 | 2 | 2 | 10 |
| Reduced water supply/drought | 3 | 2 | 2 | 1 | 8 |
| Conflict/Security | 0 | 7 | 0 | 1 | 8 |
| Public health | 2 | 5 | 0 | 1 | 8 |
| pollution/ contamination | 2 | 4 | 0 | 0 | 6 |
| Increased pests | 3 | 0 | 0 | 0 | 3 |
| Biodiversity loss | 1 | 0 | 0 | 2 | 3 |
| Climate Change adaptation | 2 | 1 | 0 | 0 | 3 |
| Price of inputs/ water | 1 | 2 | 0 | 0 | 3 |
| Natioanal-scale economic challenges | 2 | 0 | 0 | 0 | 2 |
| Coastal erosion/inundation | 1 | 0 | 0 | 0 | 1 |
| Coastal saltwater intrusion | 1 | 0 | 0 | 0 | 1 |
| Freshwater Flooding | 0 | 1 | 0 | 0 | 1 |
| Rights/empowerment/equality | 0 | 0 | 0 | 1 | 1 |
| Climate change mitigation | 0 | 0 | 0 | 0 | 0 |

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