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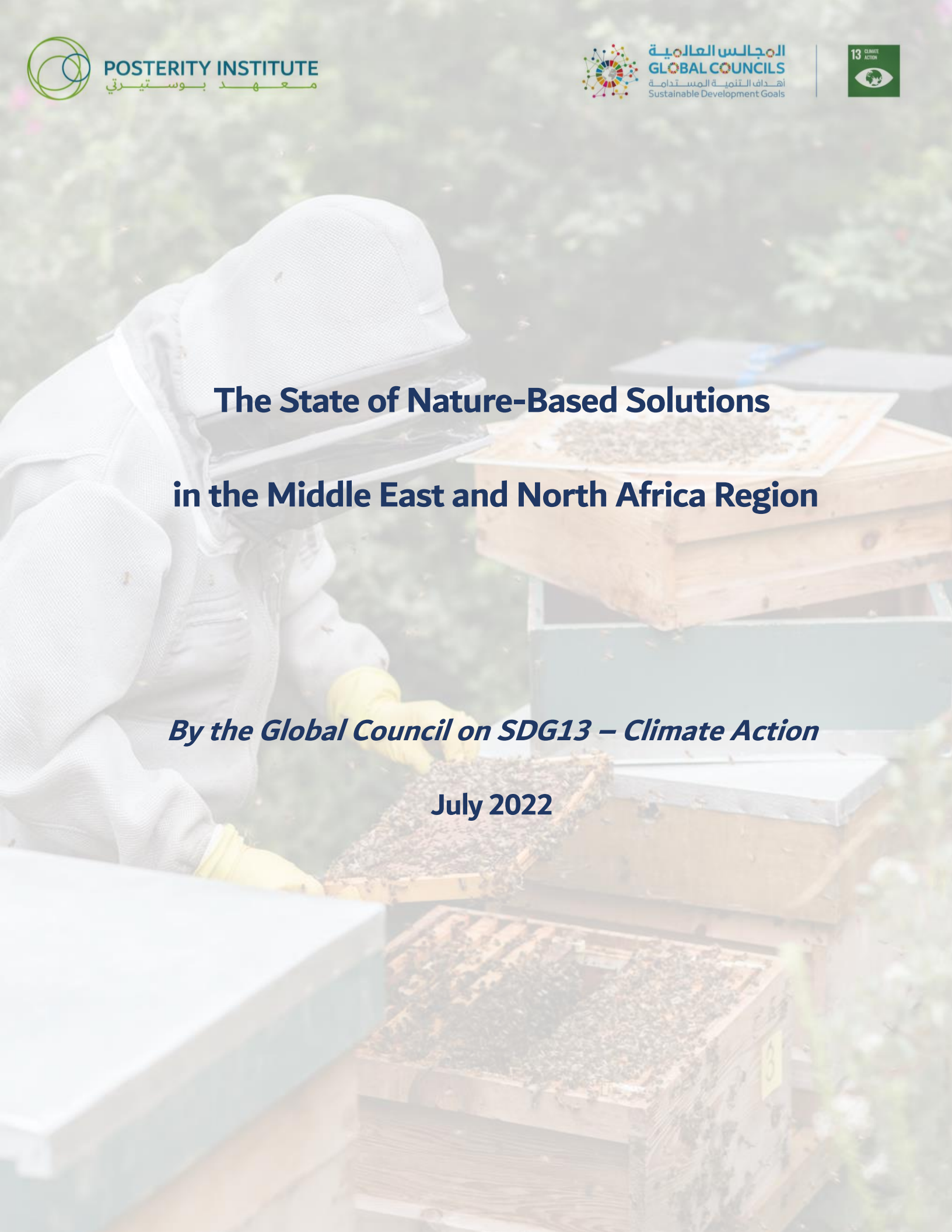

# The State of Nature-Based Solutions

# in the Middle East and North Africa Region

***By the Global Council on SDG13 – Climate Action***

**July 2022**

# Contents

## The Future of Climate Change

As global consumption of fossil fuels continues to rise, the associated emissions of greenhouse gases (GHGs) have increased as well. GHGs are extremely effective at absorbing and retaining heat, and as their concentrations increased in Earth's atmosphere, so did the quantity of heat trapped, leading to gradual increases in the planet's average temperature[1]. As a result of the influx of these gases, along with changes in Earth's surface temperature, severe variations in sensitive cycles that led to a phenomenon known as climate change was caused. While climate change has contributed to the warming of the planet's surface, it has also induced changes to weather event frequency and severity, rates of ice sheet melting and sea levels rising, and oceanic capacity to absorb and sequester excess carbon from the atmosphere[2]. These inorganic changes also pose a grave threat to living systems as well, as almost all the planet's biotic systems are adapted to a certain range of conditions which they are incapable of effectively surviving in should these criteria not be met. Hence, climate change has also accelerated the loss of biodiversity as seen at the start of 2020 with the devastating Australian wildfires that caused the death and displacement of nearly 3 billion animals[3], where studies showed that worsening weather conditions increased the likelihood of fires of that magnitude by 30%[4].

The complexities only increase when discussing the impacts of climate change on humanity. Afterall, though human beings are driving elevated emissions into the atmosphere, the fossil fuels whose combustion causes these emissions are responsible for essentially every feature of life in the modern world. Infrastructure, energy, transportation, food industry, and everything from water bottles to the Internet is dependent on the burning of fossil fuels. The Industrial Revolutions have completely shifted trends in human consumption[5], and the rapid growth experienced during these eras of industrialisation meant that the prevalence of fossil fuel dependent technology and machines that could

[1] https://climate.nasa.gov/faq/19/what-is-the-greenhouse-effect/#:~:text=The%20greenhouse%20effect%20is%20the,it%20would%20be%20without%20them

[2] https://www.un.org/en/climatechange/science/causes-effects-climate-change

[3] https://www.theguardian.com/environment/2020/jul/28/almost-3-billion-animals-affected-by-australian-megafires-report-shows-aoe

[4] https://www.nature.com/articles/d41586-020-00627-y

[5] https://ourworldindata.org/fossil-fuels

keep up with the demands of an exponentially growing population. Fossil fuels also play a significant role in the non-tangible elements of the human experience, as the world's socioeconomic and political systems, of which the livelihood and safety of billions around the world depend on, are built on the ability of fossil fuels to secure the needs that protect both.

The other side of the coin is unfortunately just as drastic. Humanity's dependence on fossil fuels is undoubtable, yet the consequences of their consumption have catapulted and exacerbated existing obstacles while creating challenging barriers with detrimental outcomes with global impacts. The impacts are widespread and affect several aspects of life, for instance:

- Rising sea levels caused by accelerated melting ice sheets will cause the displacement of hundreds of millions of individuals from existing coastal communities, and will lead to billions of dollars in loss and damage to infrastructure[6]
- Increased frequency and severity of weather events such as heat waves and droughts will intensify water stress and scarcity, and temperature extremes could make some parts of the world unliveable[7]
- Warmer oceans surfaces and higher sea levels will lead to increased frequency and intensity of hurricanes, storms, and storm surges, making them more lethal and have greater capacities to cause coastal damage especially[8]
- Unpredictable weather patterns and events, and increased flooding will cause losses in arable lands causing decreased yields in crops, and unfavourable conditions will cause declines in livestock both of which dwindle food security[9]
- Various climate sensitive diseases such as malaria, dengue fever, cholera and more will begin circulating at much faster rates, increasing the risk of epidemics and pandemics and infecting and claiming countless lives[10]

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6 https://www.nbcnews.com/science/environment/climate-change-trigger-migration-216-million-people-world-bank-warns-rcna1984

7 https://www.weforum.org/agenda/2021/10/climate-change-could-make-some-areas-of-earth-uninhabitable-by-2500

8 https://www.c2es.org/content/hurricanes-and-climate-change/

9 https://www.ipcc.ch/srccl/chapter/chapter-5/

10 https://news.climate.columbia.edu/2014/09/04/how-climate-change-is-exacerbating-the-spread-of-disease/#:~:text=Climate%20change%20will%20also%20affect,and%20more%20extreme%20weather%20events.

- As a result of decreased living space, increased water scarcity, and low food security, conflict over rare resources will increase, forcing an even larger number of individuals into displacement[11]

It is evident that with so much at stake, action to combat and curb the impacts of climate change at various scales on social, economic, political, and environmental factors is needed to secure the future of generations to come.

## Nature-Based Solutions: A Response to Climate Change

Recognising the looming dangers of climate change has led entire nations to seek and foster support that could help mitigate its effects. Since climate change is a global issue, nations have partnered with each other to tackle this concern under the United Nations Framework Convention on Climate Change (UNFCCC), particularly the Conference of Parties (COPs). Treaties such as the Kyoto Protocol and the ambitious Paris Agreement were developed with the goal of reducing and possibly reversing some of the ramifications of climate change. The goals outlined in the treaties can only be met with commitment from all parties, but more importantly with the deployment of technology and innovation that redefine the world's perspective on infrastructure, production, and consumption. While renewable energy, electrification, and consumer awareness are a few methods that have and will continue to be utilised to address these issues, a historically significant approach – still used by many indigenous communities in various parts of the world – that can combat the multifaceted hurdles of climate change is reappearing in discussions and dialogues surrounding the topic – known as nature-based solutions.

Rather than exploiting the environment to extract resources and construct infrastructure, nature-based solutions allow for the effective use of its elements and characteristics as an alternative for conventional grey infrastructure with several added advantages. Nature-based solutions (NBS) are initiatives that extract characteristics from various ecosystems and naturally recurring ecological activities and leverage them to serve the purpose of reducing the intensity of carbon in the atmosphere, as well as promote and regenerate healthy functioning environments that could also eventually be used

11 https://www.usnews.com/news/best-countries/articles/2021-10-29/how-climate-change-may-increase-global-conflicts#:~:text=In%20a%202019%20paper%2C%20researchers,risk%20over%20the%20past%20century.

to combat climate change. Additionally, NBS function can improve the state of the environment to provide benefits that were disturbed by climate change such as water and food security, and protection from extreme weather events. In fact, COP26 held in 2021 dedicated an entire day to this practice, a testament to the potential it brings to minimising catastrophes[12]. Throughout the COP negotiations, it was discussed how NBS could aid in slashing a third of emissions, especially through the implementation sustainable agriculture and climate-resilient farming techniques which will be further discussed in this paper.

Prior to delving deeper into the features and opportunities, as well as the challenges to NBS, it is important to clarify what the terms encompasses and more importantly: what it doesn't. NBS are not a quick attempt to increase foliage or biodiversity in a particular region but are long term solutions that require the account of temporal and spatial factors that contribute to the conservation or regeneration of natural ecosystems. Due to their associations with the natural environment, many entities have used NBS for greenwashing – claiming that their support for mismanaged and non-scientific based but "natural" systems is sufficient to offset their direct influence and inputs on the environment[13]. Thus in order to avoid the misuse of NBS, and to avoid ambiguity and vagueness in what these solutions should entail, the International Union for Conservation of Nature (IUCN) developed a framework[14] that highlights the necessary benchmarks that must be fulfilled for a project or initiative to be labelled as a NBS, most notably:

1. They need to address and solve societal challenges

   Due to their association with nature, it is easy to interpret NBS as a solution that exclusively addresses environmental concerns such as pollution and the loss of habitats and biodiversity – and while it does support flora and fauna, a NBS must clearly resolve an identifiable challenge to human and societal well-being.

12 https://www.un.org/en/climatechange/cop26-day-7-sticking-points-and-nature-based-solutions

13 https://phys.org/news/2022-06-expose-greenwashing-nature-based-solutions-climate.html#:~:text=First%2C%20nature%2Dbased%20solutions%20are,the%20same%20time%20continuing%20to

14 https://portals.iucn.org/library/sites/library/files/documents/2020-020-En.pdf

2. They must be designed by scale

   The complexities of ecosystems that NBS depend on must be accounted for during the design stage, as NBS should work to support and improve the interactions and quality of existing economic, societal, and environmental capacity of the area of implementation.

3. They result in an increase in biodiversity and ecosystem integrity

   A well-managed and evidence based NBS must be developed in such a way that it results in the net gain of biodiversity – the variety of plant and animal species supported through its implementation, and ecosystem integrity – the ability of an ecosystem to functional "normally" with balanced biological systems. More importantly however, is that the net gains in biodiversity must be well-identified and based on scientific evidence, as NBS should promote the flourishing of species native to the areas of their implementation, as opposed to the introduction of invasive species that would lead to the deterioration of naturally prevailing ecosystems and host species.

4. They are cost effective and have positive economic influence

   While NBS should not be treated in the same way as their grey infrastructure counterparts and must be distinguished from them in that they include living systems, it is also crucial to highlight that NBS are also investments, and the positive economic feedback from NBS will lead to their long-term success.

5. They must be inclusive, transparent, and empowering

   To avoid the use of NBS for greenwashing, and to ensure the validity and efficacy of a NBS within a certain region, they must be governed with clear policies and regulatory legislation that account for the inclusion of all stakeholders, including beneficiaries of the NBS. This also includes the acknowledgement of trade-offs, recognising that NBS will not be prioritised by all stakeholders.

6. They must be adaptively governed and sustainable

   Since NBS deal with dynamic ecosystems, it is important that the policies and regulations that govern them are flexible to recognise their ever-changing nature. Furthermore, NBS are not short-term quick fixes to challenges faced by society, but rather long-term solutions that transform the area of implementation and allow for continuous benefits observed by those who the NBS was created for.

Should a project fail to meet any of the above criteria, then it cannot be labelled as an effective or success NBS. In addition to the set criteria that NBS must meet, they are also divided into three main categories, based on the degree of human intervention, that describe the role that they play within their area of implementation[15]. The first category includes minimal human intervention and could be considered as conservation or reserve sites. This entails the use of existing, healthy, and functioning ecosystems to the advantage of humans such as the protection of a rainforest from deforestation to build agricultural farms. The second category includes moderate intervention, and mainly involves the management of ecosystems through sustainable practices that enhance the functionality and productivity of the ecosystems, such as the use of sustainable agriculture or fishing. Finally, the last category includes significant human intervention as it involves the complete restoration of a fully degraded ecosystem – such as the conversion of drylands into wetlands to serve the purpose of water security and improved community revenues from agriculture and fishing for instance. This category also includes urban NBS, the use of natural ecosystems to develop green and blue spaces against urban backdrops. Depending on the existing topography of a particular region, as well as the challenges the communities face, the three categories of NBS could be integrated.

## Climate Change and the MENA Region

Climate change is a global phenomenon, with practically all regions of the world currently facing both direct and indirect consequences. That said, certain regions are more prone to the direct and fast approaching impacts, mainly due to geographical positioning and topological factors. The Middle East and North Africa (MENA) Region is one such region, where its conditions and attributes magnify climate change and its by-products.

15 https://www.researchgate.net/figure/A-typology-of-NbS-showing-three-main-categories-of-solutions-based-on-natural-restored_fig2_307608144

To begin with, the MENA Region is one of the most water-stressed and water-scarce regions in the world, with 11 of the 17 most water-stressed countries belonging to it[16] with the average available volume of water for consumption across the region is almost six times less than the global average. While rapid increases in population and water demand for agriculture, where the region consumes a greater relative volume of water for irrigation when compared with the rest of the world, climate change and increased surface temperatures have caused more frequent and longer heat waves that have sped up the rates of evaporation, gradually reducing limited freshwater surface bodies across MENA[17]. Stronger, recurring droughts have also made precipitation patterns unpredictable, and reduced the amount of rainfall as well. Coupled with faster evaporation that decreases the level of moisture trapped in soil and heightening the risk of desertification – the dominant topography in the region, there is constant concern for reduced food security due to these conditions. Another grave issue of climate change is migration due to sea level rise. Approximately seven percent of the total population of the MENA Region, over 30 million individuals[18], resides in low-lying coastal areas, their revenues dependent on economic activities such as agriculture, fishing, and tourism due to rich biodiversity[19]. Sea-level rise will not only force these individuals into migration, but severely degrade the sources of their income and their ability to access goods and services such as living space, food and water, electricity, healthcare, and education.

Thus, continuously dwindling resources are now expected to be distributed amongst a continuously growing population. Not only does this create shortages, but it could also potentially lead to an upsurge in conflict in the region, a trait that has unfortunately been prevalent in the MENA Region. In reality, increased conflict has already been observed by the region's population. Phenomena known as 'water weaponization' and 'hydro-hegemony' indicate attacks such as extremist groups that would either withhold water from or completely flood and destroy regions, while inequitable water

16 https://www.unicef.org/mena/water-scarcity

17 https://www.ecomena.org/climate-change-water-resources/

18 https://data.worldbank.org/indicator/SP.POP.TOTL?locations=ZQ

19 https://www.iemed.org/wp-content/uploads/2021/01/Climate-Change-in-the-MENA-Region.pdf

consumption upstream a water source causes issues within communities downstream[20]. Other examples include the cutting off electricity supplies to households during extreme weather events such as heat waves or droughts, and extremist groups intentionally polluting scare water sources that lead to the spread of lethal and chronic diseases[21]. These outcomes however will not be evenly experienced by the entire population, as the most at-risk and vulnerable communities – especially households that are low-income, and individuals that are impoverished and unemployed will carry the largest burden. As a result, these individuals, who tend to suffer from physical and mental illness due to amplified scarcity, are most likely to be recruited by violent groups.

Another "conflict" related to climate change also exists in the MENA Region, albeit one that has been improving at a much faster pace. This 'conflict of interest' lies in the fact that a large majority of nations in the region have, and in most cases continue to, attribute the bulk of their economic activity to the oil and gas sector. The Middle East, and particularly the Gulf Cooperation Council (GCC), contributed to over 30% of the global supply of crude oil, and over 17% of the global supply of natural gas in 2021[22].

Almost 12% of the region's GDP is attributed to oil exports[23], with almost half of the GDPs of countries such as Iraq and Saudi Arabia depending on them. With these considerations, it becomes a much more challenging task to propose the elimination of fossil fuels from their existing economic and political systems without providing viable alternatives that address these concerns while simultaneously promoting environmental safety and stability. The good news, however, is that many countries in the region have committed themselves to net-zero and sustainability targets to control and moderate the rate of climate change. The two largest players of oil and gas in the region led these efforts, with the United Arab Emirates being the first country to announce its pledge to net-zero by 2050, with Saudi Arabia following suit and announcing its commitment to decarbonise by 2060.

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20 https://climateandsecurity.org/2021/04/drought-is-leading-to-instability-and-water-weaponization-in-the-middle-east-and-north-africa/

21https://www.ojp.gov/ncjrs/virtual-library/abstracts/water-terrorism-overview-water-wastewater-security-problems-and

22https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2022-full-report.pdf

23 https://data.worldbank.org/indicator/NY.GDP.PETR.RT.ZS?locations=ZQ

Similar to the abundance of fossil fuels in the MENA Region, it is also rich in another resource that will be just as significant to energy transitions and global decarbonisation efforts: solar energy. With the mass availability of desert landscapes and sand dunes, the region is also well equipped to construct and operate a huge volume of photovoltaic cells, harnessing the sun's power to generate sufficient electricity to begin regional energy transitions and reducing overall share and dependence of fossil fuels on energy supplies. Additionally, oil and gas giants in the area such as Saudi Aramco[24] and the Abu Dhabi National Oil Company (ADNOC)[25] are seeking opportunities in renewable energies as well, particularly focusing on green hydrogen as an effective substitute for a variety of uses. Climate diplomacy, policy and framework development, and the mobility of resources to support decarbonisation and sustainability efforts have also gained traction in the MENA Region. Initiatives such as the Middle East Green Initiative, which intends to develop a strategy to sustainably transform the whole region, and investments by companies such as Mubadala and Masdar that jump-start energy transitions through projects in the UAE, Oman, Egypt, Jordan and Morocco amongst many others.

The indication that the MENA Region is committed to the fight against climate was further solidified when it was announced that COP27 and COP28 will be hosted in two countries in the MENA Region: Egypt and the UAE receptively. While strategies for climate change mitigation – the reduction of the emissions that are driving these impacts, and climate change adaptation – creating the necessary infrastructure in response to irreparable damage and loss caused by climate change, are progressing there has not been significant discourse or action towards the implementation of NBS in the region. There are several protected sites and conservatory initiatives across MENA, but the full potential of NBS is yet to be unlocked and fully taken advantage of. Although there are many opportunities for NBS in the region, there are also many challenges that prevent them from being as mainstreamed as they should.

24https://www.aramco.com/en/news-media/news/2021/aramco-expands-focus-on-emerging-sectors-at-future-investment-initiative

25https://www.upstreamonline.com/hydrogen/adnoc-and-taqa-form-green-hydrogen-and-renewables-joint-venture/2-1-1101770

## NBS and the MENA Region

While the term "nature-based solutions" is relatively new and refers to the use or mimicry of nature to address the issue of climate change, the MENA Region has a long and rich history that demonstrates the importance of environmental conservation and restoration, as well as the inclusion of green spaces amongst residential areas. The relationship of the MENA Region and its inhabitants with nature dates as far back as the time of the Pharaohs of Ancient Egypt, where the kings of the twelfth dynasty were accredited with the restoration of the dried up Faiyum Oasis through directing an arm of the River Nile towards it, which allowed agriculture in the region to flourish[26]. Another example is one of the Seven Wonders of the Ancient World: The Hanging Gardens of Babylon, which were created to improve the aesthetic of the Empire[27]. Moreover, the very notion that gardens could be cultivated simply for pleasure and aesthetic value actually originated in the Fertile Crescent. Many practices that enhanced the natural environment of the MENA Region were adopted over the years and were further established as religion spread across the region, where many religions encouraged the protection and conservation of the environment. This was especially true for environments and ecosystems that were religiously significant, where for instance the flora and fauna surrounding holy areas such Mecca or Medina in Saudi Arabia gained special protection, and hunting or plant removal was forbidden within these areas[28].

NBS in the MENA Region's history went beyond digging canals and preserving gardens, local knowledge of the environment helped build a resilient community that took advantage of its natural resources. For instance, Bedouins in the Sinai Region in Egypt developed agricultural systems that were compatible with the harsh and dry topographies they lived in, creating special units to describe the quantity of arable lands, and planting fauna that was known to exist in the region[29], a quality that the IUCN later standardised as the introduction of only local species into an environment.

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26 https://www.asor.org/anetoday/2020/04/climate-change

27 https://www.worldhistory.org/Hanging_Gardens_of_Babylon/

28 https://www.environmentandsociety.org/sites/default/files/key_docs/gari-12-2.pdf

29 shorturl.at/hPY23

Regions that were water stressed such as the UAE pushed communities to develop a series of canals known as 'aflaj' (plural form of 'falaj') that guided freshwater from mountainous areas to arid desert lands for consumption and irrigation purposes[30]. This shows that there is a large pool of inspiration for NBS in the history of the region, and yet the presence of these solutions is extremely limited despite the dire need for their increase. While there are many challenges to NBS in general, a few of the main hurdles that must be addressed will be discussed, in addition to a few opportunities that will incentivise and eventually mainstream the availability of NBS in the region.

## Challenges to NBS in the MENA Region

The challenges and barriers to NBS in the MENA Region are, on a grand scale, similar to those they experience on a global scale with a few key elements that differentiate them form the rest. Broadly speaking, these barriers could be divided into 3 main categories: a lack of funding and perceived risks of investment, a lack of policies and regulations that govern NBS, a lack of understanding and awareness on NBS and their implementation in general, all of which lead to path dependency where stakeholders maintain existing positions and practices due to their unfamiliarity with NBS.

The main issue that hinders the implementation of NBS in general is a lack of financial resources that could be invested into the development of these projects. While climate finance and funding is on the rise, including the MENA Region, it is mostly directed towards climate-tech and mitigation efforts whereas adaptation support, which includes NBS accounts for roughly 3% of available funds[31]. More often than not, NBS are viewed as a publicly provided service, especially if the NBS being developed is in the form of integrating green spaces into urban infrastructure such as the opening of a community garden, or for instance restoring a degraded wetland to increase surface water bodies in a particular area.

30 https://www.emiratesnaturewwf.ae/en/yalla-green/606-before-we-found-oil-we-had-water

31 https://climatefundsupdate.org/wp-content/uploads/2020/03/CFF9-2019-ENG-DIGITAL.pdf

Thus, this could lead to some constraints for public funding such as the purchasing of lands which could run expensive for governments[32] especially since funds for environmentally dedicated projects – notably NBS – can be limited. Additionally, governments are more concerned with preserving and protecting existing ecosystems, especially in the wake of climate change which is causing a rapid decline in their biodiversity and stability rather than directing finances towards degraded ecosystems that would need further planning and upkeep to be restored to productive levels[33]. Private investment is significantly lower than the necessary quantities needed due to several reasons. This includes flawed perceptions of initial costs as green infrastructure is assumed to be more expensive than grey infrastructure though the opposite is true[34].

Additionally, it is difficult to properly valuate functioning ecosystems, regardless of the obvious positive influence they have on the environment and increases in biodiversity, as exact and accurate indicators are not as available and quantifiable as they would be with grey infrastructure[35]. Next, there is a lack of policy and legislative frameworks that could regulate and control the design, development, implementation, operation, and maintenance of NBS.

There are several hurdles that lead to the difficulty in creating policies, the first being that there is yet to be a single unanimously agreed upon definition for NBS, and while the IUCN standards are the most commonly used standards, there are still a few variations in definition – which also make categorising NBS under different categories difficult, causing changes to the policies and legislation that a particular project should adhere to[36]. Additionally, NBS are dynamic ecosystems whose characteristics will change over time – including the benefits that they could provide through the eventual development of the ecosystem. For instance, governance factors that regulate an NBS during its initial

32 https://journals.sagepub.com/doi/10.1177/0956247813477814

33 https://link.springer.com/article/10.1007/s10113-015-0765-6

34 https://www.eesi.org/papers/view/fact-sheet-nature-as-resilient-infrastructure-an-overview-of-nature-based-solutions

35 https://www.crossboundary.com/wp-content/uploads/dlm_uploads/2021/08/Unlocking-private-capital-for-nature-based-solutions-in-emerging-and-frontier-markets-FINAL.pdf

36 https://www.researchgate.net/publication/353822017_Governance_Challenges_for_Implementing_Nature-Based_Solutions_in_the_Asian_Region

phases to protect it from soil erosion thus allowing it to support life should later be updated to include policies that protect the biodiversity that now exists within it.

Finally, an important factor that must be accounted for is the justice, inclusivity and transparency of newly created governance tools pertaining to NBS. There are three types of justices that must be addressed to ensure fair and equitable distribution of risks and benefits through NBS. They include[37]:

- Distributional justice which ensures that access to NBS and its benefits are equitably shared amongst all members of a community, and protects it from being gentrified as a result of the presence of NBS
- Procedural justice focuses on the inclusion and participation of civil society in crucial decisions pertaining to an NBS project
- Recognition justice allows for NBS to fulfil the various needs of individuals of different races, genders, ages, religions, and ethnicities with variances in priorities and expectations for the NBS

NBS are not a new practice as they have been leveraged by indigenous communities for hundreds of years, however the integration of NBS with grey infrastructure with the goal of reducing climate change impacts is a relatively novel approach to NBS.

Thus, it can be expected that there will be a general lack of awareness and a fundamental knowledge gap, which would completely hinder the mainstreaming of these projects and initiatives as stakeholders are uninformed of the necessary advantages and risks that facilitate NBS presence. Prior to discussing NBS implementation though, gaps in awareness and concern for climate change must be addressed first – as a survey conducted by Arab Barometer[38] regarding the priorities of environmental concerns across the MENA Region showed that 38% - the lowest relative percentage when compared with other categories – classified it as very serious, while the survey highlighted that citizens prioritised education, infrastructure, and health care for both government and foreign aid spending.

37 https://www.sciencedirect.com/science/article/pii/S0264275120311872

38 https://www.arabbarometer.org/2022/03/what-mena-citizens-think-about-environmental-issues-in-7-graphs/

This could potentially prevent civil society from advocating for NBS as a solution for climate change due to a lack of awareness that the solutions provided by NBS are multifaceted and could address other concerns as well.

Knowledge gaps are also detrimental to NBS from an implementation perspective, as while the technical knowledge of the design and development stages of a NBS has a general structure similar to that of grey infrastructure, the implementation, operation, and maintenance of them is vastly different and requires different considerations for time, space, and resource availability[39].

The three factors above then lead stakeholders to what is known as path dependency where past conditioning leads them to make the same decisions that prevents them from seeking change or innovation based on concepts and practices that they are familiar with[40]. This then inhibits the transition away from grey infrastructure and toward NBS. Therefore, addressing the three main barriers to NBS would result in a fundamental change in perception and understanding, where a gradual transition could be made to ease the successful uptake of NBS while preparing all stakeholders for a more sustainable future. This brings about many opportunities that require creativity in technology, economy, policy, education, and awareness.

## Opportunities for NBS that the MENA Region Should Implement

When approaching the opportunities of NBS, especially in regions such as MENA where the need for these types of projects is significantly high and the support does not necessarily match this need, the multidisciplinary nature of NBS must be highlighted. In other words, demonstrating the potential that NBS have beyond just environmental protection and preservation is pertinent to garnering initial support and resources for these projects until they have been fully accepted and adopted as the norm.

39 https://www.ecologyandsociety.org/vol21/iss2/art39/

40 https://www.sciencedirect.com/science/article/abs/pii/S026483771830872X?via%3Dihub

Therefore, some of the features of NBS that must be highlighted are their cultural and societal benefits, their positive economic influence, and their ability to foster peace and reduce conflict.

Social implications to NBS could help make the case for them to achieve social acceptance. Humanity's historical relationship with nature has been very dynamic, with more recent trends showing a decline in these relationships especially with the rise of industrialization, technological innovation, and urbanisation where the infrastructure dictating life was no longer impacted by the natural topographical scene of a region[41]. As humanity lost its connection to nature, it became evident that exposure to the natural environment provided and nurtured physical, social, and most notably mental health and well-being amongst individuals. As far as physiological health goes, multiple benefits were observed including the reduction of chronic ailments such as cardiovascular disease or diabetes amongst individuals, and decreased respiratory illnesses were observed as well due to nature's ability to remove irritants and pollutants from the atmosphere[42]. Rates of obesity and its associated symptoms such as high cholesterol levels, diabetes, and heat disease were also reduced with increased access to green spaces. As for psychological health and well-being, epidemics of stress, anxiety, and depression and riddled various parts of the world with studies pinpointing the lack of a relationship with the natural environment and its corresponding advantages as one of the main causes of these mental illnesses[43]. For these reasons, improved access to natural spaces through adopting NBS and participation in nature related activities such as strolls through community gardens or gardening in botanical gardens that are facilitated through NBS can significantly improve mental health disorders[44]. Finally, for social heath, it has been observed that well-managed NBS help support social justice, cohesion, and reduced inequalities through generating partnerships with aligned goals of environmental protection or even preserving the system for its economic and social benefits[45]. NBS are also champions of the preservation of historically,

41 http://encyclopedia.uia.org/en/problem/135677

42 https://www.sciencedirect.com/science/article/abs/pii/S0378778819337922?via%3Dihub

43 https://www.mentalhealth.org.uk/our-work/research/nature-how-connecting-nature-benefits-our-mental-health

44 https://pubmed.ncbi.nlm.nih.gov/28688269/

45 https://naturvation.eu/system/files/mainstreaming_nbs_for_social_inclusion.pdf

culturally, or religiously significant natural sites, and can also strengthen a community's sense of identity[46].

As previously discussed, while the approach to NBS must be different as they deal with living ecosystems, they are also investments and as described by the IUCN standards, they must be economically viable. While an NBS's cost-benefit analysis may be overshadowed by intangible benefits such as overall community well-being, enhanced aesthetics to an area, and improving resilience to climate challenges, recent developments and research have showcased that NBS have the potential to provide their respective communities with employment opportunities, generate revenue streams for government or private spending, and increase the value of regions surrounding their presence. In fact, the World Economic Forum's Report on "The Future of Nature and Business" states that NBS could create over 300 million jobs and mobilise up to $10 trillion by 2030[47].

One of the most common uses of NBS for economic gains is through the use of carbon markets and carbon credits. There are many pathways and schemes for the issuance of carbon credits, the permits that allow companies to emit specified quantities of GHGs, one of which is through the development and upkeep of NBS, which are extremely effective at absorbing and reducing carbon from the atmosphere.

Through determining the quantity of carbon that a project could absorb, entities responsible for the NBS could generate verifiable credits that could then be exchanged on the carbon markets to offset carbon emissions, the transactions resulting in new streams of income[48]. With the announcement of the first regionally and globally regulated carbon trading exchanges by Abu Dhabi Global Market (ADGM)[49], and with growing demands for carbon offsetting projects in the MENA Region due to high volumes of fossil fuel related activities, NBS could be fully leveraged to meet this demand while increasing cashflow

46 https://platform.think-nature.eu/system/files/project_deliverable/d4.1_redacted.pdf

47 https://www3.weforum.org/docs/WEF_The_Future_Of_Nature_And_Business_2020.pdf

48 https://cleanenergynews.ihsmarkit.com/research-analysis/cop26-naturebased-solutions-offset-trading-on-the-rise-as-is-c.html

49https://www.adgm.com/media/announcements/abu-dhabi-to-launch-first-regulated-carbon-credit-trading-exchange-and-clearing-house-in-the-world

to the region, with this new income cycled back into either expanding and upkeeping existing NBS or investing into new projects that would allow for further carbon credit generation as well.

Climate change has been a source for conflict within the MENA Region, which is especially targeting vulnerable and at-risk communities. Resource scarcity is the main driver of climate induced conflict and terrorism[50], indicating that if a solution is capable of resolving the issue of scarcity, and promote a healthy ecosystem with abundant resources that are resilient to attacks or compromise, and can effectively meet the demands of a community, then these scarce resource could no longer be leveraged and weaponised as tools of terrorism. This is where the role of NBS could be magnified, to minimise issues regarding shortage therefore reducing the likelihood of climate driven terror attacks. A case study that demonstrates the ability of NBS and ecosystem restoration to curb the onset of terror attacks was described in India, whereby armed conflict over resources provided by forests led to civil unrest, and the illegal poaching and extraction of these resources[51]. This then led to the deployment of a "green army" with the mission of eliminating the threats posed to the forest, while regenerating degraded parts of it to restore ecosystems and biodiversity hosted by these environments.

There are many practices and opportunities that NBS can provide the MENA Region to not only boost its economic activity and address the gap that decarbonisation and energy transitions would leave behind, but to also support its mobility further towards sustainability. Furthermore, the opportunities discussed in this section must be back by substantial investment and financial resources, adequate governance and regulatory legislation, and evidence-based decisions that will ensure the success and prolong the lifecycle of NBS projects.

50 https://wedocs.unep.org/handle/20.500.11822/30792

51 https://link.springer.com/chapter/10.1007/978-981-15-4712-6_9

## NBS Case Studies in the MENA Region

While NBS projects are far and few within the MENA Region, rapid developments have been made in the last few decades that have established the base for continued growth and support of NBS within the area. A few notable examples of NBS include:

1. ADNOC's commitment to planting over 10 million mangrove seedlings by 2022 with a three-fold objective: the first is to preserve the city and country's heritage and cultural identity as mangroves were essential to the lifestyles of early communities of the city of Abu Dhabi as they provided communities with a variety of uses, the second is to protect the coastal areas of the city from rapid erosion and degradation and maintain the sensitive marine and coastal ecosystems that depend on their presence, and finally to sequester carbon dioxide and other GHG as Abu Dhabi is a major oil producing city[52]. ADNOC has also initiated the greening of Zirku Island, where over 3,500 trees now flourish including the local Ghaf, Samur, and Sidr trees.
2. Oman's Environment Authority, in partnership with several key players including the Omani Sidr Association which specializes in the promotion of local wildlife and conservation, will plant 10 million trees across the entire country. The native trees will be planted with the purpose of reducing the country's carbon footprint, where the water used to irrigate the trees will be treated wastewater, thus allowing percolation and storage in the soil as opposed to discharge into the gulf deeming it no longer useable. The initiative will include the planting of urban trees in addition to local plants which will improve the food security of the country[53].
3. The Kingdom of Saudi Arabia's Saudi Green Initiative highlights the importance of NBS, not only in restoring and regenerating ecosystems, but protecting existing ones to sustain the nation's rich biodiversity. This includes the development of the AlUla Protected Areas Network, the alNafud Preservation Initiative, and conserving habitats that endemic and local species to result in the protection of over 30% of the kingdom's marine and terrestrial areas[54].

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52https://adnoc.ae/en/corporate-responsibility/our-natural-heritage#:~:text=We%20are%20now%20committed%20to,14%20for%20Life%20below%20Water.

53 https://timesofoman.com/article/108931-10mn-trees-to-be-planted-in-oman-to-minimise-carbon-footprint

54 https://www.saudigreeninitiative.org/targets/protecting-land-and-sea/

Additionally, the kingdom has set out to restore and develop ecosystems and green spaces to sequester carbon including the planting of 100 million native trees to offset roughly 45 million tons of carbon dioxide by 2030, in addition to the planting of another 100 million mangrove tress to offset almost 100 million tons of carbon dioxide while protecting coastlines and reducing erosion[55].

4. To address water stress and scarcity across the Hashemite Kingdom of Jordan, and increased drought that has affected rainfall, an NBS project known as managed aquifer recharge (MAR) is being piloted that captures and stores water from rainfall that would've otherwise pooled up and been evaporated rapidly as a result of elevated surface temperatures[56].

While there aren't many examples of effective and ongoing NBS in the region, it is evident that the countries with the most ambitious projects are oil-exporting with relatively stable political conditions, which demonstrates the importance of the availability of financial resources on NBS presence. Thus, financial tools such as green bonds or sustainability-linked loans could be used to support the region in booming its NBS projects to reduce the impact across the entire region while generating benefits and advantages that could be shared regionally, with the proper management and governance policies that ultimately protect the NBS projects.

55 https://www.saudigreeninitiative.org/targets/greening-saudi/

56 https://siwi.org/goal-waters/jordan-2?accordion-strategy

## Conclusion

The MENA Region is no stranger to extreme weather events and the multiplier effect of climate change that worsens existing issues such as water shortage, food insecurity, migration, and conflict and terrorism. In response to these impacts however, the MENA Region boasts a diverse topography that could potentially be leveraged to develop nature-based solutions, mimicking the activity of natural ecosystems and the environment to the advantage of humanity. Despite the risks of climate change, NBS are relatively sparce in the MENA Region, which may be attributed to a collection of challenges and obstacles that deters governments, private investors, and even civil society from supporting and advocating for them. That said, there are many opportunities that should be seized within the MENA Region that would not only boost the region's ability to cope with climate change and effectively adapt its communities to its impacts, but also improve the economic and social state of the region. While the few NBS projects that exist or that have been announced are just the beginning, the arrival of COP to the region until the end of 2023 will surely encourage and incentivise the growth of NBS, and propel the region's capacity to combat climate change to the unprecedented levels it needs to transform sustainably.