Mangrove, A Nature Based Solution to Mitigate Climate Change

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ABSTRACT
Mangroves are unique coastal ecosystem providing astonishing benefits like coastal protection, carbon sequestration, nutrient processing, breeding and feeding grounds to organisms. The mangrove rehabilitation activities conducted by the Ministry of Climate Change & Environment (MOCCAE) in the United Arab Emirates (UAE) provides nature-based solution to reduce greenhouse gas emissions, carbon farming and enhances the efforts to protect and restore habitat. Currently, the UAE has around 60 million mangroves in an area of 183 sqkm that sequesters 43,000 tons of CO2 annually. The 100 million mangrove planting initiative will expand the mangrove habitat to an area of 483 sqkm and will sequester nearly 115,000 tons of carbon. The success of these activities is attributed to integrated approach to sustainability and commitment to environmental conservation. Being implemented through partnership, co-ordination and co-operation between the government and private sectors, NGOs, educational institutions contributing and strengthening efforts to protect ecosystem and biodiversity. The present paper discusses the details of successful mangrove restoration and associated blue carbon project activities United Arab Emirates.

KEYWORDS:
Mangroves, United Arab Emirates, blue carbon, climate change.

INTRODUCTION
Mangroves are one of the effective nature-based solution tools for tackling climate change, the biggest strength being capturing and storing carbon. Mangroves are highly efficient carbon sinks and provide vital ecosystem services such as coastal protection, water filtration, and habitat for

numerous species. The high effectiveness and enormous ability of mangroves to absorb and capture carbon up to four to five times greater than wild tropical rain forests.

Mangrove rehabilitation has been a key to the sustainable journey in the UAE. Mangroves or 'el qurm' (Arabic) are unique marine eco systems, covering thousands of hectares along the coastline of United Arab Emirates (UAE). It is an important and integral part of our coastal ecosystem in this country. Mangrove forests are found in intertidal areas protect the coastline from rising sea levels, storm surges and are important in the prevention of coastline erosion caused by wave action and ocean currents. They provide natural habitat for marine biodiversity, apart from making these places beautiful must visit spots.

Conservation of mangrove forests are integral to the preservation of the UAE coastline. This important coastal habitat is under constant threats, that include coastal development, pollution, sedimentation, changes in tidal flow and human impacted activities. Currently, the UAE has around 60 million mangroves in an area of 183 km^2 that sequester 43,000 tons of CO_2 annually. The sole species present in the UAE mangrove forest is *Avicennia marina* or grey mangrove. The mangroves in UAE has been steadily increasing both in area and in size with habitat rehabilitation efforts initiated by the MOCCAE.

The ambitious project to plant 100 million mangroves, launched in 2021, in coastal areas over the next decade (by 2030) incorporates mangroves as a nature-based solution into the country's commitments under the UN Paris Climate Agreement. This initiative establishes collaboration with partners like local communities, non-governmental organizations, and the private sector, ensuring widespread participation and long-term success. Alongside, 'The National Carbon Sequestration Project' was established in 2022 that aims to enhance carbon storage in ecosystems while providing socio-economic benefits to local communities. The project focuses on promoting sustainable land use practices, reforestation, and afforestation efforts. The expected results are expected to be presented in 10–15 years accelerating the net zero achievement. The 100 million mangrove planting initiative will expand the mangrove habitat to an area of 483 sqkm and will sequester nearly 115,000 tons of carbon. The success of these activities is attributed to integrated approach to sustainability and commitment to environmental conservation.

Planting 100 million mangrove trees by 2030 couples with the National Carbon Sequestration Project provides opportunities as:

- Nature-based solutions achieving net zero
- Blue carbon (the sequestration and storage of carbon by ocean ecosystems), Greenhouse Gas GHG reduction & carbon farming
- Efforts to protect ecosystems and biodiversity
- Restoration and expansion of forest habitat

The current paper discusses the history of mangroves and mangrove restoration efforts in the United Arab Emirates, the ambitious 100 million mangrove planting initiative presented as a nature based solution contributing in mitigation of climate change, its road map, current status and future prospects.

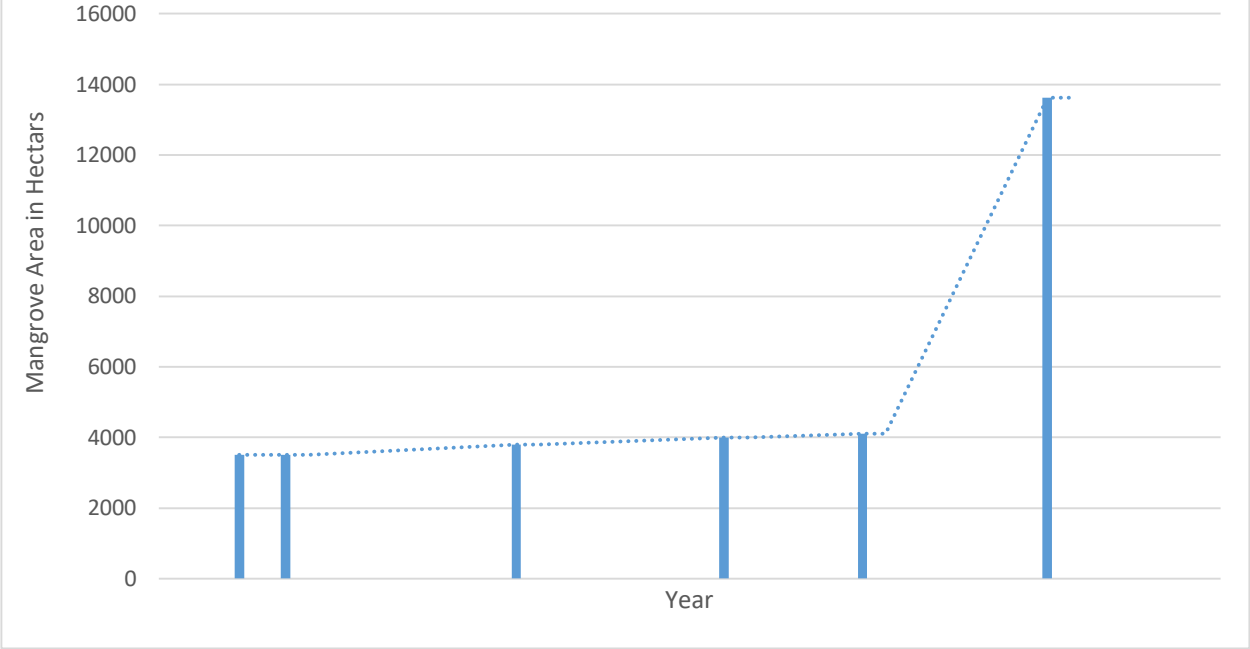
MANGROVES IN THE UAE: COMPOSITION AND EXTENT

The UAE mangrove forests have patchy distribution, significant stands are found in Abu Dhabi, Khor Al Bazm Sabkha and in Sinaiya Island. Ancient mangrove trees were recorded at two sites on Khor Al Beida and Khor Kalba. Two true mangrove species were found in the UAE, the widely distributed *Avicennia marina* (Forssk.) Vierh. and *Rhizopora mucronota* Poiret in Lam. which was re-introduced in 1984.

In 1978, according to Rabanal and Beuschel (1978) the country has an estimated mangrove area of 3,000 hectares. The estimates on FAO 153, mangrove area on 1990 was 3800 hectares, and the area changes to 4000 hectares and 4100 hectares on 1999 and 2005 respectively. From 2005

the estimated mangrove area, based on the latest survey as initiated by the MOCCAE on 2011 to 2013 extent to 13,616 hectares (Figure 1).

Figure 1. Map of Mangrove Area Extent Over 2017/2019



The restoration plantings undertaken in the country, a significant increase was noted in Abu Dhabi and Umm Al Quwain from the period of 1978 to 2013). From no document in 1978, Dubai has a mangrove area estimate of 63 hectares on 2013 (Table 1).

MANGROVE SITES IN THE UAE

Table.1 Mangrove Area Estimates on 1978 (FAO) and 2013 (G.E.Moore, et.al.)

Emirates	**Mangrove Area** (in hectares)	
	1978	2013
Abu Dhabi	2500	10834
Ajman	20	158
Sharjah	150	204
Dubai	N.A.	63
Ras Al Khaimah	20	480
Umm Al Quwain	200	1877
Estimated Total Mangrove Area	**±3000**	**13616**

Abu Dhabi has the most total estimated area of mangrove as it has approximately 86% of the total land area of the UAE and has the longest coverage of suitable coastal habitat (est. 495 km, excluding the offshore islands. After 35 years (1978-2013) the mangrove area estimates extent from 2500 hectares to 10834 hectares, showing an annual change of 238 hectares (Figure 3). Umm Al Quwain, has an area estimate of 200 hectares on 1978 and extent to 1877 hectares on 2013, with an annual change of 48 hectares (Figure 4).
Khor Kalba, Sharjah (Figure 5) the site is lined with tall mangrove trees in the channel. Stands of *A. marina* trees up to 8 meters in height and appear to be the oldest mangrove trees in the UAE, D.A. Scott (1995) [4]. On 2013, it was declared as Mangrove and Alhafeya protected Area (National Protected Area), Ramsar site no. 2125 [5]. Although in 1978, there was no document of mangrove estimates in Dubai, because of the significant planting effort in Ras Al Khor, the emirates has mangrove area extent of 63 hectares. The site was declared as a National Protected Area as Ras Al Khor Wildlife Sanctuary on 2007, Ramsar Site no. 1715.

Below; the different maps showing important mangrove sites in UAE.

Figure 3: Mangrove area estimates for Abu Dhabi for 2011-2013

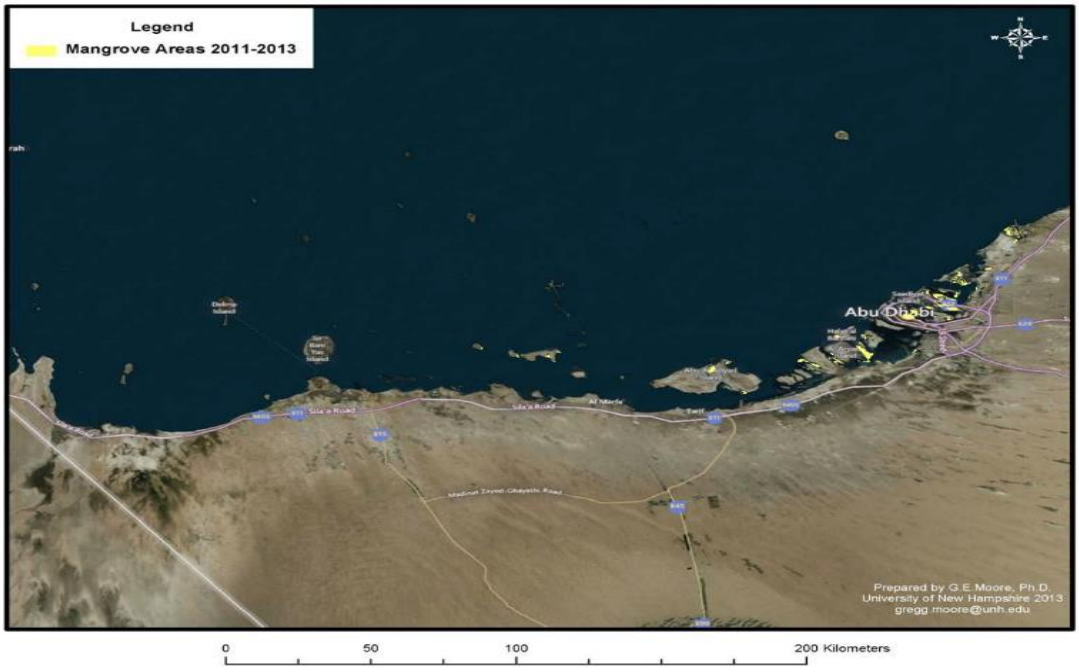


Figure 4: Mangrove area estimates for Umm Al Quwain for 2011-2013

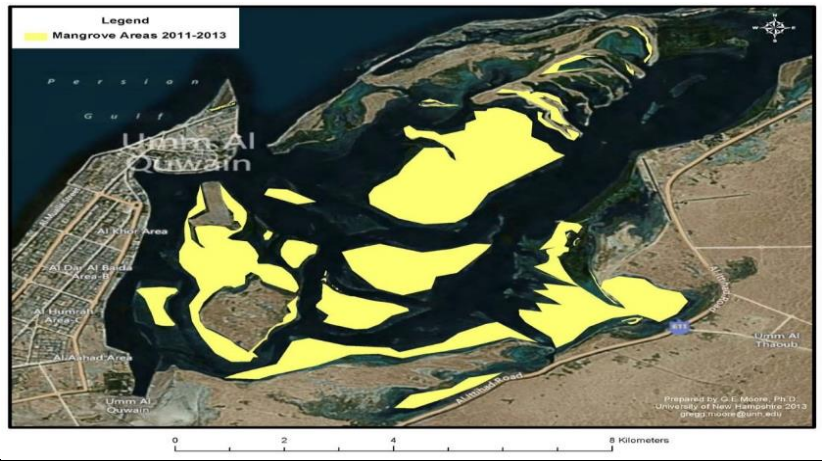


Figure 5: Mangrove area estimates for Khor Kalba (Sharjah) for 2011-2013

Figure 6: Mangrove area estimates for Ras Al Khor, Dubai for 2011-2013

CURRENT RESTORATION EFFORTS AND ACTIVITIES

In line with the UAE's announcement to expand the mangrove forests cover to enhance blue carbon ecosystems by raising the ambitious target for planting mangroves across the country to 100 million trees by 2030, the Ministry developed a plan to implement the project that includes setting annual targets for planting mangroves in each emirate during 2022-2030.

The UAE coasts have one of the rarest types of mangroves, called the grey mangrove (*Avicennia marina*), and mangroves cover large areas of the coastal areas. The UAE is home to mangrove forests that extend over an area of 183 square kilometers and capture 43,000 tons of carbon dioxide annually. With the addition of 100 million mangrove trees, the total area of mangrove forests will reach 483 square kilometers, which in turn will contribute to capturing approximately 115,000 tons of carbon dioxide annually.

The UAE national carbon sequestration project aims to enhance the country's capabilities in adapting to the effects of climate change and support the objectives of the UAE net zero by 2050 strategic initiative. The project also contributes to ensuring the protection of the marine environment, the preservation of its natural resources and biodiversity and achieving the following 2030 Sustainable Development Goals:

- SDG (13): Take urgent action to combat climate change and its impacts.
- SDG (14): Conserve and sustainably use oceans, seas and marine resources for sustainable development.

The Marine Environment Research Centre (MERD) of MOCCAE has dedicated mangrove nursery facilities that produce seedlings, in the year of 2022 a 30,750 seeds and seedlings were planted in different sites in UAE. The Ministry also works in coordination with its partners from the local environmental authorities in each emirate to expand the scope of the mangrove forests through developing nurseries and planting programs that are carried out in locations specified by the local environmental authorities. The Ministry recognizes the important role played by partners from various sectors, governmental, semi-governmental and non-governmental institutions, the private sector and public benefit associations, in achieving the goal of planting 100 million mangrove trees by 2030 many private organisations and NGOS like ENWWF, Boehringer Ingelheim, Goumbook has partnered with MOCCAE as part of their sustainability initiatives in the mangrove planting campaign.

FUTURE PLANS AND OUTCOME

The main outcome perceived by the initiative is to develop a diverse, functional, and self-sustaining mangrove forest that can provide environmental and human benefits. Protecting existing mangrove habitats to promote natural colonisation and mangrove planting has been the key steps implemented as part of this initiative, the mangrove planting initiative in the form of replanting mangrove stands with nursery raised seedlings and planting new potential areas aims to improve coastal sustainability by increasing mangrove cover in the country and serving as biodiversity hotspots, combating climate change by sequestering carbon.

In order to support the planting programs, the Ministry seeks to involve the largest possible number of leading authorities in the country. Capacity building of local entities and youth volunteers training is a key objective. A part of this a technical guideline of mangrove planting and restoration is being prepared by experts in the country. Educational awareness programs are perceived as a key objective of this initiative, where future generations can learn about climate change and resilience. Use of innovative technology in planting, like using drones and AI is being experimented with and is also to be implemented on large scale minimizing cost, efforts and time. Eventually, coordinated efforts are being implemented to achieve mangrove conservation and restoration, contributing to a green and resilient habitat in coastal areas, and help the United Arab Emirates better mitigate the impact of climate change.

REFERENCE

1 Rabanal, H.R., Beuschel, 1978. The Mangroves and related coastal fishery resources in the United Arab Emirates. FAO, Rome.

2 FAO 2007. The world's mangroves, 1980-2005: A thematic study in the framework of the Global Forest Resources Assessment 2005 Food and Agriculture Organization of the United Nations, Rome.

3 Moore, G.E., Grizzle, R.E> and K.M. Ward. 2013. Mangrove resources of the United Arab Emirates: Mapping and site survey 2011-2013. Final Report to the United Arab Emirates Ministry of Environment and Water. 28pp.

4 Convention on Wetlands 2023, Ramsar, Switzerland, https://www.ramsar.org/country-profile/united-arab-emirates