

# **The Impact of Climate Change on Desertification in The Arabian Gulf Except Saudi Arabia**

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## **Abstract:**

How can the Arab Gulf countries, Yemen, Qatar, Kuwait, Bahrain, Iraq, UAE, Oman, face the challenge of climate and the harsh conditions of desertification and its impact on groundwater supplies as well as on water desalination. In fact, many Gulf countries suffer from desertification as well as a shortage of groundwater supplies, which negatively affects the quality. Therefore, in this research, we will explain the reality of the situation in some of these countries and what are the global solutions to confront the crisis of desertification and climate change.

**Key words:** Desertification-Ecological- Dry- Climate.

## **المخلص باللغة العربية:**

كيف يمكن لدول الخليج العربي اليمن قطر الكويت البحرين العراق الإمارات عمان مواجهة تحدي المناخ والظروف القاسية للتصحر وتأثير ذلك على امدادات المياه الجوفية وكذلك على تحلية المياه، في الواقع تعاني كثير بعض دول الخليج من تصحر وكذلك نقص في امدادات المياه الجوفية مما يؤثر سلباً على جودة الحياة لذلك سنقوم في هذا البحث بشرح واقع الحال في بعض تلك الدول وماهي الحلول العالمية لمواجهة أزمة التصحر والتغيير المناخي.

**الكلمات المفتاحية:** تصحر - جفاف - مناخ - بيئة.

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### Introduction

Desertification is one of the chief environmental issues in the Arabian Gulf. Human activity in the area has led to a severe reduction in arable land, and desertification has become a serious problem for the region. This desertification is the result of complex interaction between natural and human-created phenomena. The effects of global warming, or the overall rise of Earth's temperatures as the result of the greenhouse effect, has manifested throughout the world, and they are especially apparent in the arid and semi-arid zones in the Arabian Peninsula. Global warming, largely caused by emissions from various industries that trap heat in the Earth's atmosphere, now threatens the survival of people in the Arabian Peninsula region and beyond.<sup>1</sup>

The Arabian Gulf is naturally arid or semi-arid in most regions, and this condition is already hostile to human survival. The rising temperatures that accompany global warming has made these conditions even more difficult for plants, animals, and people in the region. In the last several decades, plant and animal life have suffered serious destruction, partly as a result of human activity. Many industries in the region emit harmful gases to the atmosphere, and the overuse of resources used in industry and agriculture result in land being left bare and depleted, a process known as desertification.

There are several causes of desertification in the Arabian Gulf. The need for raw materials in industry has resulted in deforestation. Climate change causes plants and animals to succumb to hostile changes in their ecosystems. Urbanization also plays a major role in the desertification process in the

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<sup>1</sup> Climate Change Evidence: How Do We Know? NASA (2018). <https://climate.nasa.gov/evidence/> (DATE LAST VISITED).

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Arabian Gulf; human settlers clear vegetation and create settlements and farms. All of these factors result in a depletion of the groundwater supply, contributing to desertification in the area. With less rainfall throughout the year, it is easier to overuse existing water resources. Some economic practices in the area accelerate the desertification that the Arabian Peninsula experiences.<sup>2</sup>

The Arabian Peninsula is known for the richness of its oil resources. The process of oil extration has overtaxed the region's resources, which contributes to desertification. Worse, this desertification contributes to drought, the most common natural disaster in the area. Many plants and animals do not survive a severe drought, and their extinction leaves the land bare and even more vulnerable to wind and desertification. Many organizations in the area warn of the adverse effects of climate change in the Gulf region and are looking for alternatives that can reduce the negative environmental effects of industry and human settlement.

Desertification has extreme consequences for people living on the Arabian Peninsula. Food insecurity, for instance, has long affected the area, and many people depend on food aid from other regions. This is particularly true in Yemen, the poorest country in the area. These conditions also lead to population displacement as people are forced out of their homes looking for basic survival needs. This mass migration, in turn, leads to overpoulation in other areas, with the accompanying problems of housing shortages, political instability, and depletion of resourceselsewhere.<sup>3</sup>

Climate change accounts for more than half of the

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<sup>2</sup> Causes, Effects and Solutions of Desertification, Conserve Energy Future (2018). <https://www.conserve-energy-future.com/causes-effects-solutions-of-desertification.php> (DATE LAST ACCESSED).

<sup>3</sup> Waleed Hamza et al., Dust storms over the Arabian Gulf: A possible indicator of climate changes consequences, 14 AQUATIC ECOSYSTEM HEALTH & MANAGEMENT 260–268 (2011).

desertification of the Arabian Peninsula. Thanks to rising temperatures, there are fewer resources in the area, which makes the region dependent on outside help for food, water, and other resources. Desertification has affected economic activities, and some of the most arid areas can no longer attract investors. The social upheaval resulting from desertification and displacement has forced countries in the region to come up with policies that can help reduce the human factors leading to desertification in the area.<sup>4</sup>

### **Causes of desertification in the Arabian Gulf**

The Arabian Peninsula contains nine nations, all of which are either arid or semi-arid in nature. Climate change has affected the development of these nations as the area's ecosystem struggles to cope with desertification. Desertification has been highlighted as the number one barrier to development in the area. Food production has become a major problem in all nine countries, and climate change threatens to make the entire Gulf Region uninhabitable.

Desertification has been on the rise since the late 20th century, when industrialization began in the Gulf. Some major activities that have contributed to desertification in the area include overpopulation, mining activities, agriculture, and urbanization. All these causes have a direct effect on the region's natural environment.

### **Industrialization**

The Arabian Gulf is one of the wealthiest regions in the world in terms of energy reserves. Statistics indicate that over 37.5% of the world's energy comes from the region's oil fields, most of which are owned by Saudi Arabia. The wealth generated by the oil industry is so great that projections indicate that the

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<sup>4</sup> Asma Ali Abahussain, Waleed K Anwar Sh Abdu., Nabil Alaa El-Deen Al-Zubari, and Mahmmod Abdul-Raheem, *Desertification in the Arab Region: Analysis of current status and trends*. 51 JOURNAL OF ARID ENVIRONMENTS, 521-545 (2002).

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Gulf region could survive for seventy years if oil mining were stopped today. The region's industrialization began in the 20th century, when countries began exporting oil to the rest of the world. Global demand for oil has led to the growth of extraction and refinery industries in the Arabian Gulf.<sup>5</sup>

Industrialization in the Gulf has rapidly outstripped all expectations and projections. This unexpected growth has led to overexploitation of raw materials used in these activities and threatens the natural environments. Oil extraction has led to massive production of energy in the area, and waste products from this process degrade the surrounding environment. In fact, biohazardous material has destroyed both vegetation and wildlife in the area around oil fields. Gas emissions from petrochemical industries have intensified the greenhouse effect that aggravates global warming. The fact that waste products have found their way into the ecosystem means that the current regulatory measures have properly functioned to minimize environmental damage.<sup>6</sup>

Some countries such as Qatar and UAE have taken various steps toward controlling environmental damage, including the proper disposal of waste products. Qatar has established informational campaigns and public policies aimed at protecting the natural environment. These policies include regulations about the proper disposal of biohazardous industrial waste products. UAE, has also established policies that will ensure survival of the natural environment.

### Climate change

The Arabian Gulf region is a complex climate system. The area is characterized by high temperatures that have increasingly become unbearable to life of both plants and

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<sup>5</sup> Justin Dargin, *Development and Industrialization in the Arabian Gulf Region*. HARVARD JOURNAL OF MIDDLE EAST POLITICS AND POLICY (2013).

animals in this region. The survival of the natural environment has been the most affected set up in the region. Climate change has adversely affected the entire world due to the greenhouse effect that has led to global warming. Plant and animals have for centuries survived climate changes which was natural, however with the current completion of the human activities, the natural environment has been made to endure unbearable conditions that have resulted to climate change.<sup>6</sup>

Climate change has upset the established balance of the region's natural environment. The rise in temperature has led to the death of many kinds of vegetation in the area. The entire Gulf region is categorized as an arid and semi-arid area, and it exhibits the typical features of these areas. Some vegetation does survive in such regions, of course, but the rise in temperatures that accompanies climate change has also had a destructive effect on plants that have historically thrived in the region. Warmer temperatures have also diminished water sources for the region due to higher than normal evaporation rates. Because water is essential to life, most countries in the Arabian Gulf have explored desalinification and underground drilling for water. Because vegetation also depends on water resources for survival, the scarcity of water in the area has been another major factor in desertification.<sup>7</sup>

The Gulf Cooperation Council (GCC) has developed strategies to help reduce climate change. An emphasis on renewable energy in the area has been a key policy strategy for most of the countries in this area in their quest to curb climate change. Since anthropogenic activity is the foremost cause of climate alteration, it is critical to ensure regional policies focus mainly on regulating these activities to reduce the impact of

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<sup>6</sup> Tariq Al-Olaimy, *Climate Change Impact on GCC*. ECOMENA: ECHOING SUSTAINABILITY (2015).

<sup>7</sup> Raouf, Mohamed A. *Climate change threats, opportunities, and the GCC countries*. 12 MIDDLE EAST INSTITUTE POLICY BRIEF 1-17 (2008).

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climate change.<sup>8</sup>

Statistics indicate that Iran, the United Arab Emirates (UAE) is the chief emitters of carbon dioxide (CO<sub>2</sub>), a chief cause of the greenhouse effect. The United Nations has filed a report on recommendations to reduce these emissions and save the region from adverse climate change effects. The region has adopted the user pa principle (UPP) as a policy to curb CO<sub>2</sub> emissions by these countries. The policy states that every country that uses fossil energy should be responsible for the resulting emissions. However, most of the countries inthe Gulf region have not complied with the Kyoto protocol.<sup>9</sup>

### Overpopulation

The Arabian Gulf region has an estimated population of 288 million distributed across the nine nations on the peninsula. The population has been growing at a rate of 3% annually. This population increase has taxed the natural resources in the Arabian Gulf. Since the land is arid and semi-arid, most population is concentrated in one area, causing a strain on water and food supplies. The population has already exceeded the current capacity of the ecosystem, and overuse of natural resources is slowly diminishing the area's natural vegetation, leading to desertification. More people in the area creates an increased demand for food and developed land. Attempting to meet these needs has resulted in the land becoming less productive over time. This leads to more clearing of land for settlement and agriculture, and unsustainable processes have accelerated desertification ion the Arabian Gulf.

This massive population increase has been as a consequence of family planning guidelines that were adopted by countries in the region in the late 20th century. A ban on

<sup>8</sup> Id.

<sup>9</sup> Id.

contraceptives due to religious beliefs fueled steady population growth in the Arabian Gulf in the past two decades. Gulf countries had also initiated measures to increase the native-born population in an attempt to counter the number of immigrants, further leading to the overpopulation that is happening now.<sup>10</sup>

### Agriculture

As in other regions, people in the Arabian Gulf practice agriculture, including livestock and plant cultivation. For centuries, the land in the Gulf region has not been very productive, but an increasing population has required a larger food supply. This has led to a variety of harmful

land practices that worsen desertification in the area. Overgrazing is the most common of these unhealthy land practice; people who own livestock often graze their animals on the sparse vegetation, which leads to deflation. If deflation is allowed to continue, the land becomes unable to support vegetation. Overgrazing also loosens the topsoil, leaving nothing to prevent it from being swept away in the prevailing winds. Without the topsoil, the land become infertile, or desertified.<sup>11</sup>

Countries in this region have made efforts to come up with policies to regulate agricultural practices that have led to desertification. To improve on food security for the growing population, the water supply in the area must be improved. One way to do this is by developing desalination plants to produce fresh water for agricultural use. The Arabian Gulf nations have made agriculture a priority to alleviate the food shortage in the area; as a result, every nation in the area has deployed substantial

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<sup>10</sup> Onn Winckler, *Rapid population growth and the fertility policies of the Arab countries of the Middle East and North Africa*. 103 BULLETIN SERIES/YALE SCHOOL OF FORESTRY AND ENVIRONMENTAL STUDIES 444-466 (1998).

<sup>11</sup> Shabbir A. Shahid, and Mushtaque Ahmed. "Changing Face of Agriculture in the Gulf Cooperation Council Countries." In ENVIRONMENTAL COST AND FACE OF AGRICULTURE IN THE GULF COOPERATION COUNCIL COUNTRIES. 1-25. Springer, Cham (2014).



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resources toward developing healthy agricultural practices that will ensure land conservation and maintain food security.<sup>12</sup>

### Urbanization

The Arabian Peninsula is rich in petroleum and natural gas. The continuous exploitation of these resources for export has produced explosive economic growth for the region. Many companies within and outside the region have established connections for extracting these resources. Oil fields and natural gas wells are located in different places; some are even deep in the desert. Due to their locations, workers must create settlements near their work sites. This has led to the growth of towns in previously uninhabited areas. Before these towns, vegetation that covered these areas, but creating settlements in these new habitats left the ground bare and unable to support vegetation. This growth of towns in these areas has led to desertification.

Because these towns are separated from one another and require connections, roads and other transportation networks are constructed, leading to more cleared land and further desertification.<sup>13</sup>

### Mining and Extraction

The Arabian Peninsula is rich in oil and natural gas resources, which have been mined for exportation for many decades. The economic benefits to the region have been undeniable. The standard of living for people in the area has improved as a direct result of oil and natural gas exportation. However, the extraction of these resources leads to serious environmental consequences such as desertification in the

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<sup>12</sup> Id

<sup>13</sup> H. M Al-Maamary, H. A. Kazem, & M. T Chaichan, *Climate change: the game changer in the Gulf Cooperation Council region*. 76 RENEWABLE AND SUSTAINABLE ENERGY REVIEWS 555-576. (2017).

region, air pollution and overexploitation of water and land.<sup>14</sup>

Oil extraction requires sophisticated machinery and complex technology. As a result, oil producing nations in the Arabian Gulf use heavy machines to carry out mining. These machines emit harmful gases and water during the process. The improper disposal of these biohazards has led to the decrease of vegetation due to poisoning. The clearance of vegetation that succumbs to toxic substances from these machines leaves the ground bare and unproductive causing desertification. The emissions of harmful greenhouse gases is also a concern because these gases contribute to the greenhouse effect that eventually rises the temperatures of the land killing the natural vegetation. Evaporation The other way that mining has led to desertification is through leaving huge quarries in the area after exploiting minerals. These quarries are of no use to the people around and lack productivity.<sup>15</sup>

The government has implemented mining policies that regulate some of the mining activities in the area. The most common regulation is the minimization of harmful emissions from these mining companies. Mining is one of the causes of climate change in the Arabian Peninsula due to the toxic emissions of gases. Before a company is given a permit to mine in an area, it must provide a detailed plan on how it will deal with the waste products. This has helped reduce the emissions since the region was included in the list of 40 industrialized countries that need to reduce the rate of emission of greenhouse gases that lead to global warming.<sup>16</sup>

### **The Effects of Desertification in the Arabian Gulf**

Desertification in the Arabian Gulf has clear and evident consequences. Despite the area's wealth of rich in oil and natural gas resources, the region has struggled to manage the effects of

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<sup>14</sup> Id.

<sup>15</sup> Id.

<sup>16</sup> Id.

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desertification. Policies have been created to understand the causes of desertification to help reduce its effects.

### Water Shortages

Desertification has led to water shortages in the some Arabian Gulf. These water shortages have adversely affected the productivity of the land even though its rich oil and natural gas resources give the region economic stability. Statistics indicate that people in the Gulf region survive on 90 cubic meters of water per year; the standard amount of water for one individual is 1000 cubic meters per year. This shortage is attributed to desertification, which has diminished water sources in the area mainly through human activities and climate change. The region mostly relies on underground water and desalination of sea water. For some sources, desertification has destroyed the chances of refilling water from precipitation. Water shortages have also affected crop production in the area..<sup>17</sup>

Several water policies have helped to alleviate some shortages. The Arab Forum for Environment and Development suggested a policy to control the organization of water supply in the region. This suggestion included adopting water treatment technology from other countries. The strength of this policy is that it aims to use the capital acquired from oil exportation to import technology that will help generate more water. According to a report on the policies, most have started to take shape and have allowed many regions in the to improve their supply of water. The changes in agricultural practices have also ensured that there is more water to spare. Changing irrigation practices has ensured that less water is used to water the crops thus saving more water for future use..<sup>18</sup>

Since water preservation is the region's major objective,

<sup>17</sup> Id.

<sup>18</sup> Hussein Al-Rimmawi, *Middle East chronic water problems: Solution prospects*. 2 ENERGY AND ENVIRONMENT RESEARCH 28 (2012) 28..

new agricultural practices have adopted under new strategies. The practicing of mulching to protect moisture on crops has helped to reduce the amount of water used for farming. The adoption of drought resistant crops has also made the agricultural sector consume less water, preserving it for other uses. The implementation of traditional farming methods to conserve water has been a major contributor to fighting water shortages in the Gulf region. Gulf countries also review their water supply sources for leakages. They repair and install new water carriers to ensure that they save as much water as possible for other uses. Projections indicate that water shortages can be reduced in the area if nations in the region would adopt these new policies to ensure the maximum preservation of water.

### Migration

Desertification in the Arabian Gulf has made communities migrate. Most of the deserts communities in the Arabian Peninsula have migrated over the last two decades and created settlements in newer areas with better resources. Some of these migrants depend entirely on agriculture for survival, but due to desertification it is becoming increasingly difficult for them to live in these areas. Statistics indicate the migration patterns move from more arid areas into less arid areas, especially deserts created by climate change and other human activities.

Migration in the Arabian Gulf has altered relations in the area. Intercommunity clashes due to migration have erupted recently, with escalating border disputes. Both migration itself and the related disputes result from the primary problem of land degradation in the Arabian Peninsula.<sup>19</sup>

It is important to note that migration in the Arabian Gulf hinders the overall improvement of living standards in the area. Governments' resources are wasted in some areas where communities are in constant flux. Migration has also led to

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<sup>19</sup> Id

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population increases in other areas across the Gulf, straining the natural resources in these new habitats. The outcome of this is the quick depletion of more resources, creating yet more migrants.<sup>20</sup>

The region has developed several strategies to contain migration in the area. Since the major problem is desertification, the guidelines aim to improve the environmental conditions across the region. New agricultural practices in the region have helped regain some land initially lost to desertification. This has been possible through the adoption of new farming methods and the introduction of drought resistant crops. The other policy that countries in the region are employing is the importation of food to sustain their citizens in one area to discourage migration elsewhere. Oman for instance, buys subsidized food from developing countries such as South Africa and Brazil a move that has been adopted by the United Arab Emirates (UAE).<sup>21</sup>

Strict immigration policies are in place to reduce the rate of migration. The policy has been effective in the reduction of environmental refugees in the area. Most countries in the area focus on providing basic needs to their citizens to prevent migration. Some migrants, however, are still trying to escape harsh environmental conditions.

### Drought and Famine

Drought and famine occur on a regular basis in areas that are affected by desertification. In the Arabian Gulf, these natural phenomena occur frequently as a result of desertification, and they have been major concerns in the region for the last few decades. Drought occurs when the land becomes unproductive

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<sup>20</sup> Onn Winckler, *The immigration policy of the Gulf Cooperation Council (GCC) states*. 33 MIDDLE EASTERN STUDIES, 480-493 (1997).

<sup>21</sup> Nakano, Gregg. "The Relationships Between Modern Warfare, Climate Change, and Resource Sustainability," PhD diss., *University of Hawai'i at Mānoa*, 2016.

and cannot support life as a result of desertification. Communities in these regions have long suffered from the effects of drought, and famine is a regular occurrence. When desertification occurs, the land becomes unproductive and cannot sustain life causing drought whereas famine occurs when desertification depletes the water sources in the area and causes the area to lack water for a long time.<sup>22</sup>

There are two forms of drought that occur in the Arabian Gulf: the normal seasonal delays of rainfall and long-term drought that occurs as a result of human activities. The Arabian Gulf suffers from both, although the human-influenced drought due to desertification is more frequent. This results in loss of life for both plants and animals, and it also forces communities to find other means of survival such as migration into other areas. The most recent notable drought and famine occurred from 2007-2010. Many communities lost their livestock and other plants and depended on humanitarian assistance for food. This drought was also one of the reasons for the war in the area. Research into causes of the drought found out that desertification played a major role. Drought is among the major causes of poverty around this region.<sup>18</sup>

The region has recently created measures that will help to contain the effects of drought and at the same time focus on its core cause. Disaster risk management policies have been implemented in the region to increase coordination among the countries. The major objective of this drought policy is to come up with alternative sources of water while at the same time improving on existing ones. The most notable aspect of this policy is its support of desalination and water treatment. The policy is already taking shape in Kuwait, Qatar, and UAE. Other countries such as Yemen have been unable to undertake similar projects because they do not have adequate financial resources.

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<sup>22</sup> Verner, Dorte, ed. ADAPTATION TO A CHANGING CLIMATE IN THE ARAB COUNTRIES: A CASE FOR ADAPTATION GOVERNANCE AND LEADERSHIP IN BUILDING CLIMATE RESILIENCE. (2012).

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Desalination of sea water is extremely expensive, and the region's water needs currently exceed the technology's capacity.<sup>23</sup>

### Conclusion

Desertification in the Arabian Gulf has been a concern for several decades. Human activities in this region have placed a great deal of strain on the natural environment. The loss of vegetation and arable land has left the region lagging behind in terms of economic, political and social development compared to other parts of the world. Man-made factors are increasingly changing the face of the natural environment in the Gulf region.

### Recommendations

Because of the harsh environmental conditions in the Arabian Gulf and an increasing demand for water and other natural resources, a number of actions can be implemented to improve environmental conditions. According to current projections, the demand for water will have doubled by 2025. The recommendations that follow here focus on water shortages, deforestation, and desertification. These recommendations include international policies and strategies on water conservation, agricultural activities and forestry, and mitigation activities.

### Optimal Management of Water Resources

The low rainfall in the Arabian Gulf has reduced the amount of potable water for a rapidly growing population. Since there are only three main sources of water in the region (desalinated sea water, groundwater and recycled water), it is important that these resources be managed to ensure a secure

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<sup>23</sup> Abahussain et al., *supra* note 4.

supply of water. Several programs have been put in place to ensure that alternative sources of water would be available for everyday use and irrigation purposes.

Initially, water was imported from various areas to reduce scarcity, but this gave rise to political risks and became too costly. Governments also built desalination plants to make sea water usable. However, the desalination process face constant operational challenges that prohibited the process from continuing. Gulf countries should therefore resort to other methods of obtaining water.<sup>24</sup>

More studies should be conducted on the available underground water supply in the Gulf region and how this water can be used and managed. More studies should be conducted on the two major aquifers in the area: the Dammam group that forms the lower layer and the Kuwait group that forms the upper layer. The countries in the Arabian Gulf should research the current level of underground water and decide how to divide the supply amongst the countries that have access to it, including Bahrain.<sup>25</sup>

Recycling waste water is another effective water management strategy. Urbanization and population growth have increased water consumption. Although recycled water may not be pure for human consumption, it can be used for other purposes such as irrigation and cleaning. This would reduce the amount of water being wasted in the some Arabian Gulf like Yemen . The issue of water security is urgent enough that rather than encourage people to abide by water management policies, these countries should implement laws that mandate observation of water management strategies.

Lastly, governments should direct resources toward

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<sup>24</sup> Moustafa El-Darfaoui and Abdul Al-Assiri, *Response to Climate Change in the Kingdom of Saudi Arabia* FAO-RNE at 6.

<sup>25</sup> M. A. Raouf, *Water issues in the Gulf: Time for action*. THE MIDDLE EAST INSTITUTE POLICY BRIEF (2009).



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studying and analyzing water security policies to be implemented as the natural water levels decrease. This would help countries adopt ways of supplementing the water supply, especially in urban areas. Industries should also be forced to recycle their water. Water distribution should be constantly reviewed to ensure that new strategies are implementing water management strategies to further reduce waterwaste.<sup>26</sup>

### Forestry and Agricultural Activities

By implementing water management strategies, governments of countries in the Arabian Gulf can encourage their citizens to be involved in sustainable agricultural practices and reforestation. However, this will require broad planning since agriculture and reforestation consume a great deal of water. Governments should carefully allocate their limited water resources to reduce pressure on the water supply. Since reforestation is a long-term plan, countries should have long-term strategies in place for obtaining additional water for their reforestation projects. Reforestation will be vital for the region's arid climate, which should be a top priority for these countries. The Gulf countries should also continue to import virtual water—importing foods that consume large volumes of water to grow while focusing on crops that consume less water. This will ensure that the water supply is saved for use in households and forestry.

### Mitigation Practices

Finding alternative sources of energy in the region can help to mitigate the climatic changes that have resulted in desertification in the Arabian Gulf region. Reducing the use of fossil fuels will reduce the emission of greenhouse gases that

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<sup>26</sup> Taha Al-Farra, WATER SECURITY IN THE GULF REGION, Al Jazeera Center for Studies, <http://studies.aljazeera.net/en/dossiers/2015/03/20153318534835257.html> (last visited Apr 25, 2018).

contribute to global warming. The countries in the region should also adopt the use of solar energy, which will be both cheap and efficient due to its flexibility. These countries could even use solar powered machines for the desalination process, which will be less costly and result in less pollution than current energy sources.

The best environmental recommendation for the countries in the Arabian Gulf region is to establish a warning system that will alert them to rapid decreases in groundwater levels. The Gulf countries should also develop strategies for accessing water when normal groundwater sources cannot be easily used without causing major damage to the ecosystem.<sup>27</sup>

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<sup>27</sup> Id

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