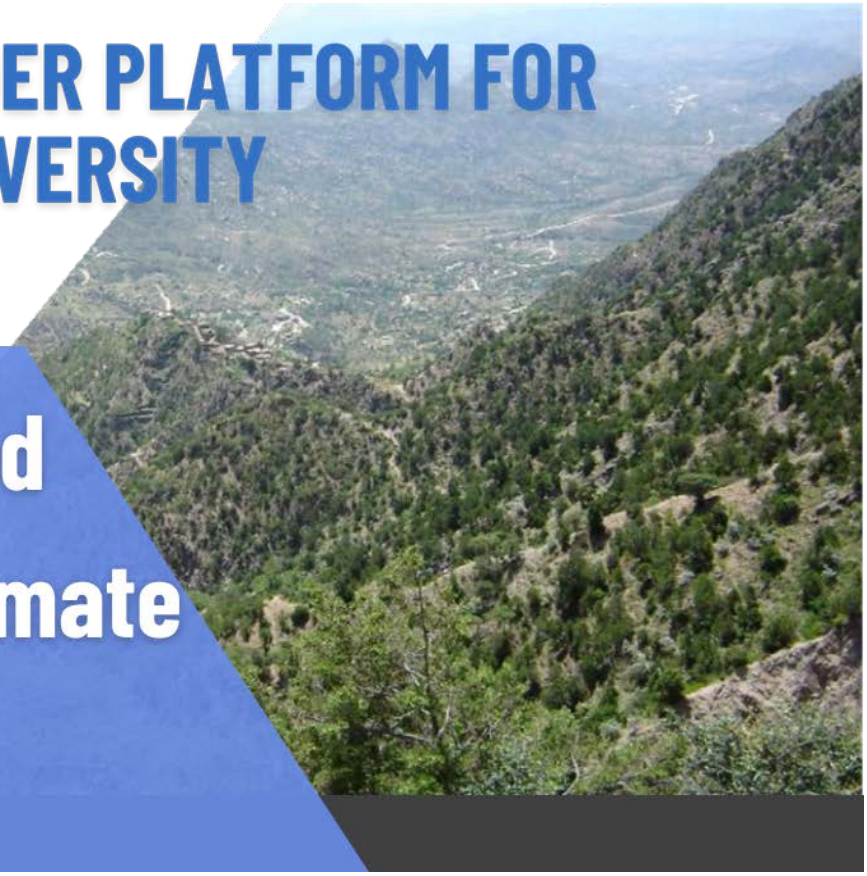
MULTI-STAKEHOLDER PLATFORM FOR PROTECTING BIODIVERSITY



Nature-based Solutions for Climate Resilience

Background

Conserving biodiversity in the Arab region requires collaborative efforts involving various stakeholders operating across different sectors and scales. A common regional platform offers diverse stakeholder groups the opportunity to come together to exchange knowledge and lessons learned, build consensus on regional priorities, and identify pathways to address common priorities.

This multi-stakeholder platform for protecting biodiversity in the Arab region launched by the United Nations Economic and Social Commission for Western Asia (ESCWA) with the support of the Government of Sweden fosters regional engagement for the preparation of projects for mobilizing finance for biodiversity conservation efforts within the context of strengthening climate resilience in the Arab region.

Objectives

- Facilitate collaboration and coordination between stakeholders involved in biodiversity conservation in the Arab region.
- Enhance understanding, exchange and action on regional challenges affecting biodiversity in the Arab region.
- Foster the development of bankable projects to mobilize finance for the implementation of priority actions in biodiversity conservation, for enhancing climate resilience.

Working Group

This technical note informs the discussions of the Working Group on Nature-based Solutions for Climate Resilience. The working group aims to formulate opportunities for pursing nature-based solutions to protect biodiversity and contribute to climate change adaptation, mitigation, and integrated natural resource management.

UNITED NATIONS الاسكوا ESCWA
Shared Prosperity Dignified Life
Sweden Sverige

A. Introduction

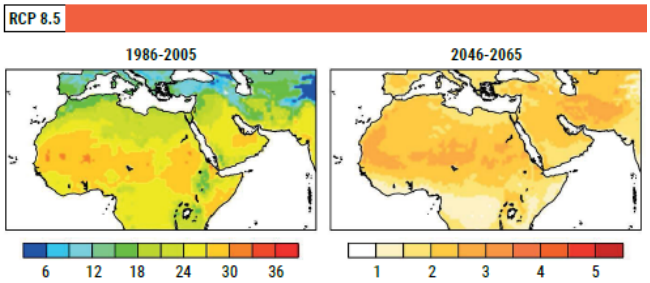
The planet and people are facing a triple planetary crisis posed by the interlinked issues of climate change, biodiversity loss and pollution. Nature-based solutions (NBS) have been identified by the scientific and policy communities as a means to consider the complex synergies and trade-offs between climate change and biodiversity[1]. This includes actions that protect, restore and sustainably use and manage nature to address socio-economic and environmental challenges, while advancing biodiversity benefits, ecosystem services and human well-being[2].

Through these actions, nature-based solutions also support emission reductions and enhance sinks of greenhouse gases[3] while reducing the vulnerability of social and ecological systems to the impacts of climate change[4]. In doing so, NBS provides timely, sustainable, cost effective, adaptive and resilient solutions which are estimated to deliver 37% of cost-effective CO_2 mitigation needs through 2030.[5]

Nature-based pathways play an important role in regulating fluxes of greenhouse gases and in supporting the resilience of communities and nature to climate extremes. They also improve biodiversity directly by protecting ecosystems and the species they support and indirectly by alleviating climate change and its impacts on species and habitats. Consequently, the value of NBS in linking climate, biodiversity and sustainable development is increasingly being recognized.[6,7]

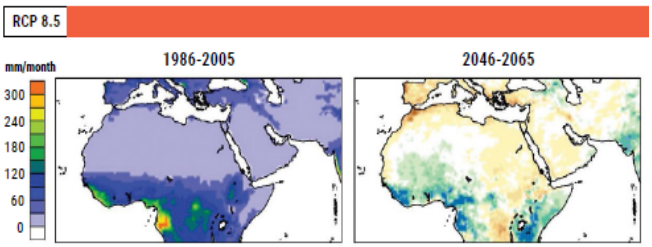
Biodiversity and ecosystems are highly vulnerable to climate change. The Regional Initiative for the Assessment of Climate Change Impacts on Water Resources and Socio-Economic Vulnerability in the Arab Region (RICCAR) regional climate projections show an increase in the average mean temperature of up to 2.6ºC under business-as-usual scenario (RCP 8.5) for mid-century (2046-2065) compared to the start of this century, as shown in Figure 1.[8]

Fig. 1. Projected increase in temperature under the business-as-usual scenario by mid-century



The RICCAR regional climate change projections also show that precipitation is largely decreasing across the Arab region due to climate change (Figure 2).

Fig. 2. Projected changes in precipitation under the business-as-usual scenario by mid-century



These changes are linked to increased climate vulnerability of agricultural and environmental ecosystems, including forests and wetlands. Forests with the highest vulnerability in the Arab region include tropical dry forest and tropical shrubland in sub-Saharan Africa and the tropical mountain system forests in the south-western Arabian Peninsula (Figure 3).

Fig. 3. Projected increased forest vulnerability from climate change under business-as-usual scenario by mid-century

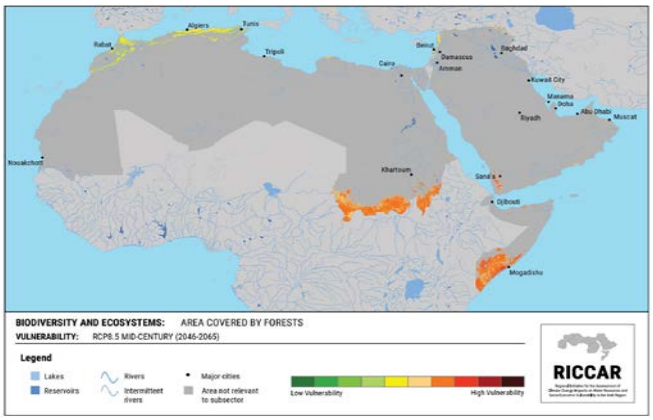
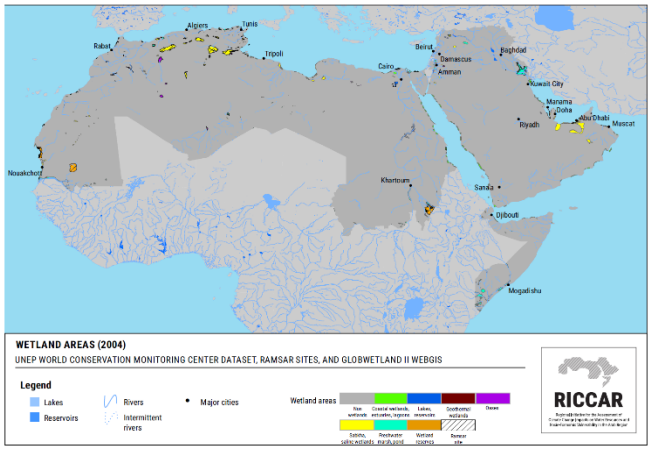


Fig. 4. Types and location of wetlands in the Arab region



Similarly, assessments show that wetlands with highest vulnerability include those located in the horn of Africa and along the Gulf of Aden and wetlands located in the Sahel and North of Senegal river. In Morocco, the Tindouf basin located to the south of the Atlas region along with Iraqi marshlands are expected to face moderate to high vulnerability to the impacts of climate change which would aggravate ongoing degradation.

Table 1. Examples of hybrid green/grey solution, the main purpose they are designed for and associated co-benefits

Hybrid solution	Main purpose	Co-benefits
Bioswales	Storm water management	1- Reduce pollution by filtering storm water 2- Reduce standing water (puddles) that can cause public health concerns 3- Create colorful gardens with a variety of flowers and plants year-round
Sand dams	Water harvesting by heightening the water table	1- Reduction in erosion and loss of topsoil 2- Purification of water 3- Reduction in evaporation losses 4- Enhancing resilience of local communities
Green Roofs	Stormwater management	1- Reduction in energy demand for cooling 2- Provide urban habitat, hence increasing habitat 3- Urban heat Island 4- Aesthetic
Watershed re-forestation	Water Purification	1- Cost Reduction 2- Soil stabilization 3- Erosion control 4- Improved water reserves
Reed beds	Water Purification	1- Reduction of Carbon footprint from cuts in energy consumption. 2- Generation of local job opportunities 3- Greening arid areas, 4- Resurgence of biodiversity fauna and flora

Wetlands also offer a nature-based solution for overcoming climate challenges, such as storing water, providing resting sites for migrating birds, mitigating flood risks and preserving natural ecosystems. The various types of wetlands found in the Arab region is shown in Figure 4.

NBS Approaches

Efforts are needed to ensure that the ecological footprint does not exceed the capacity of ecosystems to supply renewable resources and absorb generated wastes, which results in a net ecological deficit.

Compared to other ecosystem-based approaches, nature-based solutions encompass a comprehensive set of concepts that extend beyond ecosystem conservation and preservation to integrate more ambitious and extensive social and economic targets.

NBS approaches can be categorized into five intervention classes:[9]

- Restorative: Such as the Forest and Land Restoration (FLR) program implemented in Lebanon and Morocco to enhance the

role of forest landscapes for increased GHG sequestration and improved resilience towards the achievement of climate targets.[10]

- Issue-specific: Ecosystem based adaptation solutions are applied to the central part of the Iraqi marshlands which are identified as a biodiversity and socio-ecological hotspot. The objective is to protect these ecosystems to support resilience of local communities against climate change.[11]
- Green infrastructure: A hybrid green/ grey infrastructure solution is being tested in Al-Zouhour area in Jordan through bioretention areas and bioswales which are vegetated ducts used to treat, absorb, and convey stormwater runoff and contribute to alleviation of flash floods risk in urban contexts.

  Green infrastructure solutions often generate a myriad of benefits such as the reduction in the operation and maintenance costs, increase in local property values, improvement in public health, esthetic values and air quality, as well as limited/controlled losses and damages from extreme weather events (Table 1).
- Management: Egypt's National Climate Change Strategy (2022) explicitly calls for the preservation of natural resources in facing the risks of climate change. Under the strategy, water resources management interventions were devised and are planned to enhance climate change resilience.[12]
- Protection: Hima is a traditional rangeland management system and is recently being revived in arid zones of the Arab region to protect degrading ecosystems from overgrazing, climate change, urban settlements and overexploitation of land and water resources.[13] This practice has been used since ancient times and consists of setting land aside to allow for its regeneration through participative approaches and constant dialogue (Figure 5).

Fig. 5. Revival of the Hima in Jordan[14]

B. 2030 Agenda & MEA Linkages

The United Nations Convention on Biological Diversity (CBD), the United Nations Convention to Combat Desertification (UNCCD), and the United Nations Framework Convention on Climate Change (UNFCCC) and the 2030 Agenda for sustainable development–address climate change issues and are working together to enhance synergies across their areas of application. Nature-based solutions offer a multifaceted approach to support and synergize interventions towards the achievement of their respective goals by addressing environmental challenges, conserving biodiversity, combating land degradation, and mitigating climate change.

The NBS concept builds on the existing United Nations Convention on Biological Diversity (CBD) ecosystem approach however, it links various ecosystem-based approaches and fosters their synergies. Nature-based approaches extend beyond environmental and conservation-focused ambitions and aspires to

include social and economic targets as well. The Global Biodiversity Framework (GBF) adopted at the fifteenth meeting of the Conference of the Parties (COP 15) of the United Nations Convention for Biological Diversity (Decision 15/8) explicitly reference NBS in the targets established for the achievement of the four overarching GBF goals, namely for:

- Climate mitigation and adaptation, as well as disaster risk reduction to enhance resilience of biodiversity against climate change (target 8)
- Restoration and enhancement of ecosystem functions and services, such as regulation of air, water, and climate, and protection from natural hazards and disasters for the benefit of all people and nature (target 11).

The contribution of nature-based pathways towards the achievement of global climate goals is reflected by the Paris Agreement calls:

- For the conservation and enhancement of natural carbon sinks and reservoirs of all types covering terrestrial, coastal and marine ecosystems (Article 4, paragraph 1 (d))
- To prevent deterioration of ecosystems caused by deforestation and forest degradation, to reduce emissions and incentivize noncarbon benefits associated with such approaches (Article 5.2).

It also acknowledges the key role of sinks in achieving the goal of reaching climate neutrality, i.e., zero net emissions, in the second half of the century, and recognizes that socioeconomic and ecological resilience can be built through the sustainable management of natural resources.[15]

Furthermore, the scope of NBS interventions echoes the three social, economic, and environmental dimensions envisaged under the 2030 Agenda for sustainable development. Several sustainable development goals (SDGs) and targets support the conservation and restoration of ecosystems and their biodiversity, which in turn underpins the delivery of nature-based processes. These include those that aim to:

- Protect and restore water-related ecosystems (SDG 6.6);
- Conserve and support the sustainable use of marine ecosystems (SDG 14); and
- Protect, restore and promote the sustainable use of terrestrial ecosystems and their related biodiversity (SDG 15).

Other SDGs related to poverty eradication (SDG1), ending hunger (SDG2), ensuring healthy lives (SDG3), resilient infrastructure (SDG9), sustainable consumption and production patterns (SDG12) and combating climate change (SDG13) are also aligned with the principles guiding NBS implementation.

C. Current Status

The natural pathways that are most often considered for climate action across the Arab region include forests, mangroves, and wetlands. Nevertheless, the forest and agroforestry sectors represent the ecosystem-based pathway responsible that contribute to the greenhouse gas (GHG) emission reduction commitments included in the Nationally Determined Contributions of Arab States.

Forestry

Besides their carbon sequestration potential, forests support local communities' resilience against the impacts of extreme climate events. It is estimated that a typical medium-sized tree can intercept about 9 m^3 of rainfall per year which can attenuate risk of soil erosion, flooding, and land degradation. Forests also have air purifying functions with obvious implications on health and well-being and

when maintained and managed properly can contribute important economic value through their provisioning, touristic and cultural services.

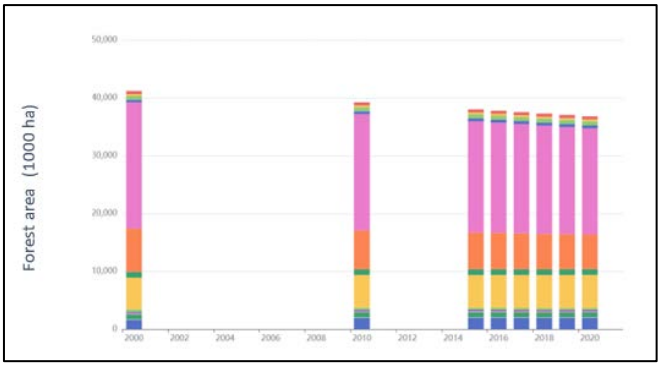
Across the Arab region, severe losses in forest cover were depicted from remotely sensed imagery analyzed over the period extending from 1999 to 2012 and which exceeded 550,000 km2 (55.3 *106 ha).[16]

Furthermore, outcomes from monitoring the SDG indicator on forest area coverage (SDG15.1) in Arab countries indicate interruptions in data generation (Figure 6) and prevents an accurate analysis of changes in forested areas which highlights the role of remote sensing and aerial photography in ensuring continuous forest data needed to inform NBS interventions for the achievement of climate targets. [17]

Nevertheless, in recognition of their importance in supporting their targeted emission cuts, many countries have considered forests among the various avenues envisaged for carbon emission reduction:

- Sudan, aims to achieve around 40% of the planned GHG emission reductions (in CO_2eq) committed over the period 2021-2030, through the restoration of degraded forests and afforestation of degraded lands;[18]
- Morocco, Tunisia, and Jordan have also identified the amounts of GHG emission cuts targeted through forested ecosystems;
- Despite the magnitude of these removals, it is believed that the land-based pathways have not yet been exploited to their full potential;[19]
- Some countries have recognized the value of forested ecosystems in achieving their targeted emission cuts, but the share of these pathways' potential to the total targeted carbon removal was not calculated. This is the case of the Kingdom of Saudi Arabia (KSA), where nature-based alternatives are planned through the forestry sector under the Saudi Green Initiative (SGI)[20] launched in 2021 to plant 10 billion trees.

Fig. 6. Changes in total forest area in countries of the Arab region (2000-2020) [21]



Mangroves

The importance of coastal ecosystems such as mangroves is increasingly gaining attention for their role in climate mitigation and adaptation and/or their co-benefits. The rates of carbon sequestration per unit area in mangroves are significantly higher, up to four to five times greater, than those captured in forests.[22] The regulating functions of mangroves include wave attenuation and shore stabilization. Mangroves have also an important role for food security and economic resilience of dependent communities.

The cultural value of mangroves encourages tourism, recreation and education activities as well as enhance the aesthetic importance and cultural heritage of the region.

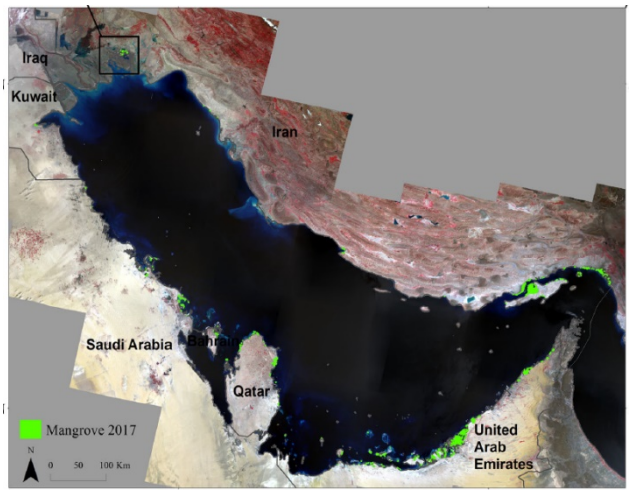
Contrary to global trends of degrading mangroves at 2.1% annually, gains in mangrove population in the Arab region are exceeding losses, resulting in net increases.

- Along the red seacoast, expansion in mangroves areas reached 12% over 41 years from 1972 and 2013[24]
- Similarly, expansion in mangrove

population was noted on the coastal areas of the Arabian Gulf and Gulf of Oman (Figure 7)

- Greatest mangrove expansion was noted in the United Arab Emirates which saw spatial coverage double over the past 15 years from 40 km^2 (2005) to 79 km^2 as calculated through satellite imageries taken in 2017.[25]

Fig. 7. Mosaic image of mangrove distribution (green areas) along the Gulf shores taken in 2017. [23]



Although mangroves' contribution to national carbon sequestration targets was not quantified in any of the Arab countries' NDCs, the benefits and contribution of this type of ecosystems was clearly referred to, through:

- Integrated coastal zones management (ICZM) plans in Egypt, Oman, and Morocco. The ICZM In Egypt, is implemented in the world's largest low lying coastal and delta areas through the construction of low-cost nature-based systems such as sand dune dikes in identified high climate vulnerability hotspots to reduce the threat of coastal flooding.
- Information and knowledge generation on the GHG sequestration potential of blue carbon is undertaken by Bahrain to assess mangroves and sea grass beds carbon sequestration potential in addition to adaptation co-benefits.
- Improved national monitoring systems are initiated in Lebanon and Sudan in identified pilot sites and species to better understand the climate vulnerability of coastal ecosystems and inform consequent management and preservation policies.

Other major mangrove plantation projects include the:

- United Arab Emirates COP26 commitment to plant 100 million mangrove seedlings by 2030 to support carbon sequestration and protect ecosystems and biodiversity;
- Oman initiative to cultivate one million mangrove seedlings over the coming 5-year period to enhance carbon uptake and support resilience against extreme weather events, coastal erosion and sea water intrusion.[26]

Wetlands

According to the Ramsar (1971), wetlands are land areas that are permanently or seasonally saturated or flooded with water. Inland wetlands include marshes, ponds, lakes, floodplains, and swamps. Peatlands are a type of wetlands with an accumulated layer of partially degraded plant matter- peat. Currently the extend of wetlands coverage in the Arab region varies considerably, with countries having the largest coverage include Egypt with 4.5 million ha, Algeria 3 million ha,[27] Mauritania 1.25 million ha[28], Tunisia more than 1.2 million ha, Libya 1 million ha and 537,400 ha in Iraq. In Morocco, Jordan, and Syria the extent of wetland coverage does not exceed 400,000 ha[29] in each country.

Based on national inventories and datasets, it is estimated that 50% of wetland areas were lost over the twentieth century in most parts of the Arab region.[30] These figures are consistent with global wetland loss trends. Furthermore, the trend in wetland loss is

maintaining a sustained increase as evidenced in many parts of the Arab region.

- The greatest losses across the Arab region were reported in Iraq in the Mesopotamian marshland areas where 79% were lost between 1986 and 2000.[31] The losses were mainly the resultant of anthropogenic activities notably through drainage for agricultural production purposes (Figure 8).

Fig. 8. Protecting Marshlands to enhance climate resilience of local communities.[32]

- In Egypt as well, the Burullus lagoon was heavily degraded showing 42.8% losses in area between 1973 and 2011. [33] Siltation and island formation within the wetland ecosystem are responsible for most of the shrinking in surface area.
- The Sudd in Sudan represents one of the largest tropical wetlands in the world[34,] is facing threats from uncontrolled hunting, refugee settlements, increased grazing and cultivation, deforestation, and infrastructure development. Oil exploration and exploitation are an emerging concern.

Peatlands have considerable carbon storage potential exceeding all other types of ecosystems' capacities and estimated at twice the carbon of the entire world's forests. They can also contribute to water purification and have considerable cultural and recreational significance. It is estimated that for each 10 cm drop in the water table resulting from draining peatlands for conversion into agricultural areas and urban settlements, 5 tCO_2 eq per ha are released[35], which means that policy prioritization should focus on the preservation of peatlands.

- In Iraq, the preservation of peatland from degradation alone is estimated to result in avoided emissions of 33 million tons CO_2eq/yr.[36] The value of peatland preservation becomes evident when these values are compared with GHG emission cuts targeted in Iraq NDCs (90 million tons of CO_2eq/yr).[37]
- In Sudan as well, peatland restoration and avoided peatland degradation can achieve additional 2.91 and 0.58 million tons CO_2eq/year, respectively as benchmarked in 2030.

D. Major Challenges

Despite the popularity of the concept, the translation of NBS principles into practice remains limited as a result of the ambiguity surrounding the identification of what can be considered as nature-based solutions. Furthermore, the translation of the concept into standardized and well accepted practices remains at an early stage. Consequently, interventions packaged as "nature-based" might lead to:

- Maladaptation with adverse impacts for climate and biodiversity. This is the case of monoculture plantations undertaken as NBS to offset carbon emissions, but which would result in considerable disruption to the ecosystem and biodiversity
- Green-washing by large corporations that focus on achieving short term commitments compared to the longer-term climate objectives

Furthermore, deficiencies in scientific evidence, inadequate policies and regulatory tools and lessons learned accumulated from their application represent important

obstacles facing a greater uptake of natural pathways for climate action.

Deficiency in Political and Regulatory frameworks

Most nature-based interventions are planned in response to specific emerging needs and deployed locally at small scales.[38]

- A comprehensive framework for the integration of accumulated knowledge and experience in policy and learning processes remains absent
- NBS are often included as theoretical commitments and lack the metrics for evaluation and monitoring which hampers the possibility for follow-up on progress towards their achievement

Insufficient science and knowledge

Assessments for the economic values of various ecosystem services and functions are at the core of decision-making processes regarding the feasibility of ecosystem services for the provision of climate solutions. A better understanding of the full scope of ecosystem functions and services with their associated values is key to assess tradeoffs.

- This is the knowledge area where most gaps were identified
- Ecosystem service valuation performed in various parts of the world have generated great variability in outcomes based on living standards and local perceptions.

Nevertheless, it is well established that the climate value of global ecosystem services is greater than originally estimated in initial assessment research. [39]

Limited practice and accumulated experience

Evidence regarding NBS tangible and measurable outcomes with assessment of related cost effectiveness is still lacking, due to insufficient implementation and lessons learned generated from NBS projects. Hence, piloting NBS projects would support breaking existing silos among practice, science, and policy processes towards a shift from NBS conceptualization into actual nature-based practices.

Financing Gaps

It is estimated that investments in nature-based solutions (NBS) need to increase four-fold by 2050 if the world is to meet various climate change, biodiversity, and land degradation targets.[40] Difficulties facing effective mobilization of resources towards nature-based approaches are identified by:

- Ill-defined objectives by donors which might result in focusing on quick gains on the detriment of comprehensive solutions with more sustainable, longer term impacts;
- Tradeoff between short term donor expectations versus the longer time span over which NBS outcomes are typically achieved;
- Existing funding silos across local government departments.[41]

E. Opportunities for Action

Policy and governance

The value of biodiversity is not fully accounted for in global climate change policy framework. However, planning climate actions based on nature-based pathways can enhance political willingness for the implementation of existing biodiversity conservation and restoration policies and improve funding opportunities. Also, it encourages the mobilization of efforts to frame NBS related concepts and hence increases chances for their uptake by decision makers.

Box 1. Open-Air Laboratories (OALs)

Application: A successful NBS implementation model integrating the policy, practice and science considerations which is devised within the framework of the H2020 project OPERUNDUM

Location: Spercheios River in Greece

Brief Description: The project application demonstrated the effectiveness of NBS for the control of drought and river flooding and highlights possibility for further upscaling in other geographical areas.

- The aim was to increase water storage capacity of embankments, increase the ability of water infiltration and reduce water flow connectivity for drought control.
- Implemented Nature-base interventions included restoration and stabilization of riverbanks, clearing of bed material load, alterations in riverbed to help regulate the water flow and by planting grass and trees buffer strips to interrupt surface flows
- Engaged various groups of stakeholders including researchers, practitioners from various disciplines such engineers, agronomists, sociologists; local authority representatives; farmers, entrepreneurs, and civil society organization members.
- The impacts were noted in improved infiltration capacity which reduces risk of flooding, preservation of the natural ecosystem, improved native biodiversity as well as enhanced economic, cultural, and educational opportunities.

Spercheios River in its initial state and during the construction works [42]

Furthermore, there is great value in policies that simultaneously address synergies between biodiversity loss mitigation and climate change while considering societal impacts to maximize co-benefits and help meet development aspirations for all.

Therefore, greater synergies across environmental agreements such as the UN Framework Convention on Climate Change (UNFCCC), the Convention on Biological Diversity (CBD) as well as with the Sustainable Development Goals could support the simultaneous mitigation of biodiversity loss and climate change impact. [43]

Science, innovation and technology

At the global level, ecosystem value assessments have shown greater outcomes than originally estimated. However, more accurate information at smaller geographical scale is still needed to inform decision-making on tradeoffs involved in nature-based solutions.

The few ecosystem value assessments undertaken for the Arab region, have confirmed their importance in informing decision-making processes.

- The Abu Dhabi Blue Carbon Demonstration Project assessed the feasibility of mangrove plantation projects in the UAE.[44] When the scope of assessed ecosystem services was expanded beyond climate regulation functions to include shoreline stabilization, fisheries support, direct recreational use and water quality regulation; outcomes endorsed greater investments in mangrove reforestation and preservation.[45] This resulted in raising reforestation targets from 30 to 100 million mangroves as per the first and second NDC, respectively.
- Lebanon Reforestation Initiative (LRI)[46] projected changes in forest values by 2023 considering climate regulation and other

supporting functions. The provisioning, tourism and air quality regulating values were found to exceed by far the forest carbon sequestration values.[47] This provides tangible evidence supporting forest protection and conservation policies to limit the conversion of forested areas into cropped lands, which currently poses the highest threat to forests in Lebanon.[48]

Capacity building: needs, opportunities, beneficiaries

Historically, the Arab region has accumulated considerable experience from the implementation of traditional biodiversity conservation practices through participatory land governance approach such as the ancient Hima "institution" which encourages land regeneration and biodiversity restoration with high efficiency and cost-effectiveness in the Arab region.[49] These practices are being revived in Jordan, Egypt and KSA.

Similarly, the Aflaj, a traditional groundwater irrigation system drawing upon indigenous people exploration and drilling skills has succeeded in preserving water from evaporation and maintaining water dependent ecosystems in Oman.

Fig. 9. Reed beds for produced water purification in Oman[50]

Nowadays, the capacities of practitioners in the application of natural pathways for climate solutions are increasing through the application of bio-engineered alternatives, or green infrastructure solutions, which include for example:

- Bio-remediation to treat produced water generated from oil extraction in Oman (Figure 9) and wastewater in Lebanon through the use of reed (phragmites australis) beds; and
- Green stormwater management using bioswales in Amman to increase the absorptivity of surfaces in managing flash floods risk for improved urban climate resilience.[51]

Funding mechanisms, investment opportunities

Despite challenges in financing NBS implementation, local level considerations and changes in global trends could support opportunities for improved mobilization of funds towards enhanced NBS uptake:

- Effective prioritization of the societal challenges considered;
- Robust analysis of NBS alternatives and their short and longer term impacts;
- Advent of Environmental and Sustainability Governance indicator; frameworks (such as ESG) which supports the integration of nature-based solutions into investment decisions;
- Increased number of governments and private companies pledging net zero emission targets;
- Expansion in green/grey infrastructure projects investments; and
- NDCs contribution to the prioritization of investments in climate resilient and sustainable infrastructure projects.

Endnotes

1. Pörtner, H.O., et. al. 2021. IPBES-IPCC co-sponsored workshop report on biodiversity and climate change. IPBES and IPCC. DOI:10.5281/zenodo.4782538.

2. Key, I.et al. 2022. Biodiversity outcomes of nature-based solutions for climate change adaptation: Characterizing the evidence base. Front. Environ. Sci., 11 October 2022. Sec. Conservation and Restoration Ecology.
3. Girardin, C. A. J., Jenkins, S., Seddon, N., Allen, M., Lewis, S. L., Wheeler, C. E., et al. (2021). Nature-based solutions can help cool the planet — If we act now. Nature 593, 191–194. doi:10.1038/d41586-021-01241-2.
4. Seddon N et al. (2020). Global recognition of the importance of nature-based solutions to the impacts of climate change. Global Sustainability 3, e15, 1–12. https://doi.org/10.1017/sus.2020.8.
5. Griscom. B., et al, 2017. Natural Climate Solutions. Earth, atmospheric and planetary sciences. 114 (44) 11645-11650.
6. Climate Home News. 'Nature-based solutions' prove divisive at Glasgow climate talks. 11 November 2021.
7. Climate Home News. 'Nature-based solutions' prove divisive at Glasgow climate talks. 11 November 2021.
8. United Nations Economic and Social Commission for Western Asia (ESCWA) et al. 2017. Arab Climate Change Assessment Report – Main Report. Beirut/ ESCWA/SDPD/2017/RICCAR/Report. https://riccar.org/publications/arab-climate-change-assessment-report-main-report
9. Cohen Shacham. E, (2019). Core principles for successfully implementing and upscaling Nature-based Solutions. Environmental Science and Policy 98 (2019) 20–29.
10. Examples of NBS targeting restoration interventions include ecological restoration, forest land restoration, ecological engineering.
11. Examples of NBS targeting issue-specific interventions include ecosystem-based adaptation-EbA, ecosystem based mitigation, ecosystem disaster risk reduction, etc.
12. Examples of NBS targeting management interventions include integrated coastal management, Integrated Water Resources Management – IWRM.
13. Examples of NBS targeting protection interventions include area based conservation, protected areas management.
14. Ecologist Special Report: The Al Hima Revival by Abraham, C. (22/08/2017).
15. United Nations, 2016. Paris Agreement.
16. Faour, G. et al. (2016). Detecting changes in Vegetation Trends in the Middle East and North Africa (MENA) Using SPOT Vegetation. Available at: https://journals.openedition.org/cybergeo/
17. Chapter 3, status, trends and Future dynamics of biodiversity and ecosystems Underpinning Nature's contribution to People.
18. Republic of the Sudan, First Nationally Determined Contribution under the Paris Agreement. Updated October 2021 (page 5).
19. Griscom. B., et al, 2017. Natural Climate Solutions. Earth, atmospheric and planetary sciences. 114 (44) 11645-11650.
20. https://di.unfccc.int/ghg_profiles/nonAnnexOne/SAU/SAU_ghg_profile.pdf
21. ESCWA Arab SDG monitor from the internet: https://arabsdgmonitor.unescwa.org/multichart.aspx?target=15.1
22. Gulf News Report: UAE to plant 100 million mangroves by 2030 through National Carbon Sequestration Project. 17 December 2022.
23. Almahasheer, H. (2018). Spatial coverage of mangrove communities in the Arabian Gulf. Environmental Monitoring assessment: 190:85.
24. Almahasheer, H., et al (2016) Decadal Stability of Red Sea Mangroves Estuarine Coastal and Shelf Science 169 (164-172).
25. Almahasheer, H. (2018). Spatial coverage of mangrove communities in the Arabian Gulf. Environmental Monitoring assessment: 190:85.
26. Project proposal submitted by Oman concerned ministries during the Climate Finance Forum. Beirut, September 2022.
27. Rapid cultural inventories of wetlands in Arab states including Ramsar Sites and World Heritage Properties Building greater understanding of cultural values and practices as a contribution to conservation success.
28. Rapid cultural inventories of wetlands in Arab states including Ramsar Sites and World Heritage Properties Building greater understanding of cultural values and practices as a contribution to conservation success.
29. Perennou, C. (2012). Existing areas and past changes of wetland extent in the Mediterranean region: an overview. Ecologia mediterranea, tome 38 n°2, 2012. pp. 53-66.

30. Perennou, C. (2012). Existing areas and past changes of wetland extent in the Mediterranean region: an overview. Ecologia mediterranea, tome 38 n°2, 2012. pp. 53-66.

31. Ike, F. and Ottah, C.R. (2019) A Multi-Layer Based Assessment of Wetland Changes in the Southern Iraqi Marshlands Using Remotely Sensed Data. International Journal of Geosciences,10, 801-810.

32. UNDP Stories, available at: www.undp.org/arab-states/stories/ahwari-women-beating-heart-iraqi-marshes

33. Hesham M.El-Asmar (2013) Surface area change detection of the Burullus Lagoon, North of the Nile Delta, Egypt, using 36Water indices: A remote sensing approach. The Egyptian Journal of Remote Sensing and Space Science, Vol 16 , Issue 1, pp 119-123.

34. Rebelo LM., El Moghraby A.I. (2018). The Sudd (South Sudan). In: Finlayson C., Milton G., Prentice R., Davidson N. (eds), The Wetland Book. Springer, Dordrecht. https://doi.org/10.1007/978-94-007-4001-3_23.

35. Joosten, Hans from youtube: CREAF Talks. Hans Joosten: The peatland pathway to 2050. https://www.youtube.com/watch?v=DA6Nq5Br7YQ

36. Griscom. B., et al, 2017. Natural Climate Solutions. Earth, atmospheric and planetary sciences. 114 (44) 11645-11650.

37. Ministry of the environment of the Republic of Iraq and UNDP.(year not mentioned) Nationally Determined Contributions of Iraq (NDC).

38. Cohen Shacham. E, (2019). Core principles for successfully implementing and upscaling Nature-based Solutions. Environmental Science and Policy 98 (2019) 20–29.

39. Costanza et al (1997) Costanza, R., dArge, R., de Groot, R., Farber, S., Grasso, M., Hannon, B., Limburg, K., Naeem, S., Oneill, R.V., Paruelo, J., Raskin, R.G., Sutton, P., van den Belt, M., 1997. The value of the world's ecosystem services and natural capital. Nature 387, 253–260.

40. Robert C. Brears (2022) Financing Nature-Based Solutions. Palgrave Macmillan.

41. Thomson, A, et al (2023). Paying for nature-based solutions: A review of funding and financing mechanisms for ecosystem services and their impacts on social equity. Sustainable Development, available at: https://doi.org/10.1002/sd.2510

42. OPERANDUM website.

43. Pörtner, H.O., et. al. 2021. IPBES-IPCC co-sponsored workshop report on biodiversity and climate change. IPBES and IPCC. DOI:10.5281/zenodo.4782538.

44. Costanza et al (1997) Costanza, R., dArge, R., de Groot, R., Farber, S., Grasso, M., Hannon, B., Limburg, K., Naeem, S., Oneill, R.V., Paruelo, J., Raskin, R.G., Sutton, P., van den Belt, M., 1997. The value of the world's ecosystem services and natural capital. Nature 387, 253–260.

45. AGEDI 2013, Blue Carbon in Abu Dhabi – Protecting our Coastal Heritage: The Abu Dhabi Blue Carbon Demonstration Project.

46. Charbel, E. and Rahal, L., 2021. Mapping and Valuing Forest Ecosystem Services in Lebanon. Study completed under the USAID-funded Livelihoods in Forestry Project. Lebanon Reforestation Initiative (LRI), Beirut.

47. Charbel, E. and Rahal, L., 2021. Mapping and Valuing Forest Ecosystem Services in Lebanon. Study completed under the USAID-funded Livelihoods in Forestry Project. Lebanon Reforestation Initiative (LRI), Beirut.

48. Ickowitz, et al; 2022. Transforming food Systems with trees and Forests. The Lancet Planetary Health. Vol 6, issue 7.

49. The Economics of Land Degradation: A Case Study of Zarqa River Basin in Jordan: An economic valuation of a large-scale rangeland restoration project through the Hima system in Jordan. 2015.

50. Petroleum Development Oman, 2017.

51. UN-Habitat-ROAS. Climate Change Strategy for the Arab Region, 2022-2025.

Copyright © 2023
By the United Nations Economic and Social Commission for Western Asia (ESCWA)

Reference as:
ESCWA, Nature-based solutions for Climate Resilience – Technical Note. Beirut, E/ESCWA/CL1.CCS/2023/WG.5/Technical Note.3. Issued 7 July 2023.

This document was issued without formal editing.

The opinions expressed are those of the authors and do not necessarily reflect the views of the United Nations or the Government of Sweden.

The designations employed and the presentation of the material in this technical note do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delineation of its frontiers or borders.