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## Nature-Based Solutions: Mitigating Climate Change Within the UNFCCC Context



Sustainability Research Paper

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In 2023, the sixth United Nations Environment Assembly (UNEA) convention provided the first multilateral definition of Nature-based Solutions (NbS), emphasising their dual role in protecting nature and benefiting humans and biodiversity. Although not explicitly recognised under the United Nations Framework Convention on Climate Change (UNFCCC) framework, NbS are acknowledged through references to, inter alia, ecosystems, forests and carbon sinks in the Paris Agreement and CoP Decisions. Nationally Determined Contributions (NDCs) submissions have increasingly mentioned (indirectly and explicitly) NbS, especially in the second round. What are Nature-based Solutions? What is the role of NbS in the context of the UNFCCC, particularly in climate change mitigation? Does the private sector have a role in financing NbS activities?

## SUSTAINABILITY RESEARCH PAPER

This research paper is part of a 12-month series published by the Al-Attiyah Foundation every year. Each in-depth research paper focuses on a current sustainability topic that is of interest to the Foundation's members and partners. The 12 technical papers are distributed to members, partners, and universities, as well as made available on the Foundation's website.





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NDC submissions have increasingly mentioned (indirectly and explicitly) NbS, especially in the second round and the significant mitigation potential and capability of NbS to sequester up to 10 gigatonnes of CO<sub>2</sub> annually by 2050, are now increasingly recognised.

NbS are valued for their cost-effective, multifunctional approach to reducing greenhouse gas emissions and providing co-benefits. However, financing remains a major challenge, with current public finance allocations insufficient for widespread implementation.

Private-sector investment through voluntary carbon markets can help supplement public funds. In 2023, despite a contraction in the market, the total reported transaction value of the VCM was USD \$723M.

Nevertheless, while private investment is crucial, it must aim for high environmental integrity and implementation and stringent social safeguards to avoid issues like over-crediting and community harm.





The term Nature-based Solutions (NbS) was first introduced in a 2008 World Bank report for the World Conservation Congress in Barcelona. The concept was later used in a 2009 position paper to the UNFCCC COP15 by the International Union for Conservation of Nature (IUCN). In subsequent years, both the European Commission (EC) in 2015 and the IUCN in 2016 developed definitions of NbS. The EC's definition emphasised cost-effectiveness and innovation, particularly in the context of urban green infrastructure<sup>1,2</sup>. In contrast, the IUCN's definition focused more on biodiversity and well-being<sup>1,2</sup>. The IUCN definition served as a basis for the formal definition adopted by the United Nations Environment Programme (UNEP) during the fifth session of the United Nations Environment Assembly (UNEA-5) in March 2022<sup>1</sup>. This resolution provides the first multilaterally agreed definition of NbS<sup>3</sup>.

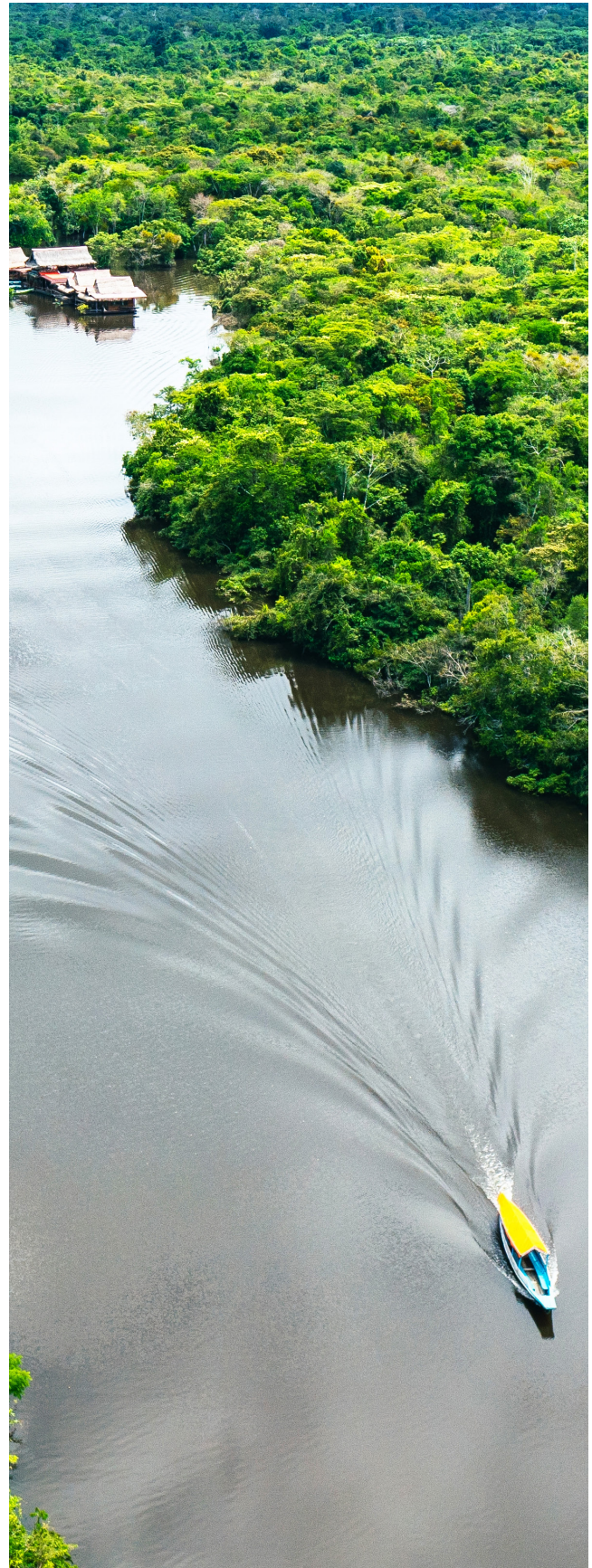
According to the UNEA resolution, NbS are defined as "actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services, resilience and biodiversity benefits<sup>3</sup>. The resolution also emphasised the importance of the implementation of social and environmental safeguards in NbS, in line with the Rio Conventions and acknowledged the role of NbS in the achievement of the Sustainable Development Goals (SDGs)<sup>1,2,3</sup>. Therefore, it is important to note that, according to the official UNEA definition, measures that negatively impact biodiversity and/or do not contribute to human welfare should not be considered NbS.



The resolution also mandated the UNEA to assess criteria, standards, and guidelines on NbS<sup>3</sup>. However, negotiations towards their adoption failed during the sixth session of UNEA (UNEA-6) in (March 2024), with negotiations expected to resume during CBD COP16 (October 2024) or UNEA-7 (December 2025)<sup>4</sup>. Despite the lack of specific guidance at the multilateral level on the implementation of NbS, over the years, guidelines and criteria have been developed by institutions such as IUCN, the World Bank, and WWF. These guidelines agree on the need to support biodiversity and ecosystem integrity, ensure social safeguards, and fully engage Indigenous peoples and local communities in the design and implementation of NbS<sup>1,2</sup>.

A recent literature analysis conducted by Uearthdox identified that 85% of the literature reviewed supports the NbS concept. NbS supporters view NbS as cost-effective (i.e., relatively low implementation cost compared to technological measures such as carbon capture and storage) and a low-risk approach to climate adaptation and mitigation<sup>1,5</sup>. Furthermore, they have a strong co-benefit component as these solutions offer significant synergies with biodiversity protection targets and other ecosystem services provisions such as food and water, climate regulation, and recreational opportunities<sup>1,6</sup>.

On the other hand, around 15% of the literature analysed by Uearthdox is critical to the concept of NbS for climate adaptation and mitigation<sup>1</sup>. Critical institutions include academia, justice and human rights NGOs and Indigenous Peoples and Local Communities (IP&LC) organisations. Critics, for example, argue that the misapplication of NbS can continue to marginalise Indigenous Peoples and Local Communities<sup>1</sup>.







Concerns have also been raised about potential negative impacts on biodiversity – if proper safeguards are not put in place, such as the promotion of non-native monocultures through afforestation projects, which may lead to the spread of new pests and other disasters<sup>5,7</sup>. Furthermore, NbS are associated with high risks of non-permanence (i.e., how to ensure the long-term sequestration and permanence of emissions reductions). These solutions can be disrupted by natural disasters, such as deforestation and peatland drainage, as well as by political, legal, and sector-specific factors that could easily reverse their impact<sup>1,2</sup>. Additionally, other criticisms are framed in the contexts of NbS in the carbon markets context and include concerns about greenwashing (e.g., companies purchasing carbon credits without committing to concrete emission reductions creating an illusion of being committed reduce their emissions) and views on commodification

of nature (i.e., concerns about making “nature” exchangeable through the market)<sup>1,2</sup>.

Although NbS tend to be associated with carbon markets, there is no formal definition of what an NbS measure is. In this regard, examples of NbS measures can encompass government-led national or subnational programmes, locally driven initiatives funded by private sources, or projects executed by multilateral institutions or donor agencies in coordination with governments. Indigenous Peoples and local communities-led initiatives such as mangrove restoration projects in coastal areas or tropical forest conservation projects can also be considered NbS measures<sup>7</sup>. Furthermore, NbS can be implemented across terrestrial and marine ecosystems, although there is significantly more knowledge and understanding about terrestrial-related measures<sup>8,9</sup>.



NbS are not formally recognised or defined under the UNFCCC framework, which is why the term is absent from the Paris Agreement and its corresponding decisions. To find references to NbS in the Paris Agreement, one must look for mentions such as ecosystems, forests, and removals by sinks<sup>7</sup>. Hence NbS are primarily implemented in the Agriculture, Forestry, and Other Land Use (AFOLU) sector<sup>10</sup>. Most of these NbS-related references can be found in the preamble and Articles on mitigation (Article 4), forests and sinks (Article 5), and adaptation (Article 7)<sup>7</sup>. The COP27 decision texts also contain indirect references to NbS. Likewise, the Glasgow Climate Pact, agreed upon by nearly 200 nations at COP26, underscores the importance of NbS for climate change mitigation and adaptation without explicitly naming them.

It acknowledges the intertwined global crises of climate change and biodiversity loss and the crucial role of protecting, conserving, and restoring nature and ecosystems, for climate adaptation and mitigation, while ensuring social and environmental safeguards<sup>10</sup>. While the Paris Agreement and its decisions increasingly recognise the significance of NbS, Article 6, which addresses international carbon markets, indicates a trend toward excluding certain forest-related options, particularly in its Article 6.4 decisions. Negotiations for Article 6.4 are ongoing, and it remains unclear whether Reducing Emissions from Deforestation and Forest Degradation (REDD+) projects will be included under this Paris Agreement Crediting Mechanism. Concerns about the high risks of inflated baselines and the risk of non-performance for this type of project continue to dominate the discussions.



Figure 1 - 1 NbS in Updated NDCs 14

## NATURE-BASED SOLUTIONS IN THE UPDATED NDCS



105 NbS in updated Nationally determined Contributions; red dots denotes NDCs in which the term "nature-based" explicitly mentioned

NbS can be implemented for both adaptation and mitigation. However, there is growing emphasis on their role in climate change mitigation, and extensive research has highlighted the importance of NbS in achieving mitigation targets<sup>11,6</sup>. For example, terrestrial NbS could sequester around 10 gigatonnes of carbon dioxide annually, which is more than the annual emissions from the entire global transportation<sup>12</sup>. Across various ecosystems, forests have the highest overall mitigation potential, followed by grasslands and agricultural areas. Peatlands and coastal wetlands have a very high potential per hectare, but their smaller areas result in a lower overall potential<sup>6,8</sup>. Overall, it is indicated that nature can contribute about 30% of the solution for climate change mitigation<sup>8,11</sup>. Nevertheless, there are high levels of uncertainty associated with the current estimates of the mitigation potential of NbS<sup>2,5</sup>, primarily due to low-quality data in the land-use sector.

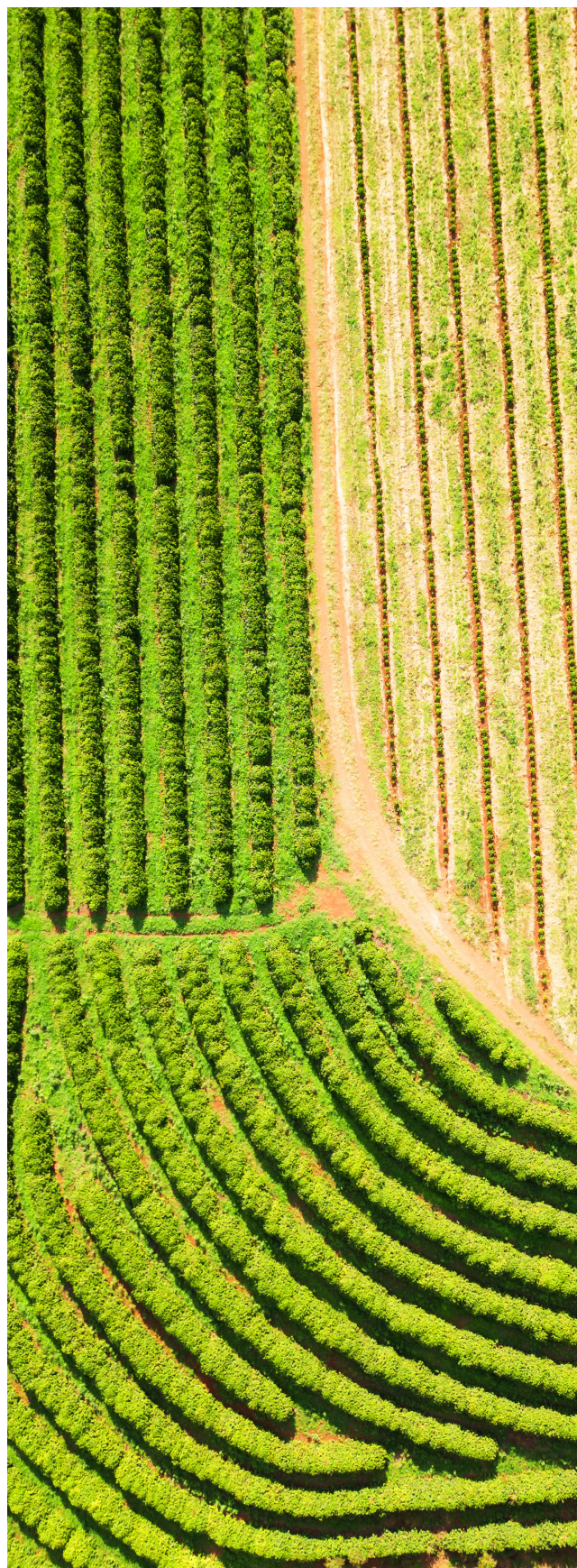
Therefore, it is also indicated that this uncertainty has led to an overestimation of NbS's emission reduction potential by at least 10%<sup>11,7</sup>.

Despite NbS not being an official UNFCCC terminology, its use in NDCs is increasing, as it can be seen by comparing the references to NbS in the first-round vs the second-round of NDCs<sup>14</sup>. Around 148 signatories to the Paris Agreement have submitted a new NDC as part of the new NDC round submission. The analysis of these new NDCs reveal enhanced ambition for NbS, with 84% of revised NDCs making references to the protection or restoration of ecosystems, or agroforestry, in their mitigation and/or adaptation plans, up from 78% in the first round<sup>14</sup>.

It was also found that a total of 102 States – or 84% of all updated NDCs – commit to restoring or protecting ecosystems or implementing nature-based agriculture such as agroforestry<sup>14</sup>. Furthermore, 41% of all revised NDCs (50 countries) explicitly mention 'Nature-based Solutions', with two more referring to 'nature-based' actions or interventions<sup>14</sup>. Still, some countries do not reference NbS directly or indirectly in their NDC documents. This absence is not necessarily a limitation, as there is no specific requirement to include AFOLU targets in the NDCs, and even less so for NbS targets<sup>7</sup>.

It's important to note that NDC references to NbS are a positive sign. However, these commitments need to be translated into domestic policies, specific targets, and corresponding funding. In some cases, even if NDCs do not explicitly reference NbS or only minimally address them, it doesn't mean that a country isn't heavily relying on NbS or the AFOLU sector to reduce its emissions<sup>7</sup>.

For example, Brazil, despite not placing a strong emphasis on NbS in its NDCs, has extensive programs focused on sustainable agriculture (Plan ABC+) and protecting the Amazon rainforest (Action Plan for Prevention and Control of Deforestation in the Amazon-PPCDAm)<sup>7</sup>. This highlights the importance of looking beyond the surface of NDCs to understand a country's true commitment and actions towards NbS and AFOLU initiatives<sup>7</sup>.







To guarantee the climate mitigation benefits of NbS, governments must commit to providing sufficient and long-term financial support. Public funds are the primary funding sources for NbS, making governmental involvement crucial in financing these initiatives. However, the necessary scale of funding for a meaningful transition cannot be supplied by governments alone<sup>8</sup>. NbS receive only a small portion of the current public and private climate mitigation financing. In 2017-2018, only 3 per cent of all climate finance (for mitigation or adaptation) was allocated to the AFOLU and natural resource management<sup>8</sup>.

The COP26 Presidency identified finance for nature and nature-based solutions as one of eleven public finance priorities, urging increased contributions from both public and private sources<sup>8</sup>.

The need is particularly acute in tropical countries, where implementing NbS for climate change mitigation costs a median of US\$100 per tonne, amounting to nearly 6 per cent of national GDP, with some cases reaching up to 46 per cent<sup>8,15</sup>. International transfers, both public and private, will be necessary to support these efforts in tropical nations<sup>8,15</sup>.

A substantial increase in private-sector investment is needed to complement public funding<sup>8</sup>. Carbon markets can provide an opportunity to channel private resources. Carbon markets can be defined as systems designed to reduce greenhouse gas emissions by allowing the buying and selling of carbon credits. A carbon credit typically represents 1 tonne of Co2 achieved through implementing a carbon emission or removal project.



A carbon project must be additional (ensuring that the carbon reductions would not have occurred without the project, set a baseline (reference scenario to measure the project's impact), ensure that the emissions reductions and removals are permanent in time, contribute to sustainable development and minimise environmental and social impacts. Emissions reductions achieved must be verified by an independent third party.

Carbon markets take various forms, encompassing both compliance and voluntary contexts. Compliance markets are typically driven by national mitigation objectives made in the context of international commitments (e.g., Kyoto Protocol, Paris Agreement) or domestic regulations (e.g., California's cap-and-trade programme, Colombia's carbon tax)<sup>16</sup>. Conversely, Voluntary Carbon Markets (VCM) are driven primarily by corporate environmental and social responsibility goals, such as net zero commitments<sup>16</sup>.

VCM Standards are private entities that set guidelines and methodologies for measuring emission reductions and removals from carbon projects. The largest VCM Standards are Gold Standard, Verra, the American Carbon Registry (ACR) and the Climate Action Reserve (CAR). It is important to note, though, that the distinction between VCM and compliance markets has become less clear with the adoption of the Article 6 decisions, as countries could use credits issued under VCM standards to meet their targets set under their NDCs.

NbS projects have been more prominent in the VCM markets than in compliance markets. For instance, under the Kyoto mechanisms, only A/R projects were allowed. Certain cap-and-trade mechanisms, like the European ETS, do not accept NbS credits, and as mentioned earlier, it remains unclear whether the Article 6.4 mechanism will allow REDD+ projects.



Figure 2 - VCM Transaction Volumes, Values and Prices by Project Category 2022-2023<sup>17</sup>

CATEGORY	2022			2023			Percent Change		
	Volume (MtCO <sub>2</sub> e)	Value (USD)	Price (USD)	Volume (MtCO <sub>2</sub> e)	Value (USD)	Price (USD)	Volume	Value	Price
Forestry & Land Use	113.0	\$1.1 B	\$10.14	36.2	\$351.3 M	\$9.72	-68%	-69%	-4%
Renewable Energy	92.7	\$386.1 M	\$4.16	28.6	\$111.1 M	\$3.88	-69%	-71%	-7%
Chemical Processes/ Industrial Manufacturing	13.3	\$68.5 M	\$5.14	12.2	\$50.2 M	\$4.10	-8%	-27%	-20%
Household/ Community Devices	9.1	\$77.6 M	\$8.55	9.9	\$76.6 M	\$7.70	+10%	-1%	-10%
Energy Efficiency/ Fuel Switching	6.6	\$35.6 M	\$5.39	9.4	\$34.4 M	\$3.65	+43%	-3%	-32%
Agriculture	3.8	\$41.7 M	\$11.02	4.7	\$30.6 M	\$6.51	+24%	-26%	-41%
Waste Disposal	6.2	\$44.9 M	\$7.23	1.5	\$10.9 M	\$7.48	-77%	-76%	+3%
Transportation	0.18	\$770 K	\$4.37	-	-	-	-	-	-

On the other hand, VCM standards have developed various methodologies for NbS types like A/R, REDD+, Improved Forest Management (IFM), soil carbon sequestration, and Blue Carbon. In 2023, the total reported transaction value of the VCM was USD \$723M<sup>17</sup>, with Forestry and Land Use Credits accounting for US\$ 351.3M<sup>17</sup>. Despite the significant critics of the NBS projects (see below), A/R and REDD+ credits still hold the largest share in the VCM.

Private sector entities can participate in carbon markets by developing projects, financing third party-developed projects, or acquiring carbon credits. Regarding NbS projects, their primary involvement is within the VCM. Still, it is crucial for them to invest in high-integrity projects or acquire high-integrity credits, meaning, inter alia, projects that are additional, have robust baselines, and minimise social and environmental risks, as NbS projects have been heavily criticised for not meeting those requirements. These critics, highlighted in numerous papers, have stemmed from flaws in methodologies but also due to unscrupulous project developers.

Consequently, NbS projects are under constant scrutiny from the media and NGOs<sup>18</sup>.

Therefore, while private investments in NbS are essential, they must adhere to strict environmental and social safeguards and strive for the highest environmental integrity. Project developers should not only meet the requirements set by standard bodies but also implement best market practices. This might involve applying Article 6.4 rules, where applicable, or following IFC safeguard requirements in addition to the standards' safeguards. Given the risks associated with NbS projects, thorough due diligence at the onset of project development and effective risk mitigation activities are crucial. For private entities buying NbS carbon credits, it is essential to refer to rating agencies or, when possible, perform their own due diligence.

Here we summarise three main types of NbS carbon projects and highlight common risks associated with each, providing a starting point for investors looking to engage with these projects:



### **Improve Forest Management:**

IFM encompasses a wide range of practices aimed at increasing or maintaining forest carbon stocks and preventing their loss. Common activities include extended rotation periods, increasing productivity, shifting from production to conservation, reduced impact logging, and avoiding degradation. These activities are often implemented simultaneously. Of the five major carbon crediting programs, ACR, CAR, and Verra register IFM projects. Most IFM credits originate from the United States, primarily due to their eligibility under California's Emission Trading Program. Other notable countries of origin include Mexico, which has several hundred projects registered with CAR, and China, which has projects registered with VCS<sup>19</sup>.

IFM projects face a high risk of failing to meet the additionality requirement, which varies with the forest management practices implemented. For instance, increasing forest productivity can maintain or increase timber revenue, while shifting from timber production to conservation is more likely to be additional due to the loss of timber revenue. These projects often overestimate total emission reductions and removals due to unrealistic baselines and underestimated leakage. The benefits of sustainable development are generally limited and vary depending on the specific activities of the IFM project. For example, shifting from timber production to conservation can significantly contribute to SDG 6 (clean water and sanitation) and SDG 15 (life of land), whereas reduced impact logging has modest positive impacts on a few SDGs<sup>19,20</sup>.





## A/R Activities

A/R activities can be categorised into commercial afforestation, which creates new forests for timber production, and the establishment of natural forests, which focuses on creating ecologically appropriate forests on non-forest land. In the latter case, forests are not used for commercial purposes like harvesting but may support sustainable subsistence. Major carbon crediting programs, including ACR, CAR, GS, Verra, and CDM, support both projects. Both project types remove greenhouse gases by increasing forest carbon stock<sup>21</sup>.

For A/R projects focused on establishing natural forests, the risks of failing additionality requirements are low, as many projects rely exclusively on carbon credit revenues to fund tree planting and forest maintenance. Also, most methodologies keep the risk of overestimating removals low. The sustainable development benefits of these projects are highly context-

dependent but tend to be positive, especially in those cases where reforestation is done with native species<sup>21</sup>.

Conversely, while having quantification methodologies that likely lead to low to medium overestimation of removals, commercial afforestation projects face higher additionality risks. This is because these projects do not solely rely on carbon credit revenues but also generate income from timber harvesting. Furthermore, establishing planted forests on non-forest land areas does not necessarily provide substantial SDG benefits. Although this project type directly supports the afforestation target under SDG 15 (life on land) and can improve water retention, reducing flood and erosion risks, it can negatively impact biodiversity by introducing fast-growing species, potentially in monocultures, and by applying fertilisers, which can harm the ecosystem<sup>22</sup>.



## REDD+

REDD+ projects can be divided into two categories: avoiding unplanned deforestation and avoiding planned deforestation. These projects can be implemented at various scales: local, nested within a larger area, or at the jurisdictional level (national, subnational, or in Indigenous' protected areas). Local agents drive unplanned deforestation due to socioeconomic forces like subsistence agriculture, encroaching roads, or illegal logging<sup>24</sup>. Planned deforestation refers to legally authorised deforestation planned by an identifiable entity. These projects reduce emissions by avoiding the loss of forest carbon stocks. Among the major global carbon crediting programs, only Verra offers registration for these project types, while ART TREES supports Jurisdictional REDD+. Avoided Planned Deforestation and Avoided Unplanned Deforestation together hold the largest share of carbon credits in the voluntary carbon market<sup>17</sup>.

The old Verra methodologies were criticised for significantly overestimating emission reductions<sup>24</sup>. The new methodology, VM0048, released by Verra in December 2023, aims to reduce this risk but may still lead to overestimation. Most projects are financially unattractive without carbon credits, indicating low non-additionality risks. However, Verra allows activities that are legally mandated but not systematically enforced as an exception to meet the additionality criterion, which could pose a risk of having projects that are not truly additional<sup>24</sup>.

These project types contribute to SDG 6 (clean water and sanitation) and SDG 15 (life on land). Healthy forests retain water better, reducing flood risks, and project activities help maintain or improve forest ecosystems by avoiding deforestation and introducing sustainable management practices.

However, poorly designed projects can restrict access to forest resources or limit agricultural expansion without providing alternatives, negatively impacting local communities' livelihoods (SDG 1, no poverty). Furthermore, in tropical regions, contested land tenure and failure to recognise Indigenous land rights have been issues in past projects<sup>24</sup>.







NbS have a significant mitigation potential, with estimates suggesting they could sequester up to 10 gigatonnes of carbon dioxide annually by 2050. Their role in climate change mitigation has gained significant attention due to their effective and cost-efficient approaches to reducing greenhouse gas emissions while delivering multiple co-benefits.

Financing remains a critical hurdle for the widespread implementation of NbS, as current public and private climate finance allocations are insufficient. The report emphasises the need for substantial private-sector investment to complement public funding, highlighting the role of voluntary carbon markets in leveraging private resources. In 2023, the annual size of the VCM was around US\$ 1.3 billion, with REDD+ and A/R projects holding the largest market share. The private sector can participate as project developers, financiers or through buying credits.

However, despite the necessity of private investment to scale NbS, projects must aim for the highest environmental integrity. This includes robust baseline estimations and accurate quantification of emission reductions alongside stringent environmental and social safeguards. NbS projects have faced significant criticism, particularly regarding over-crediting and negative impacts on surrounding communities. Thus, the private sector's role is crucial but must be guided by high-integrity practices to avoid greenwashing and ensure genuine climate benefits.

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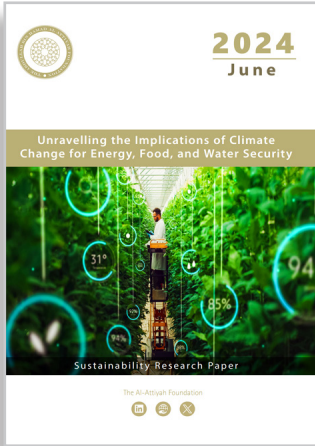
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24. CCQI (2025): Avoided Unplanned Deforestation, <https://carboncreditquality.org/download/Factsheets/EN/Avoided%20Unplanned%20Deforestation.pdf> (Accessed: July 21 2024)

### Contributing Authors:

- Sandra Dalfiume
- Anne-Kathrin Sacherer

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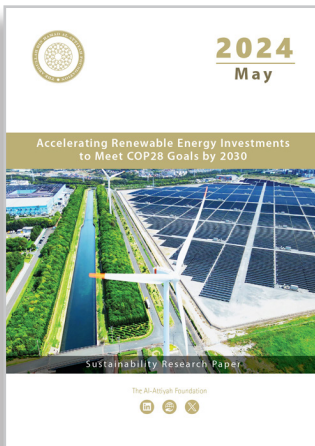
June – 2024

**Unravelling the Implications of Climate Change for Energy, Food, and Water Security**

Global climate change is becoming more severe, as evidenced by the global mean temperature reaching a record high of  $1.45 \pm 0.12$  °C above the pre-industrial levels in 2023.



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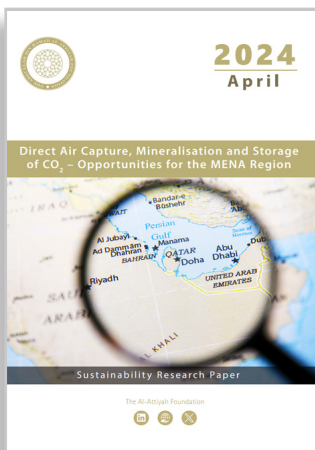
May – 2024

**Accelerating Renewable Energy Investments to Meet COP28 Goals by 2030**

At COP28, over 130 countries committed to tripling global installed renewable energy (RE) capacity from around 3,400 gigawatts (GW) in 2022 to 11,000 GW in 2030 or 60% of global power generation capacity.



(QRCO.DE)



April – 2024

**Direct Air Capture, Mineralisation and Storage of CO<sub>2</sub> – Opportunities for the MENA Region**

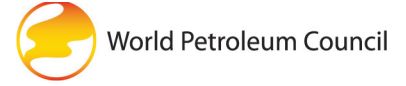
As the world grapples with the consequences of anthropogenic emissions, the Middle East, and North Africa (MENA) region stands at a critical juncture.



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Our partners collaborate with The Al-Attiyah Foundation on various projects and research within the themes of energy and sustainable development.





## The Al-Attiyah Foundation

 Tel: +(974) 4042 8000,  
Fax: +(974) 4042 8099  
 [www.abhafoundation.org](http://www.abhafoundation.org)

 Barzan Tower, 4th Floor,  
West Bay.  
 PO Box 1916 Doha, Qatar

 [AlAttiyahFndn](#)  
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