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## CLIMATE CHANGE AND LAND USE IN THE GCC COUNTRIES WITH A SPECIFIC REFERENCE TO QATAR PENINSULA

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### **Abstract:**

*The Gulf cooperation council is an intergovernmental organization comprised of six representative countries (Kingdom of Saudi Arabia, Oman, UAE, Kuwait, Bahrain, and Qatar). The climate of the Gulf cooperation council countries is arid and semi-arid, with high temperatures and scarcity of rainfall. The “Gulf cooperation council” countries have one of the world’s maximal-growing populations. The “Gulf cooperation council” countries’ population is estimated at 54 million in 2020, a 30% increase from 2000, with most people living in the region’s cities. The cultivable land is limited, calculating about 4.25 percent of the total land area in “Gulf cooperation council” countries. However, the forestland area slightly increased from 1227.7 ha in 1990 to 1301.71 ha in 2009. Permanent pasture and meadows land cover areas increased from 121420 ha in 1990 to 172195 ha in 2009. With the specific reference to Qatar as a case study, its population increased haphazardly from 109,521 people to 2,338,085 people between 1970 and 2017. The cultivable land area expanded insignificantly from 1000 ha in 1970 to 14000 ha in 2019. No change was recorded in the area under forestland, and it remained the same at 0.0% in 1970 and 0.0% in 2017. Under enduring pastures and meadows, the land area remained the same from 50,000 ha in 1990 to 50,000 ha in 2009. However, the site lies under permanent crops, and temporary yields also increased.*

**Keywords:** Land use, Climate change, Drought, Pasture, Meadows, etc.

### **INTRODUCTION:**

The “Gulf Cooperation Council” (GCC) is a political and economic alliance of six West Asian countries, the Kingdom of Saudi Arabia, UAE, Kuwait, Qatar, Bahrain, and Oman. The “Gulf Cooperation Council” countries were established in Riyadh (Saudi Arabia) in May 1981. The Gulf Cooperation Council aims to attain unity and integrity among its member countries on their common

objectives and similar political and cultural identities based on Arab and Islamic cultures. The Presidency of the council replaces annually within the GCC countries. Many countries in the “Gulf Cooperation Council” are interconnected by their dialect, morals, antiquity (many countries of the world were under equal regulation during the epoch of the Roman and the Ottoman empires, etc.), and geographic components such as landscape or groundwater watershed. Arguably, the essential article of the Gulf cooperation council charter is Article 4.0, which declares that the basis of the coherence was formed to build up strong relations among its member countries and develop cooperation among these countries, citizens. The Gulf cooperation council also has an armor planning council coordinating military cooperation between member countries. The “Gulf Cooperation Council” decision-making body is the Supreme Council, which convenes annually and consists of Gulf Cooperation Council heads of state. Resolutions of the Supreme Council are ratified by equanimous confirmation.



Fig. Location of the GCC Countries

**Table: Information About the Gulf Cooperation Council Countries**

Countries	Total Area (×10 <sup>6</sup> hactare)	MAT (°C)		
		Minimum	Maximum	MAP (mm)
BAHRAIN	0.08	23.0	30.1	83
KUWAIT	1.78	19.9	34.3	121
QATAR	1.16	21.6	32.7	74
OMAN	30.95	23.9	33.0	125
SAUDI ARABIA	214.97	19.7	32.9	59
UAE	8.36	20.2	33.7	78

Source; Detail area from FAO (2012)

However, arrangements in tax policy have proven to be fruitful. The Customs Union came into effect in 2015, and member states introduced its Value Added Tax of 5 percent in 2018. The kingdom of Saudi Arabia and the UAE have typically led policy coordination. It was the first country to send troops to Bahrain in 2011 and the first to collect Value Added Tax. The membership of the Gulf cooperation council continued for the first few decades, but changing regional relations sometimes led to speculation about changes in membership. Enlargement seemed possible when the interests of the Gulf States merged with those of the other Arab states. Two other Arab countries, Jordan and Morocco, joined the GCC during the 2011 Arab Spring uprisings invited to do so. Egypt and her other Gulf Cooperation Council members, Saudi Arabia, the United Arab Emirates, and Bahrain, imposed a lockdown on Qatar in 2017. In December 2018, Qatar's head of state skipped the annual "Gulf Cooperation Council" submission and sent an appropriate delegate instead. Still, tensions seemed to have eased, and it sent a prime minister in 2019.

**Table- Changes in Total Arable Land in the GCC Countries (1965-2010), ( area in 1,000 ha)**

Countries	1965	1975	1985	1995	2005	2010
Bahrain	1.0	1.0	2.0	2.0	2.0	1.3
Kuwait	1.0	1.0	3.0	5.0	11	11.3
Oman,	20.0	23.0	29.0	28.0	28.0	99.0
Qatar,	1.0	1.0	8.0	13.0	13.0	12.0
Saudi Arabia,	1220	1620	2550	3655	3500	3200
UAE	5	11	26	43	64	64
<b>Total</b>	<b>1248</b>	<b>1646</b>	<b>2617</b>	<b>3746</b>	<b>3618</b>	<b>3323.6</b>

Source- FAO (2012b)

#### POPULATION:

The "Gulf Cooperation Council," known as the GCC, is a territorial cooperation system between the six southern gulf countries, i.e., Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, United Arab Emirates. The 1981 Constitution was formulated fixed the need for identity and the assumption of a single culture and nation. Geographical closeness, religious similarity, language, culture, and similarity of rules and economic and social conditions were crucial factors that strengthened the establishment. The total area of gulf cooperation council countries is 2.55 million square km. In addition, the "Gulf Cooperation Council" countries have a predicted population of about 46.5 million. Despite the expansion of the non-oil sector economies, since the 1970s, oil has been a significant component of government revenues in all six countries, accounting for about 45% of world oil reserves and 25% of crude oil transports. GCC governments have invested heavily in

framework advancement and other economic sources to realign their economies in recent years. The perception of commercial growth has developed a sophisticated culture in these countries and has essentially impacted demographic structure. The Gulf Cooperation Council countries relied heavily on foreign knowledge and labor due to the lack of local experts that outstrip the local population in some countries.

The “Gulf Cooperation Council” population growth has increased more than tenfold over the past 50 years. In 1950, it was 4 million; in 2010, it was 46.5 million. By the middle of 2010, the “Gulf Cooperation Council” countries were home to 27 million foreigners, 59% of the population. Foreigners accounted for the majority in the United Arab Emirates, Qatar, Kuwait, and Bahrain. In the UAE, foreigners constitute over 88% of the population. Only Oman and Saudi Arabia have kept their proportion of foreigners relatively low, about 30% and 27%, respectively. The population increase rate in the Gulf Cooperation Council countries is closely related to economic expansion. For example, in the United Arab Emirates, one of the region’s most dynamic economies, foreign workers make up a large part of the population. According to the 2010 census, the United Arab Emirates has a population of 8.2 million, of which only 950,000 are UAE residents. The number of people in 2005 was about 818,000, which equates to a growth rate of about 3% per annum over five years.

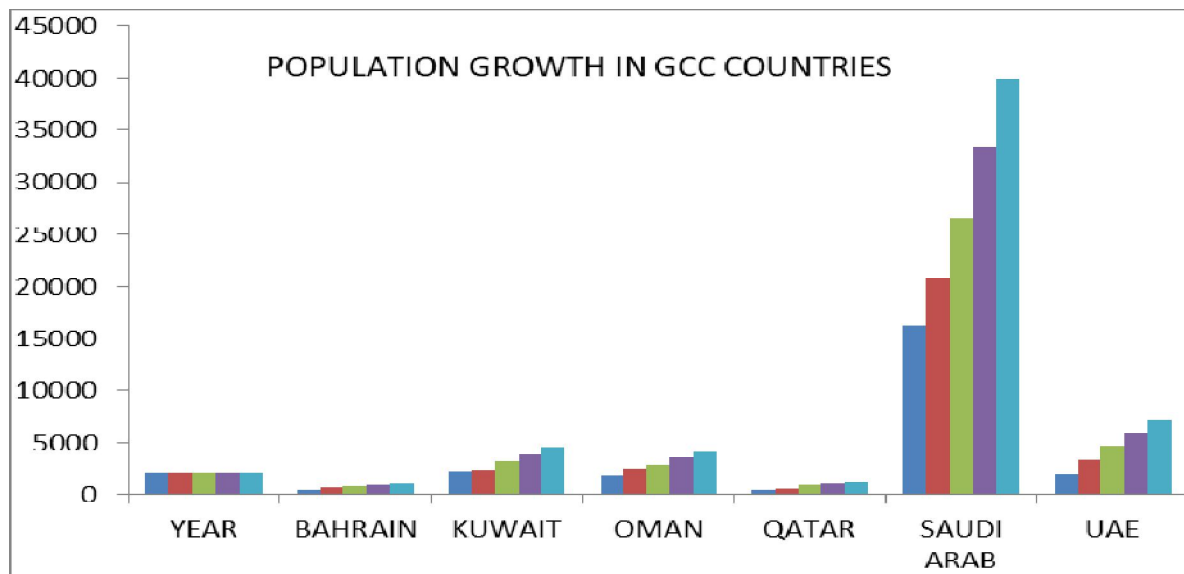
**GCC COUNTRY’S POPULATION GROWTH:**

Annual population growth in the Gulf Cooperation Council countries is around 2.4%, well above the global average of 1.1%. Fertility rates have declined significantly over the past two decades, and demographic change is beginning, but it will take another 20 to 30 years for the associated youth surplus to even out. Population growth remains high during this period as some Gulf countries attract large numbers of foreign workers. By 2030, the Gulf Cooperation Council people will double from 2000 to almost 60 million.

**TABLE- POPULATION GROWTH IN THE “GCC” COUNTRIES (1990-2030)**

YEAR	BAHRAIN,	KUWAIT,	OMAN,	QATAR,	SAUDI ARAB,	UAE
1990	493	2143	1843	467	16256	1867
2000	650	2228	2402	617	20807	3247
2010	799	3080	2791	891	26643	4770
2020	951	3832	3473	1072	33332	5963
2030	1095	4555	4137	1225	39950	7125

Source: United Nations World Population Prospects 2006



**Fig: Population growth in GCC countries**

### **AGRICULTURAL LAND USE IN THE GCC COUNTRIES:**

Arable farmland is attributed to broad fields used for agricultural aims, along with arable, horticultural fields, pastures, rangelands, pastures, fallow lands, livestock, fishing, etc. The state has a low productivity rate, and only a few states can be categorized as “good” for agriculture. It encompasses 1.8 million hectares of forests, a negligible portion of the country's landmass. 1.5 million hectares of forest resources can be found in the mountains of southern Saudi Arabia, the United Arab Emirates, and Oman. It implies that desertification is still a major environmental issue in Gulf Cooperation Council countries. These reasons may be related to land degradation in GCC countries due to urban expansion, industrialization, and grazing.

### **CLIMATE CHANGE AND WATER RESOURCES IN THE GCC REGION:**

The significant brunts of climate change on water resources are increasing temperatures, changes in precipitation arrangement and snowfall cover, and expanded frequency of floods and droughts. These changes directly affect the GCC countries. As ocean levels increase, natural and purpose-built islands in this region and elsewhere could disappear, and Bahrain could lose up to 15 kilometers of coastline. In addition, groundwater salinity will rise, further soil degradation in the region, and negatively affect land and the gulf's biodiversity. As one adept said, rising temperatures mean an increased demand for water. Water scarcity is a daunting prospect due to falling freshwater levels and rising seawater salinity (affecting the efficiency of desalination plants).

The United Nations Intergovernmental Panel on Climate Change released four reports in 2007 announcing that global warming is irrefutable and appreciable evidence. Human activity is the leading cause of climate change. According to the report, the Earth is experiencing its warmest surface temperature since 1850, and global warming over the past 12 years has caused average international sea levels to rise. Rising temperatures are responsible for various

natural phenomena worldwide, including rising sea levels, melting ice caps, and more severe storms. Suppose temperatures continue to increase significantly if temperatures exceed 2-3 degrees Celsius. In that case, the IPCC advised that the world could face extensive species, destruction, comprehensive hunger, reduced crop production, and sustained sea-level rise. Many security experts consider climate change a more significant threat than global terrorism.

### **WATER RESOURCES IN GCC COUNTRIES:**

**SURFACE WATER-** None of the GCC countries has perennial rivers or lakes. Surface water resources are scarce or non-existent, except in the mountainous regions of southwestern Saudi Arabia, southern UAE, and northern and southern Oman. The average annual precipitation in the “Gulf Cooperation Council” countries is estimated at 20,593 billion m<sup>3</sup>. The kingdom of Saudi Arabia and Oman share the most, approximately 158.47 billion m<sup>3</sup> and 37.60 billion m<sup>3</sup>. The United Arab Emirates and Kuwait receive 6.72 billion m<sup>3</sup> and 2.27 billion m<sup>3</sup> of rainwater annually. Qatar and Bahrain receive very little rainwater. Evaporation rates in the GCC countries vary between 2.5 mm per day. Annual evaporation varies between 2500 mm per year. The flat nature and high evaporation rates of most GCC countries make direct harvesting and use of surface water runoff difficult.

**GROUNDWATER-** Groundwater resources in the GCC countries are divided into renewable resources, mainly found in shallow alluvial aquifers, and non-renewable resources in deep aquifers. The potential of the shallow aquifer is relatively tiny. It is based on precipitation events and surface runoff. Decisive aquifer resources are experienced in the massive, comprehensive series of sedimentary layers of the Arabian continental shelf beneath two-thirds of the peninsula—four major structural units found in the Gulf Cooperation Council countries.

**Table- Productions and Capacities of Desalination locations of the GCC Countries**

<b>Countries</b>	<b>No. of Plants</b>	<b>Capacity(million m<sup>3</sup>/ year</b>	<b>Production(million m<sup>3</sup>/year</b>
Bahrain,	2.0	72.0	69,0
Kuwait,	6.0	288.0	331.0
Oman,	2.0	29.1.0	22.0
Qatar,	2.0	425.0	110.0
Saudi Arabia,	22.0	874.0	795.0
UAE,	8.0	00	242.0

Source- Mohmmad Fahad al rashed and Mohsen sharif (2000)

### **ARABLE LAND IN GCC COUNTRIES:**

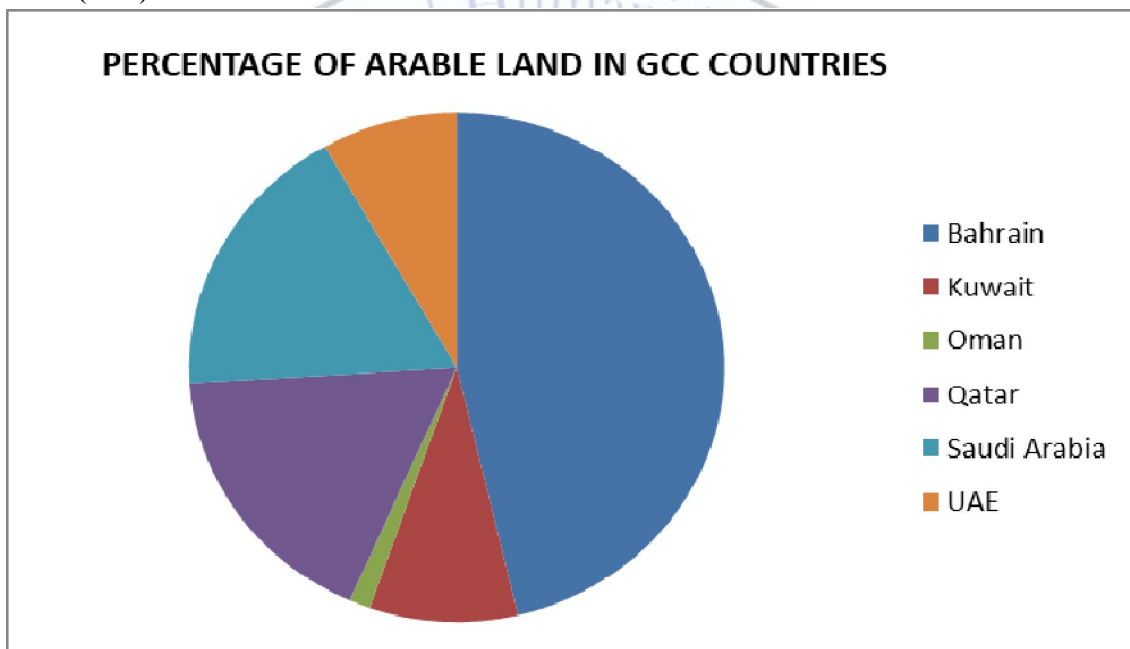
Arable land includes transitional crops, intermediate hay pastures or pastures, market and gallery gardens, and bare intermediate land. Deserted and potentially arable lands resulting from slash-and-burn cultivation are not considered arable land. Since the vast area is desert, the total

cultivable land is marginal and unevenly distributed in the countries of these areas.

**Table- % of Cultivable Land and Permanent Crops in Gulf Cooperation Council Countries**

Countries	Arable Land %	Permanent Crops %
Bahrain	4.35	4.35
Kuwait	0.84	0.17
Oman	0.12	0.14
Qatar	1.64	0.27
Saudi Arabia	1.67	0.27
UAE	0.77	2.27

Source- FAO (2012)



**Fig: % of cultivable land in GCC countries**

Middle Eastern countries share a predominantly dry environment. Bahrain has the most cultivable land (4.35%) and is cultivated with long-lasting crops. Oman has the lowest rate of arable land (0.12% of the country is arable land), and Saudi Arabia has the minimum% of permanent crops. The resting land is arid, pristine, or used for alternative activities, 91 percent of the entire 665 km<sup>2</sup> in Bahrain, 99 percent of 111 km<sup>2</sup> in Kuwait, 99 percent of 212,640 km<sup>2</sup> in Oman, and 98 percent area of 11,347 km<sup>2</sup> of Qatar, 98 percent of Saudi Arabia’s area of 2,149,690 km<sup>2</sup>, 97% of the United Arab Emirates area of 83,600 km<sup>2</sup>. The gulf countries are plagued by water shortages, limiting the cultivation of crops and livestock.

**FOREST LAND:**

Flora cover in the “Gulf Cooperation Council” countries is uneven at perfect, with forest

patches relatively small and unevenly distributed across the GCC countries. In comparison, four countries, i.e., Bahrain, Kuwait, Oman, and UAE, have 4000 hectares of woodland. Before 1970, the relatively low price of oil resulted in low demand for charcoal as an energy source. In addition, deforestation is immensely valuable, so the area of woodland in the province remains steady. However, later in the 1970s, while oil prices increased, charcoal became a cheap substitute and an aggressive energy determinant in all GCC countries. In addition to charcoal production, wood extraction for furniture, construction, and industrial use is also responsible for deforestation. Agricultural expansion is another major cause of deforestation, which has accelerated since the 1970s.

**Table-Change in Forest area (1990-2009) in the GCC Countries Total Forest Area (1000 hac)**

Countries	1990	1996	2002	2005	2009
Bahrain	0.20	0.30	0.4	0.5	0.5
Kuwait	3.50	4.30	5.1	5.6	5.97
Oman	2.0	2.0	2.0	2.0	2.0
Qatar	0.00	0.00	0.00	0.00	0.00
Saudi Arabia	977.0	977.0	977.0	977.0	977.0
UAE	245.0	284	310.8	312	316.24

Source- FAO (2012)

**PERMANENT MEADOWS, PASTURE, AND GRAZING LAND:**

Permanent meadows and pastures are used for growing herbs and forage plants for five years or more. Endless fields and pastures comprise about 25% of the total land area. Ranges are significantly used for pasture, horses, and livestock. Enduring meadows and pastures cover around 79% of the kingdom of Saudi Arabia. The Rub Al Khali and Nahud desert covers most of Saudi Arabia’s area. In addition, except for urban lands, the rest of Saudi Arabia’s land is extensively grazed. Livestock typically feeds crop residues left over after harvesting. Sheep grazing adversely affects soil quality by reducing SOM and exposing the soil surface. The former affects the soil’s natural, synthetic and organic properties. Such as, the volume and cohesion of aggregates reduce, the convenient water-holding capacity is decreased, soils with a light structure will permeate faster, and grounds with a heavier structure will permeate slower. As SOM decreases, cation exchange capacity (CEC) decreases, leading to lower biological activity and soil fertility. Extensive grazing exposes the soil surface, increasing the risk of soil destruction and reducing capacity. Grass and plant debris are not sufficient for munching. As a result, livestock is fed to stalls along with crop debris, weed biomass, arid feed, and some rubbles.



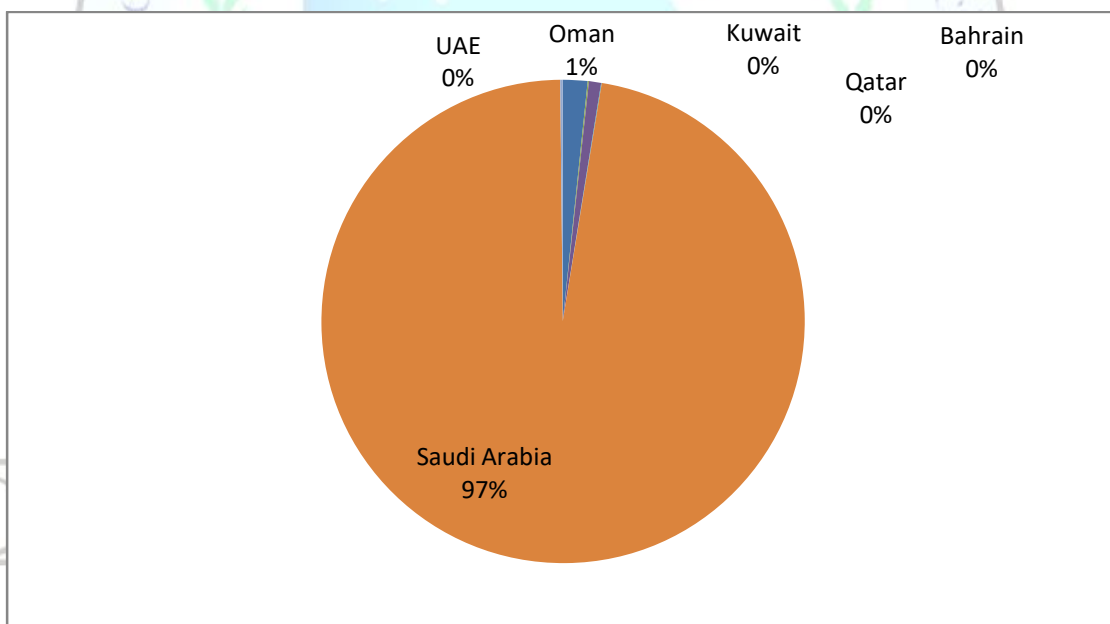
**PERMANENT CROPS:**

Perennial crops are those that, once planted, take up the field for many years and do not need to replant with each harvest. Long-lasting yields combine flowering herbs, berry shrubs, nuts, and vines but prevent plants from being grown for timber and enduring pastures. Since the 1960s, the area of land under perennial crops has increased to meet the increasing demand for food, medicine, and recreation associated with a growing population.

**Table- Area of Permanent Pasture and Meadow in GCC Countries (1990-2009) Total Area (1000ha)**

Countries	1990	1995	2000	2005	2009
Bahrain	4	4	4	4	4
Kuwait	136	136	136	136	136
Oman,	1000	1000	1000	1700	1700
Qatar,	50.0	50.0	50.0	50.0	50.0
Saudi Arabia,	120000	170000	170000	170000	170000
UAE	230	300	305	305	305

Source- FAO (2012)



**Fig: Area of Permanent Pasture and Meadow in GCC Countries (1990-2009)**

**TEMPORARY CROPS:**

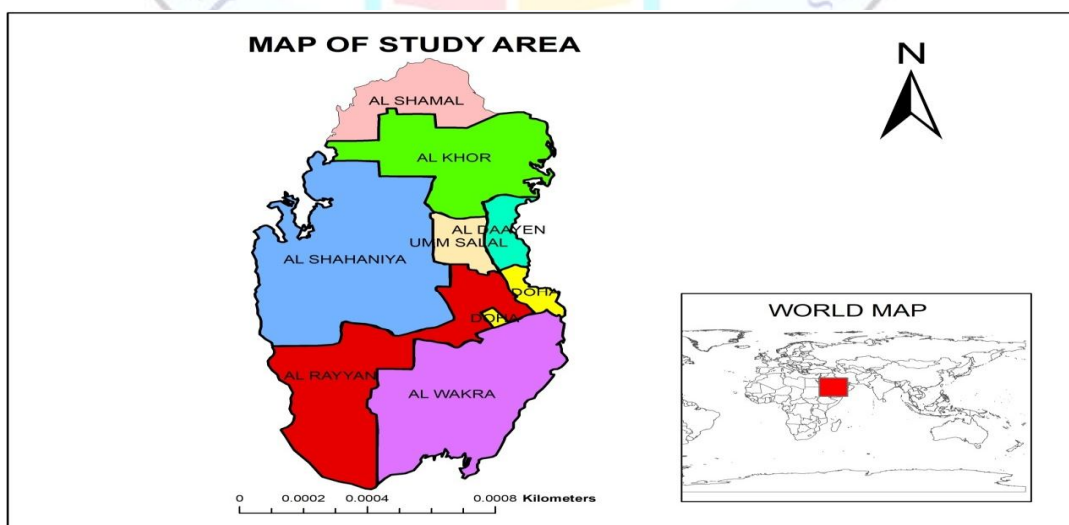
During one to two years, temporary crops are sown and harvested, including grains, perishables food, herbs, hardwood, etc. These yields are more significant than long-lasting ones because people and livestock depend on them. Therefore, the temporary crop area is larger than the permanent crop area. Since 2001, the area has been slowly increasing as cultivable

land is defined, and a few are converting to ambitious uses.

**QATAR: “A CASE STUDY”:**

The State of Qatar is a peninsula along the Arabian Gulf’s western coast. This gulf borders Qatar from the east, west, and north sides. Qatar is bound by the Kingdom of Saudi Arabia from the south, which provides the country with land access to the Arabian Peninsula. Qatar is a small country that occupies a barren peninsula on the southern shore of the Persian Gulf. Until the discovery of oil in 1949, Qatar was a poor British-associated state that relied on fishing and pearl diving. Qatar is self-sufficient in the Arabian Gulf, enclosed by Saudi Arabia, Bahrain, UA E, and Iran. The archipelago is centrally between coordinates 24° 27' and 26° 10' north and longitudes 50° 45' and 51° 40' east along on the Persian Gulf's western shore. In the Gulf province, Qatar occupies a territory from around 11,437 sq. kms on a close to the bottom basalt peninsula that projects northward for 160 km.

Qatar is a desert with moderate agricultural activity in reservoirs dependent on rapidly declining groundwater resources. Historically, the country’s population is relatively small, increasing from 111,133 in 1970 to 744,029 in 2004. Over the subsequent seven years, this population growth reached an estimated 1.8 million in 2011, with an average annual growth rate of 20 percent. This massive growth of population, fueled by a growing oil and gas industry, has attracted large numbers of temporary migrant workers. These workers have come to Qatar to take up jobs that create in various sectors of industry, construction, services, and education. About 84 percent of Qatar’s population is expatriates, and Qatari nationals comprise 16 percent of the people. This territory includes several archipelagos, shoals, and shallow waters in the inshore waters of Qatar. Harul, Silawa, Al Ahat, Al Sahriyah, Al Aaliyah, and Al Basilia are the most famous. Qatar is about 185 km away in length and 85 km in width. The coastline is about 550 kilometers long, with shallow coastal waters in various areas bordered by the North, East, and Gulf waters on the peninsula’s west side.



**Fg: Map of the study area**

Qatar is a peninsula on the eastern coast of the Arabian Gulf. Its only land border lies in the southern part of Saudi Arabia. The Persian Gulf strait separates Qatar from the neighboring island nation of Bahrain and shares maritime borders with the United Arab Emirates and Iran. The waters of the Arabian Gulf surround most of the country, but only a land border of about 60 km separates it from the Kingdom of Saudi Arabia. The United Arab Emirates is in the east of the country. Qatar's regional waters extend approximately 95 nautical miles to the east, 51 nautical miles to the North, and the Arabian Gulf. Qatar is divided into eight municipalities: Doha, Al Rayyan, Al Wakrah, Umm Salal, Al Dayan, Al Shania, Al Khor, and Al Shamal. Islam is the state religion of Qatar, and Sharia (Islamic law) is the primary government source. Qatar, an absolute monarchy ruled by the Al-Thani family, was known for pearl hunting and maritime trade before the discovery of oil and natural gas. Qatar had its third-largest natural gas reserves in the world; in 2018, it was one of the wealthiest countries per capita. The State of Qatar accepts the United Nations Charter. Qatar is centrally located in the Gulf Cooperation Council member states. Qatar and Bahrain have long debated ownership of the Hawar Islands, which lie between the two states.

#### **POPULATION:**

The population of Qatar before independence must be estimated because, until oil revenues created a reason to stay on the peninsula, individuals and whole tribes migrated when the economic or security situation became intolerable. Some sought work elsewhere; others joined neighboring branches of their tribe. In 1908, a British observer estimated 27,000 inhabitants; 6,000 were described as foreign enslaved people and 425 as Iranian boat builders. The population was presumably steady until the 1930s and 1940s, when residents were forced to leave Qatar because of economic difficulties and regional unrest, leaving barely 16,000 people there in 1949, according to one estimate. Following an increase in oil exports in the 1950s, Qatar saw an influx of Arabs from other Persian Gulf nations and international workers, especially Indians. With the help of British experts, the Qatari government conducted a census in 1970 that revealed a population of 111,113, of which 45,039, or more than 40%, were designated as Qataris. The greatest population expansion was brought on by the oil boom of the 1970s and the flood of foreign laborers that followed, so that by 1977, it was estimated that 200,000 people, or roughly 65 percent of the total population, resided in the nation. The population increased at an average yearly rate of 8.9 percent between 1960 and 1975 and 12.7 percent between 1970 and 1975.

The "Gulf Cooperation Council" countries have a combined population of 369,079, according to the 1986 census. Additionally, a 1990 estimate put the total population at 371,863, including 70,000 Qataris. The GCC countries' combined population was estimated to be 484,387 in 1992, growing at a 3.2% annual pace. With a birth rate of 31.8 per 1,000 people and a death rate of 2.5 per

1,000, natural population growth in 1989 was 29.3, which is a fast rate for a developing nation. According to the 1986 census, Doha and the nearby city of Al Rayyan were home to 84 percent of the country's inhabitants. Al Wakrah and Umm Said were two more cities. 99% of people on the Qatar peninsula, according to data from the 2020 World Bank, reside in metropolitan areas. About 75% of the population was male, which reflected the significant number of migrant workers.

#### **AGRICULTURAL LAND USE:**

According to the World Bank's collection of development indicators compiled from officially recognized sources, Qatar's arable land was reported at 5.8312% in 2018. Arable land is attributed to the percentage of cultivated land, permanent crops, and permanent pastures. FAO defines the cultivable area as temporary crops, temporary pastures for grazing, land under markets or vegetable gardens, and temporary fallow land, excluding abandoned slash-and-burn land. Permanent crops are those that remain on the ground for an extended period of time, such as cocoa, coffee, and rubber, and do not require replanting after each harvesting. Land covered with blossoming bushes, orchards, deciduous trees, and grapevine falls into this category; however, land covered in timber or trees farmed for timber does not. A permanent pasture is an area with both native and domesticated vegetation that has been used as fodder for more than five years.

#### **ARABLE LAND AND CLIMATE CHANGE:**

Arable land refers to temporary cultivation, mowing or grazing, market and vegetable garden land, and fallow land (less than five years). Fallow land by slash-and-burn cultivation does not fall into this category. The 'arable land' data is not intended to represent a potential arable land area. As a marginal country, our significant addition is defined. Therefore, as producers of fossil fuels and as countries particularly vulnerable to the impacts of increasing sea levels, we are very sensitive to the challenges and potential benefits of decarbonization. At the UN Climate Action Summit 2019, His Highness the Amir of Qatar stated, "The phenomenon of climate change is undoubtedly one of the serious challenges of our time. It is a problem continuously exacerbating and causing many problems that intertwine in their economic, environmental, and social dimensions. In addition, it has severe negative repercussions on all forms of life, including human life, and on both developed and developing countries alike, especially on the tracks of the sustainable development to which all peoples aspire." A high level of political commitment to addressing climate change is needed to ensure all government agencies' loyalty and to overcome intra-organizational conflicts and inertia. In some countries, responsibility for sustainable development issues is delegated to environmental ministries. Still, these tend to be understaffed, have insufficient governmental influence, and lack the necessary cross-sectorial policy integration impeding the process. In Qatar, the Qatar National Vision 2030 lists environmental development as one of its four main pillars. It is committed to rapid urban expansion to ensure harmony between socio-economic development and environmental protection

priorities.

Climate change is a universal problem, but its brunt's are multifaceted. Small and developing countries are often on the front lines of climate change and bear the burden. Qatar lacks cultivable area and fresh water resources for carbon sink improvement, woodland, and lush spaces, making it especially vulnerable to the effects of global warming. Increasing sea levels damage coasts and marine life, cause land degradation, and lower freshwater levels. Rising temperatures will increase groundwater salinity and reduce freshwater levels, threatening water security and reducing the efficiency of critical regional desalination plants. Qatar is one of the ten countries most affected by sea level rise based on the proportion of land area and wetlands affected. Qatar is actively working toward the management of risks identically with climate change. There are several important and positive developments, these are

- The FIFA World Cup 2022 will be held in Qatar, which is dedicated to hosting an eco-friendly event and the first carbon-neutral championship by using solar-powered stadiums and energy- and water-efficient cooling and lighting equipment.
- Qatar announced the completion of the largest carbon storage facility in the region in 2019. By 2025, it hopes to have captured more than five million tonnes of CO<sub>2</sub> from Qatar's LNG production yearly.
- In order to increase species diversity, improve air quality, and reduce the nation's carbon footprint, Qatar announced a plan to plant one million trees by 2021 during the seventh international agricultural exhibition and the first international environmental exposition in Qatar.
- The "one plant" Global Sovereign Wealth Fund, which has been successfully established to encourage green investments, accelerate efforts to examine environmental problems in the investment sector, and administer the sovereign economic fund, includes the Qatar Investment Authority as a founding member. 44% of the wealth infrastructure project is made up of zero carbon investments.

#### **PERMANENT PASTURES, MEADOWS LAND, AND GRAZING:**

Herbaceous comb yields are perennially grown in pastures and enduring meadows, either under cultivation or in their natural state. For the inhabitants of Qatar, cattle grazing is a relatively small substantial source of revenue. But for Qatar's land use, perennial herbages and meadows are crucial. Pastureland on rangelands was previously of a high standard and well-managed. However, due to soil degradation brought on by overgrazing and the transfer to other land uses since the 1980s, the rangeland area has run out. Between 1970 and 2019, the amount of land in Qatar covered with enduring pastures and meadows stayed constant at about 50 thousand hectares.

### **PERMANENT CROPS:**

Qatar's environment was unfavorable for plantation and organic farming due to its harsh temperature. In the Qatar peninsula, during the summer months, desalinated chlorine water, poor annual rainfall, and arid soil. In addition, all add up to quite the challenge of turning a desert area into a green oasis is inherently limited in scope due to the harsh climate and lack of arable land. Despite this, small-scale farming, nomadic herding, pearling, and fishing were the predominant means of subsistence in the region until the commencement of oil drilling in 1939. Farming currently plays only a minor role in the economy. Of the 8,312 hectares of arable land in 1994, 2,345 hectares were used to cultivate permanent crops, while 5,987 hectares were used to grow annual crops. Date palms were the most abundant permanent crop. Root vegetables such as carrots, potatoes, onions, and fodder beets are some of the most important crops produced by Qatari farms.

### **TEMPORARY CROPS:**

Temporary crops are all land used for yields with a less than one-year expanding cycle and must be newly sown or planted for further production after the harvest. In 2019, temporary crops for Qatar were 8 thousand hectares. Though Qatar's temporary crops fluctuated substantially in recent years, they tended to increase through the 2005 - 2019 period ending at 8 thousand hectares in 2019.

### **DROUGHT IN THE GCC COUNTRIES:**

"Gulf cooperation council" countries are situated within the dry and semi-desert provinces; these provinces have accomplished serious drought since the 1980s. A drought is an ancient event in GCC countries, but it grew well known late the mid-twentieth century. Investigations into drought, its origins, and its management have attracted researchers from far-off places. Due to a changing climate, the sensitivity to aridity may increase in the ensuing decades. Throughout a large section of the Gulf Cooperation Council, precipitation typically exceeds 15% over the ensuing several generations. As a result, there may be changes in how land is used; for instance, crop production may be hampered by a lack of moisture, the length of the growing season may be shortened, and the amount of pasture, cropland, and herding land may decline. Similar changes will occur in farming practices, along with possible declines in animal and plant productivity, resource degradation, and worries about agro economic challenges. There have been numerous attempts to control drought by adopting new technology that increase water use efficiency and water conservation, have been initiated by ICARD. These methods may take a generation may take a generation for these methods to be fully adopted because they are not evenly spread among the "Gulf Cooperation Council" nations. Programs to introduce new, drought-tolerant plants are also in progress. Drought has numerous causes in the GCC countries, including:

- (1) The prolonged drought in the Sahelian region is brought on by global cooling in the northern hemisphere.

(2) Growing greenhouse gas levels contribute to global warming, which causes some places to become drier and others to become humid.

(3) The meteorological mechanisms that produce precipitation are weakened by a decline in plant cover, which eventually leads to drought. As a result, the following strategies can be used to control drought:

(1) The management of drought occurrences should be a top priority for governments; in other words, they should not only anticipate the onset of a drought but also model its detrimental effects on people, wildlife, ecosystems, and agriculture.

(2) By looking for new water sources, enhancing communication between nations that share surface or groundwater basins, and raising awareness of water shortage among farmers, water management needs to pay greater attention regionally and nationally.

(3) Converting old irrigation methods, such flood irrigation, to more modern ones, like drip and sprinkler irrigation.

(4) Establishing new methods for managing soil, including switching from conventional or traditional ploughing to preservation.

(5) Using controlled munching to match with accessible grasslands and pastures; and

(6) reducing deforestation and increasing it along with a forestation, agro forestry, and reforestation.

## CONCLUSIONS:

The Gulf Cooperation Council province is in a barren and semi-desert climate, expressed by excessive temperatures and insufficient rainfall. In addition, deserts occupy a large portion of the Gulf region. The population in the Gulf Cooperation Council countries has increased significantly since the 1950s. Arable fields, permanent pastures, meadows, and catch crops have increased in the Gulf Cooperation Council countries since the 1950s. Cropland acreage has expanded since the 1960s.

On the other hand, proportionately, the average has declined due to population growth. The area under forests and plantations has decreased since the 1960s due to the harsh climate. In the context of Qatar, the total population has tripled since the 1980s. Areas under agricultural fields, long-lasting pastures, meadows, and enduring crops have expanded since the 1960s. In comparison, the average forest and intercrops have declined since 1960 due to low rainfall. Drought is always a severe consequence in the GCC countries. For example, most countries have experienced serious droughts since the 1980s, and vulnerability to drought and desiccation may expand shortly. Policies, therefore, include conservation agriculture, modern irrigation methods, afforestation, and reforestation. In addition, the use of solar energy must also be expanded in order to implement climate change adaptation strategies.

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