

- Teacher guidelines for case study - Mangroves in Saudi Arabia: Working with nature to combat climate change



Generic green skills

Cognitive competencies:

- Environmental awareness and a willingness to learn about sustainable development
- Systems and risk analysis, skills to assess, interpret and understand both the need for change and the measures required
- Identifying ways of being part of the solution

Interpersonal competencies:

- Marketing skills to promote greener products and services
- Consulting skills to advise consumers about green solutions and to spread the use of green technologies



Learning objective

Students are expected to:

1. Understand the importance of mangroves in combating climate change.
2. Identify the actions for preserving and planting mangroves in Saudi Arabia.
3. Promote the Saudi Green Initiative and encourage more people to engage in it.



Format

Group discussion, presentation, and field trip



Role of teacher

Facilitator



Resources needed

A4 paper, pens, cardboard, student worksheet, case study



Time required

1 hour for classroom learning and a 3-hour field trip



Assessment

The assessment will be based on:

1. The group presentation that demonstrates your understanding of the important role of mangroves in the carbon cycle and combating climate change, and your suggestions for facilitating people's engagement in the implementation of the Saudi Green Initiative.
2. Exhibition posters for promoting the preservation and planting of mangroves and the implementation of the Saudi Green Initiative.

Suggested teaching and learning sequences

Before the class:

1. Ask students to read the case study “Mangroves in Saudi Arabia: working with nature to combat climate change” and the concept information sheet “Carbon cycle and climate change” provided online (<https://www.greenskillsresources.com/>), and think about:
 - a. The important role mangroves play in the carbon cycle.
 - b. Why mangroves are important for Saudi Arabia to combat climate change.
2. Ask students to search online about the “Saudi Green Initiative (SGI)” (<https://www.saudigreeninitiative.org/targets/greening-saudi/>) and identify what has been done to preserve and plant mangroves in Saudi Arabia. Remind students to select at least one action to share in groups in class.

During the class:

1. Group discussion and presentation

- a. Group students into groups. Facilitate students to share their ideas about the pre-class questions:
 - i. The role mangroves play in the carbon cycle.
 - ii. Why mangroves are important for Saudi Arabia.
 - iii. Actions for combating climate change in Saudi Arabia.
- b. Refer to the 24 initiatives proposed in the SGI, and facilitate students to:
 - i. Discuss how they will engage in the implementation of the SGI.
 - ii. Provide suggestions for facilitating people to engage in the SGI from different perspectives. Each group should focus on at least one initiative and discuss this further.

For example, for the initiative “Green Mosques”, students can think about what they could do, and what the government should do, to encourage people to engage in it.

- c. Ask students to summarize their group discussion on A4 paper and use different graphical forms to present their findings (e.g. graphs, a mind map and a tree map).
 - d. Invite students to share their group work with the whole class.
- #### 2. Plan a field trip to the Mangrove Eco-Park with your group
- a. Help students to plan a field trip that focuses on:
 - i. The education points/programs in the Mangrove Eco-Park and select at least one to participate in.
 - ii. A visit to the on-site field lab to study the mangrove forest and coastal biodiversity.
 - b. Ask students to take notes during their visit, particularly in relation to the main points discussed in the class.
 - c. Remind students to take pictures that they will use for the campus/community promotion (exhibition posters).

After the class:

1. Students need to visit the Mangrove Eco-Park and collect materials to use for making the exhibition posters.
2. Ask students to design their group exhibition posters and send the draft to the online learning platform used in your institution and ask for comments from other groups and you.
3. Help students to finalize their exhibition posters according to the comments and print them out.
4. Ask students to put up their exhibition posters in the dedicated place on campus to promote the preservation and planting of mangroves and the implementation of the Saudi Green Initiative.

Suggested answers/examples for the activities

1. Group discussion and presentation

a. Discuss the pre-class questions:

- i. The role mangroves play in the carbon cycle.

Mangroves quickly sequester more carbon for longer than land-based trees. The mangrove ecosystem is the most productive ecosystem and stores more carbon in its above- and below-ground parts than a terrestrial forest, and can continue to do so for millions of years. The carbon found in coastal soil is often thousands of years old.

- ii. Why mangroves are important for Saudi Arabia.

- Mangroves provide various important ecosystem services, such as nutrient cycling, carbon storage, soil formation and ecotourism to support the livelihoods of coastal societies in Saudi Arabia.
- Mangroves are particularly suited to the Kingdom's thirsty desert shorelines. Despite the Gulf waters having a higher salt content than most oceans and seas around the world, the plantings have a strong 90% survival rate. Their resilience can be seen in how they thrive in extreme variations of water temperatures and dissolved oxygen.
- Mangroves live in conditions that no other tree can and they connect the land and the sea. Mangroves are an important nature-based solution towards adapting to, and mitigating, climate change in Saudi Arabia.

- iii. Actions for combating climate change in Saudi Arabia.

- Saudi Arabia has announced it aims to plant 450 million trees by 2030—with a long-term target of 10 billion trees, and collaborative efforts to plant 50 billion trees in the Middle East.
- Saudi Arabia is promoting the concept of a circular carbon economy (CCE) that will reduce emissions from oil and gas production (Luomi et al., 2021). This, however, only addresses a fraction of relevant emissions, as most emissions come from fuel combustion rather than oil and gas extraction and processing.
- In the buildings sector, Saudi Arabia has introduced energy efficiency measures, such as insulation standards for new buildings, and tightened minimum energy performance standards for air conditioners to reduce local oil consumption.

For more analysis regarding actions for combating climate change in Saudi Arabia, please refer to the climate action tracker: <https://climateactiontracker.org/countries/saudi-arabia/policies-action/>

b. Refer to the 24 initiatives proposed in the SGI

- i. Students should discuss how they will engage in the implementation of the SGI.
- ii. Provide suggestions for facilitating people to engage in the SGI from different perspectives. Each group should focus on at least one initiative and discuss this further.

For example, for the initiative “*2023 Green Mosques: Plant 30,000 trees across 100 mosques, irrigated with water recycled from ablution*”, students can visit the mangrove nursery in the Mangrove Eco-Park to learn how to nurture mangrove seedlings and provide training for the people in the mosque they usually visit.

Students can suggest the government organizes field trips to Mangrove Eco-Park for their citizens, to learn the importance of mangroves for Saudi Arabia to combat climate change and how to plant mangroves. They can also put forward ideas about how to effectively recycle water from the ablution for the mosques.

2. Plan a field trip to the Mangrove Eco-Park with your group

- a. Please refer to the introduction of the Mangrove Eco-Park here:
<https://www.aramcoexpats.com/articles/more-than-just-a-pretty-place-aramco-s-new-mangrove-eco-park-a-natural-wonder/>
- b. Since the Mangrove Eco-Park does not have an online platform, you may need to plan a field trip there before the class, to collect some information to help students plan their field trip.
- c. Remind students the exhibition poster should include pictures and reflections from their field trip, as well as promoting the Saudi Green Initiative.

Reference:

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

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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.>