

# - Case Study -

## Mangroves in Saudi Arabia: Working with nature to combat climate change



**Sustainable development goals (SDGs)**

Goal 11: Sustainable cities and communities

Goal 13: Climate action

Goal 14: Life below water



**Relevant concept/ issues**

Climate change and biodiversity



**Relevant sector**

Forestry

### **Background**

Along with 197 parties, Saudi Arabia signed a United Nations convention on combating desertification. Achieving neutrality in land degradation is an essential element toward reaching the sustainable development goals adopted by all United Nations member states in 2015 to protect the planet and to end poverty by 2030.

Human poverty is closely linked with ecological degradation. Damaged ecosystems put pressure on the capacity of lands and seas to support people. Paramount for our carbon-constrained planet is retaining, building, and restoring sustainable environmental, social, and economic communities. Investing in nature-based climate change solutions lifts people out of poverty, which in turn preserves biodiversity.

Saudi Arabia is an ancient land fringed by spectacular seas to its east and west. However, no rivers flow, rainfall is sporadic, and summer temperatures are high. Despite the scarcity of water, nature lives in this imposing, but fragile, environment but many native plants and animals are vulnerable to extinction. The Kingdom is home to native tree species not found anywhere else on Earth. Aligned with its Saudi Vision 2030 transformational program, Saudi Arabia has activated multiple native tree-planting programs along its coastal plains, wide-open deserts, and mighty mountains.

## Carbon cycle

The carbon cycle is nature's way of reusing carbon atoms, which travel from the atmosphere into organisms on Earth and then back into the atmosphere over and over again. On Earth, most of the carbon is stored in rocks and sediments, while the rest is located in the ocean, atmosphere, and in living organisms. These are the reservoirs, or sinks, through which carbon cycles.

Carbon is released back into the atmosphere when organisms die, volcanoes erupt, fires blaze, fossil fuels are burned, and through a variety of other mechanisms. Humans play a major role in the carbon cycle due to their activities, such as the burning of fossil fuels or land development. As a result, the amount of carbon dioxide in the atmosphere is rapidly rising.

For more information about the carbon cycle, please refer to the concept sheet on “Carbon cycle and climate change/global warming”.

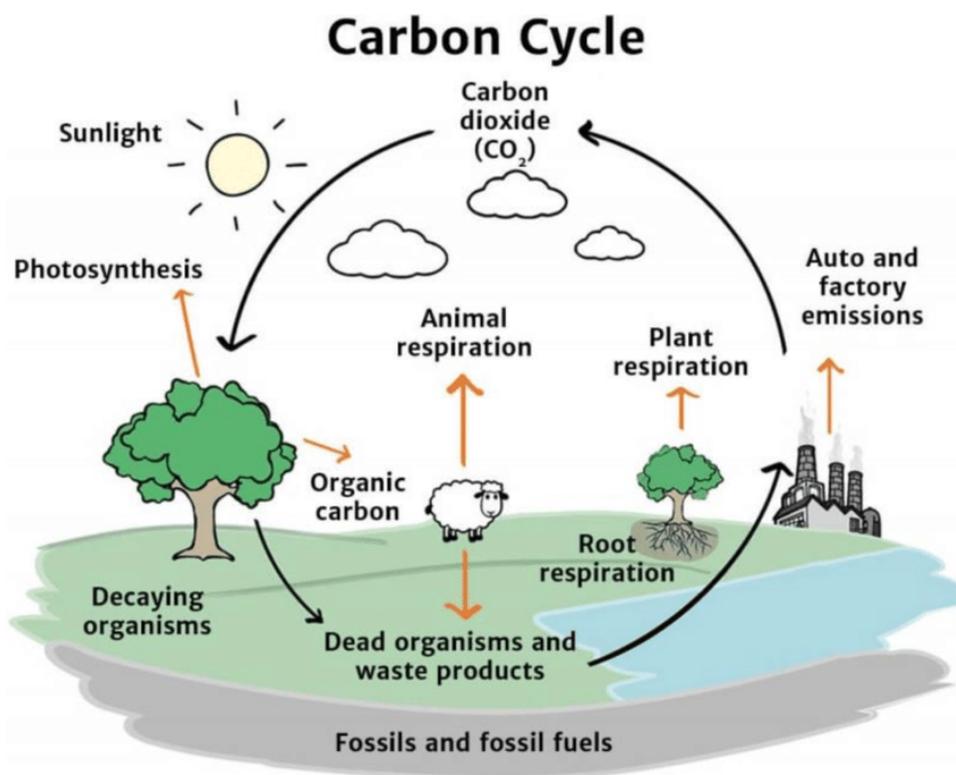


Fig. 1. Carbon Cycle.  
Source: Alamy (2020).

Blue carbon is the term for carbon captured by the world's oceans and coastal ecosystems. Sea grasses, **mangroves**, salt marshes, and other systems along our coast are very efficient at storing CO<sub>2</sub>. These areas also absorb, and store carbon, at a much faster rate than other areas, such as forests, and can continue to do so for millions of years. The carbon found in coastal soil is often thousands of years old. When these systems are damaged or disrupted by human activity, an enormous amount of carbon is emitted into the atmosphere, contributing to climate change (National Ocean Service, 2022).

## The importance of mangroves in combating climate change

Mangroves, as the only tree type able to live in saltwater, can (Pineiro, 2020):

1. Quickly sequester more carbon for longer than land-based trees
2. Absorb air pollutants and purify water by absorbing impurities and heavy metals
3. Prevent erosion and stabilize coastlines
4. Provide abundant habitats for coastal fauna and flora

Mangroves perform several important ecological functions such as coastal protection, carbon sequestration, enriching the biodiversity of coastal areas, promoting land accretion and supporting fisheries. They also have more economical significance. Specifically, the mangrove ecosystem possesses great potential to mitigate the adverse impacts of climate change and maintains a higher range of ecological stability. Mangroves grow luxuriantly in harsh conditions, such as high salinity, temperature, extreme tides, strong winds, and muddy and anaerobic soil. They evolved with well-developed morphological, ecological as well as physiological adaptations that make them more resistant and resilient to overcome the effect of adverse condition. Mangroves have unique properties in terms of their structure and function such as viviparous germination, well-developed aerial roots, lack of growth rings, adaptability to environmental changes and more efficient nutrient retention capabilities. **Various important ecosystem systems, such as nutrient cycling, carbon storage, soil formation and ecotourism were provided by mangroves that supported the livelihoods of coastal societies in tropical and subtropical areas.** The mangrove ecosystem is the most productive ecosystem and **stores more carbon in the above- and below-ground than terrestrial forests (see Figure 2).** This ecosystem acts as a functional unit, which involves plants, animals, microorganism and their interactions with the surrounding environment.

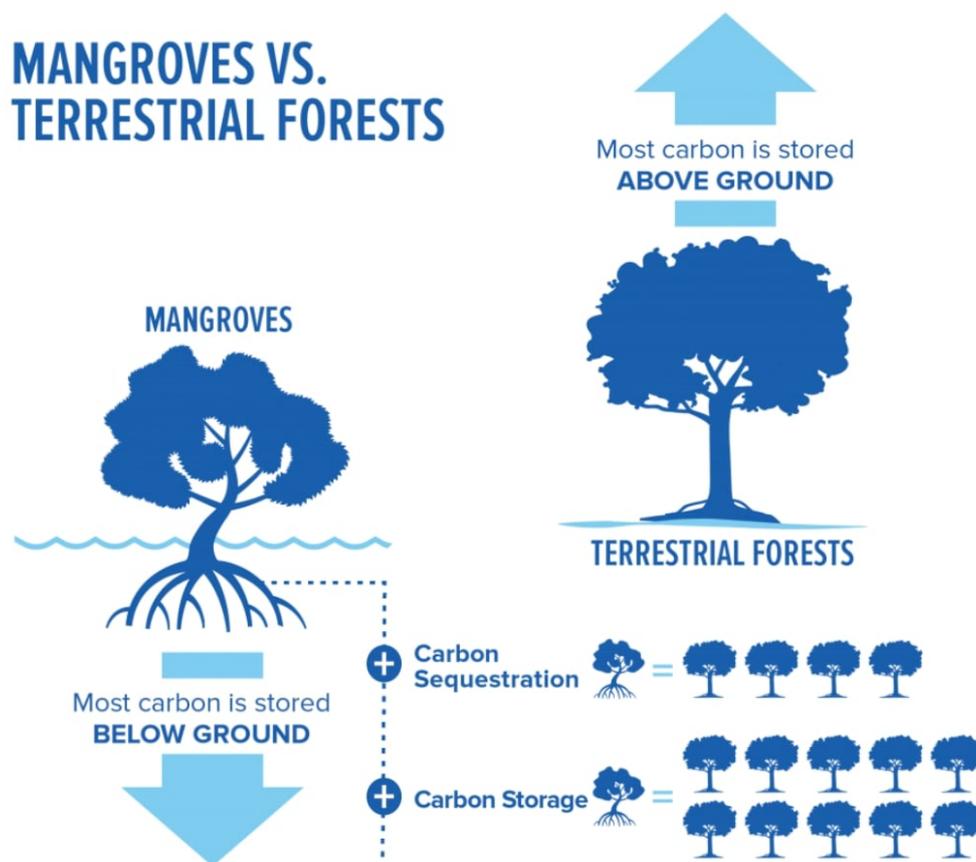


Fig. 2. Mangroves vs Terrestrial forests.

Source: [https://earth.org/data\\_visualization/the-true-value-of-mangroves/](https://earth.org/data_visualization/the-true-value-of-mangroves/)

Mangroves are particularly suited to Saudi Arabia's thirsty desert shorelines. Despite the Gulf waters having a higher salt content than most oceans and seas around the world, the plants in mangroves have a 90% survival rate, and thrive in extreme variations of water temperatures and dissolved oxygen. Although Saudi Arabia has sporadic rainfall and sparse vegetation, it is surrounded by seas on both sides, making mangroves ideal as a species to increase natural forests in the Kingdom, because they don't need to be watered. They live in conditions that no other tree can, they connect the land and the sea, and are an important nature-based solution towards adapting to, and mitigating, climate change (Pinheiro, 2020).

Mangroves are mainly found off the southwestern waters in the Jizan region. They help protect marine habitats, seagrass, coral reefs, and more from harmful runoffs from passing boats and human waste. To further protect mangrove forests, the ministry planted more than 875,000 mangrove trees in the southern regions of the Red Sea coast. The first is in a location dubbed Bahar1 and is near the cultural village, south of Jizan city, where 440,000 trees were planted. There were 435,000 mangrove trees planted in Bahar2 in the town of Al-Sawarmah (ARABNEWS, 2021).



Fig. 3. Mangroves that planted in the Jizan region.  
Source: <https://www.arabnews.pk/node/1953386/saudi-arabia/mangroves/>

## The actions of planting mangroves

### 1. The Saudi Green Initiative

The Saudi Green Initiative began on October 23/24, 2021, and aims to assert the country's ambitions to achieve change domestically and regionally regarding climate change, to build a better future, and improve the quality of life. The country has made significant efforts to protect the environment and mitigate the effects of climate change. Reducing carbon emissions is crucial for slowing the impact of climate change and restoring environmental balance. According to the Green Initiative, ten billion trees are planned to be planted throughout the Kingdom in order to transform the desert into green land and rehabilitate 40 million hectares of land in the upcoming decades (ARABNEWS, 2021).

Twenty-four initiatives are contributing to the target of planting 100 billion trees across Saudi Arabia. For more information about the Saudi Green Initiative, please visit: <https://www.saudigreeninitiative.org/targets/greening-saudi/>

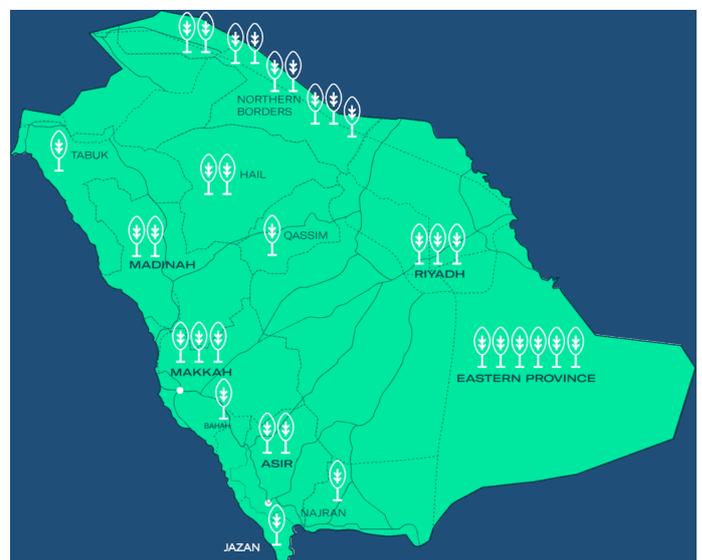


Fig. 4. The Kingdom's journey towards 10 billion trees  
Source: <https://www.saudigreeninitiative.org/targets/greening-saudi/>

## 2. Aramco's New Mangrove Eco-Park

The Eco-Park is the first facility in the Kingdom dedicated to the preservation of mangrove forests, which provide critical buffer zones between land and sea as well as being breeding and nursery grounds for various marine life.

The development of the eco-park was completed in 2021, and now protects 64 km<sup>2</sup> of marine habitats including mangrove forests, salt marshes and sea grasses, which are all important nurseries for fish and shrimp.

This eco-park helps foster knowledge and appreciation of this fragile ecosystem, and consists of a visitor center, trails, and boardwalks, with various observation and education points. Each element of the facility contributes to the mission of environmental preservation and local awareness. An on-site field lab is fully equipped with all the tools necessary to study the mangrove forest and coastal biodiversity. A boardwalk has been for visitors to stroll into the estuary and view the forest and the local wildlife up close. An adjacent mangrove nursery houses seedlings that will expand the size of the mangrove forest, and keep this mangrove forest alive and well for generations to come (*The Arabian Sun*, 2021).

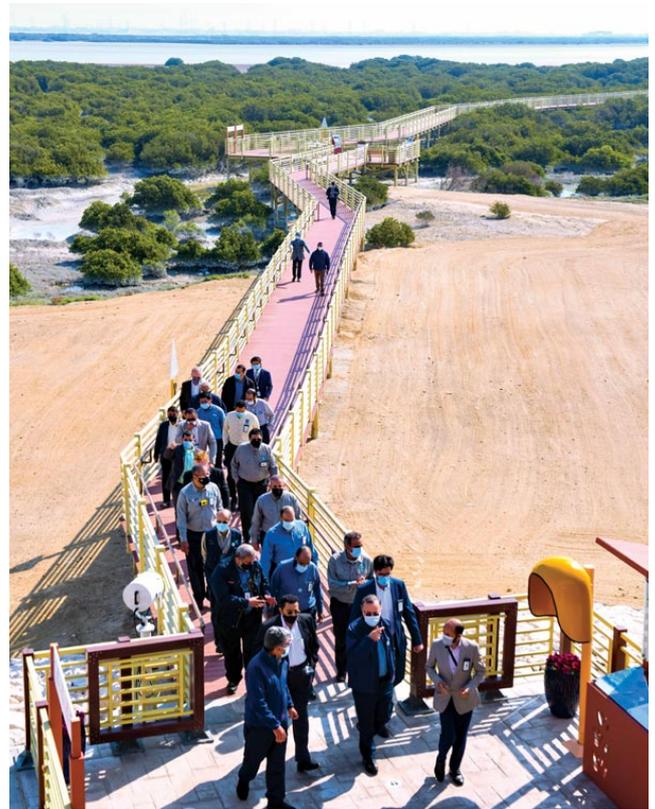


Fig. 5. Opening ceremony at the Mangrove Eco-Park near Ras Tanura on 11 January, 2021.

Source: <https://www.aramcoexpats.com/articles/more-than-just-a-pretty-place-aramco-s-new-mangrove-eco-park-a-natural-wonder/>

### Reference:

More than Just a Pretty Place: Aramco's New Mangrove Eco-Park a Natural Wonder. (2021).

Retrieved from <https://www.aramcoexpats.com/articles/more-than-just-a-pretty-place-aramco-s-new-mangrove-eco-park-a-natural-wonder/>

Pinheir, J. (2020). 2 million mangroves added to the carbon front line. Retrieved from <https://www.aramco.com/en/magazine/elements/2020/2-million-mangroves-added-to-the-carbon-front-line#2>

Saudi Arabia's carbon-rich mangroves are key to combating climate change. (2021). Retrieved from <https://www.arabnews.pk/node/1953386/saudi-arabia>

What is the carbon cycle? Retrieved from <https://oceanservice.noaa.gov/facts/carbon-cycle.html#:~:text=The%20carbon%20cycle%20is%20nature's%20way%20of%20reusing%20carbon%20atoms,%2C%20atmosphere%2C%20and%20living%20organisms.>