OIC Environment Report 2023

Resilient Recovery for a Sustainable Environment

ORGANISATION OF ISLAMIC COOPERATION

STATISTICAL, ECONOMIC AND SOCIAL RESEARCH AND TRAINING CENTRE FOR ISLAMIC COUNTRIES

OIC Environment Report 2023

Resilient Recovery for a Sustainable Environment

Organisation of Islamic Cooperation

Statistical, Economic and Social Research and Training Centre for Islamic Countries

Kudüs Cad. No: 9, Diplomatik Site, 06450 Oran, Ankara –Türkiye

Telephone +90–312–468 6172

Internet www.sesric.org

E-mail pubs@sesric.org

ISBN: 978-625-7162-32-6

Cover design by Publication Department, SESRIC.

For additional information, contact Research Department, SESRIC through: research@sesric.org

Acknowledgement

Under the leadership of H.E. Mrs. Zehra Zümrüt SELÇUK, Director General of SESRIC, a research team supervised by Mazhar HUSSAIN, Director of the Economic and Social Research Department, and comprised of Fahman FATHURRAHMAN and Esat BAKIMLI prepared this report.

Part 1 on Key Drivers of Environmental Change, Section 4 on Role of Natural Capital in the Economy, and Section 5 on Performance of Environmental Management were prepared by Esat BAKIMLI. Introduction Section, Section 6 on State of Water, Air, Land, and Biodiversity, and Part 3 on Climate Change Challenges were prepared by Fahman FATHURRAHMAN. Conclusions & Policy Suggestions Section was prepared jointly by the authors.

Contents

Acronyms

AQG	Air Quality Guidelines
BBB	Build Back Better
CO_2	Carbon Dioxide
COMCEC	Standing Committee for Economic and Commercial Cooperation
COMSTECH	Standing Committee for Scientific and Technological Cooperation
COVID-19	Coronavirus Disease of 2019
ECA	Europe and Central Asia
EPI	Environmental Performance Index
ESALA	East and South Asia and Latin America
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
GDP	Gross Domestic Product
GHG	Green House Gases
IEA	International Energy Agency
INDC	Intended Nationally Determined Contribution
IOFS	Islamic Organization for Food Security
IPCC	Intergovernmental Panel on Climate Change
IsDB	Islamic Development Bank
ICESCO	Islamic World Educational, Scientific and Cultural Organization
IWRM	Integrated Water Resources Management
LDN	Land Degradation Neutrality
LTS	Long-Term Strategies
MDBs	Multilateral Development Banks
MENA	Middle East and North Africa
NCA	Natural Capital Account
NCD	Nationally Determined Contribution
ND-GAIN	Notre Dame Global Adaptation Initiative
NO_2	Nitrogen Dioxide

Foreword

Allah, the Almighty, has created the universe and its various resources for the use and welfare of mankind. While benefitting from these resources, however, human beings must not cause degradation and over-exploitation. Instead, as the designated guardians, we are duty bound to conserve natural resources and protect the environment while avoiding the overconsumption and waste. Nonetheless, the speed and intensity of environmental degradation and global warming driven mainly by human activities have increased significantly in recent times posing severe negative implications for our very survival.

In this context, the *"OIC Environment Report 2023"* highlights the interconnected environmental challenges faced by humanity, including climate change, pollution, deforestation and land degradation, and underscores the urgent need for a paradigm shift towards sustainability driven developmental pathways. The report also emphasizes the critical role of the environment in post-COVID recovery efforts, calling for the integration of environmental considerations into policies and practices across all sectors to shape a more sustainable and resilient future. It also provides a sobering assessment of the intensifying impacts of climate change, particularly on food security in OIC member countries, and calls for urgent action to mitigate and adapt to these challenges posed by rising temperatures, extreme weather events, and biodiversity loss.

Overall, the report highlights a concerning reality that the current level of socio-economic development in the world was attained at the cost of environmental degradation, which in turn poses substantial risks to the future well-being of our societies. However, the extent of environmental degradation and associated risks is more visible in the developing world compared to the developed countries, which are the prime culprits in harming the environment while pursuing their development agendas. For instance, while the global deforestation rate has slightly declined in the last two decades, OIC member countries have witnessed an increase in deforestation rate from 0.27% to 0.44% per year. Moreover, air pollution continued to be a significant threat to the health and well-being of societies in many OIC member countries, resulting in 1.6 million premature deaths in 2019. Additionally, water stress has become a pressing issue for 30 OIC member countries, with 18 of them facing critical stress levels, putting their water resources at great risk of depletion.

The impacts of climate change are further compounding environmental challenges on a global scale. While the average per capita greenhouse gas emissions in OIC member countries are comparatively lower than the global average, urgent action is imperative to mitigate the severe impacts of climate change, enhance resilience, and ultimately address future environmental risks. Recent estimates indicate that over half of the OIC member countries are highly vulnerable to climate change due to inadequate mitigation and adaptive capacities. Furthermore, climate change exacerbates the vulnerabilities of food insecurity and malnutrition, affecting various aspects of food systems including agricultural production, food accessibility, and food utilization. Therefore, it is crucial for OIC member countries to reinforce their commitment to global climate negotiations and integrate robust environmental policies into their overarching sustainable economic

development strategies, with the ultimate goal of achieving net-zero emissions in the near future.

The policy recommendations in this report call on all stakeholders to specifically address the need for greener development pathways and build resilience for a more equitable and sustainable future. The report also underscores the importance of multilateral cooperation and collective action in addressing environmental issues. As a diverse group of countries sharing common values and interests, the OIC has a unique role to play in fostering international cooperation, knowledge sharing, and capacity building for environmental sustainability.

Invoking the Islamic teaching on just use and sustainable management of natural resources, I invite all stakeholders to heed the findings and recommendations of this report and take bold and decisive action to safeguard environment for the benefit of our present and future generations. I hope the findings of this report will contribute to the joint efforts of OIC member countries to enact appropriate policies and strategies for the protection and sustainable management of the environment across the Islamic world.

Zehra Zümrüt SELÇUK
Director General
SESRIC

Executive Summary

During the last decade, global warming has reached to 1.1°C above pre-industrial levels with diverse impacts on water scarcity, vector-borne diseases, agricultural productivity, and displacement due to extreme weather events. The economic slowdown caused by the pandemic has resulted in temporary reductions in greenhouse gas emissions, but these are insufficient to address the long-term challenge of climate change. As OIC member countries face the double challenge of recovering from the damage to their development gains and adapting to a changing world, there is an opportunity for a "build back better" recovery that prioritizes sustainable, inclusive, and resilient growth.

KEY DRIVERS OF ENVIRONMENTAL CHANGE

The world population is expected to exceed 8.5 billion by 2030 and to continue growing – albeit at a much slower rate – to reach 10 billion in the second half of the 2050s, owing primarily to population growth in developing countries. Given the fact that many experts have been expressing great concerns about the negative impacts that even the current 7.8 billion people are having on the planet, population growth, as a stress factor on the environment, will be of particular concern to developing countries in the coming decades. The situation is even more challenging for OIC countries since they continue to have higher population growth rates.

The global urban population has been continuously growing and will continue to grow in the foreseeable future, bringing with it a set of environmental challenges. As of 2020, it is estimated that about 4.4 billion people, 56.2% of the world population, live in urban areas, and this number is projected to reach 5.2 billion by 2030, increasing the share of the urban population to 60.4%. Urbanization has also been on the rise in OIC countries. The percentage of the urban population is estimated to have increased from 41.9% in 2000 to 51.4% in 2020, and it is projected to further increase to 55.7% by 2030.

Economic growth is needed for the wellbeing of the economy, raising standards of living, and improving quality of life in both advanced economies and in the developing world. However, it is also considered responsible for the excessive depletion of natural resources and the degradation of ecosystems, although discussions about the complex relationship between economic growth and environmental quality continue to be on the global agenda under the umbrella of sustainable development. With this in mind, statistics show that developing countries and OIC countries have been growing at much faster rates than developed countries in the last two decades, and this trend is expected to continue in the next five years until 2025. Given the average growth rate estimates for the next five years, developing countries' output is expected to rise by 5.1% a year and, by 2025, will be 3.5 times what it was in 2000. Similarly, the output of OIC countries is expected to rise by 4.3% annually to almost triple over the same period. Thus, this high-growth performance requires more attention to be paid to its environmental reflections.

RECENT TRENDS IN ENVIRONMENTAL RESOURCES MANAGEMENT

Role of Natural Capital in the Economy

Environmental or natural capital is a significant component of the wealth of nations, particularly in developing countries. In developed countries, natural capital accounts only for less than three percent of the wealth, while, in developing countries, more than a fifth of wealth derives from natural capital. OIC member countries are even more reliant on natural resources – particularly non-renewable, subsoil assets – for economic well-being, with natural capital accounting for more than a quarter of the total wealth. Moreover, in four OIC countries, natural capital accounts for at least half of total wealth.

Performance of Environmental Management

OIC member countries with an average score of 35.7 points on the Environmental Performance Index (EPI) for 2022, still lag behind both other developing countries (40.7) and developed countries (60.6) despite the improvement they have achieved in the last decade. OIC member countries in MENA and in Europe & Central Asia (ECA) are performing relatively well and have also improved their environmental performance more than those in other regions in the last decade. Among the 52 OIC member countries covered in the 2022 EPI, the United Arab Emirates had the highest score (52.4), securing the 39th position in the global rankings, while Afghanistan emerged as the top country in OIC to improve its EPI score (+23.9 points) over the last decade.

State of Water, Air, Land, and Biodiversity

Conservation of land ecosystems remains an unsolved issue globally and in OIC countries. Despite the growing number of protected areas worldwide, land areas are still being degraded rapidly. Currently, one fifth of the Earth's land area is degraded, undermining the wellbeing of billions of people, driving the loss of biodiversity, and intensifying climate change. One of the reasons for land degradation is deforestation. Despite the fact that forests provide critical ecosystem services (such as water supply, livelihoods, climate change mitigation, and food production), forest degradation and deforestation continued at an alarming rate. Globally, approximately 420 million hectares of forest have been lost since 1990 due to conversion to other land uses, though the rate of deforestation has slightly decreased in recent decades –from 0.13% forest area loss per year between 2000 and 2010 to 0.12% between 2010 and 2020. While the global deforestation rate is improving (somewhat), the OIC group is showing an opposite trend. During the period 2000-2010, the rate of deforestation in the OIC countries was 0.27% per year, but it increased significantly to 0.44% for the period 2010-2020.

Land degradation and deforestation have both contributed significantly to the ongoing loss of biodiversity, and thus to people's livelihoods. According to the Red List Index

(RLI), biodiversity has been declining in all world regions over the last decade. Globally, species are facing increased extinction risk, as evidenced by a drop in the RLI value from 0.8 in 2000 to 0.73 in 2020. Similarly, OIC countries, on average, are also experiencing an increased risk of extinction for all species, albeit at a slower rate. Their RLI levels averaged at 0.89 in 2020, decreasing slightly from 0.91 in 2000. The loss of biodiversity would be disastrous for human beings, as biodiversity provides them with ecosystem services that are essential for survival. It not only provides food and shelter but also keeps water cycles running and maintains the ecosystem's balance.

Air pollution is a "silent killer", ranked as the fourth leading cause of premature death. Globally, air quality has little improved over the last decade, as measured by annual mean PM2.5 concentrations. The global average population-weighted annual mean PM2.5 levels improved only marginally, falling from 42.7 µg/m3 in 2010 to 42.6 µg/m3 in 2019. In parallel, PM2.5 concentrations in OIC countries also declined slightly, from 42.5 µg/m3 to 42.3 µg/m3 over the same period. The slow progress made in reducing PM2.5 concentrations demonstrates that many countries lack national standards and do not monitor PM levels. It is also worth noting that only two OIC countries, Maldives and Brunei Darussalam, have met the World Health Organization (WHO) Air Quality Guidelines (AQG) annual average PM2.5 standards of 10 µg/m3.

High levels of air pollution have serious implications for the health of population in OIC countries. The threat is now doubled as more evidence suggests that the COVID-19 disease is more likely to spread in areas with the high level of air pollution. According to Health Effects Institute (2020), in 2019, air pollution was responsible for the premature deaths of 6.7 million people worldwide. In the same year, deaths related to air pollution amounted to 1.6 million in OIC countries. In relative terms, deaths due to air pollution per 100,000 people were 131 in OIC countries, significantly higher than the global average of 86. The burden of air pollution varies greatly across regions, reflecting differences in exposure and the underlying prevalence of disease and other population susceptibilities. Countries with high levels of air pollution may have a low death rate, for example, because of a well-equipped healthcare system.

Water stress increased globally from 16.4% in 2000 to 16.7% in 2020. It also increased significantly in OIC countries over the same period, from 25.7% to 33.5%. At the moment, the OIC group is classified as a water-stressed region. According to UN-Water & FAO (2018), countries begin to experience “water stress” at a 25% level, with levels above 70% considered critically stressed. Individually, 30 OIC countries are suffering from water stress, with 19 of them experiencing critical stress. The majority of countries experiencing water stress are in arid and semi-arid regions where water resources are scarce. At the sub-regional level, the majority of countries in Middle East and North Africa (MENA) and East and Central Asia (ECA) regions are facing severe water stress, and most OIC sub-regions are expected to experience an increase in water stress of at least 1.4 times by 2040.

Given the benefits they provide, it is critical to protect and restore water-related ecosystems. Waterbodies in OIC countries showed a sharp decline, with their area falling from 1.77% (of total land area) in 2005 to 1.70% in 2018. This corresponds to approximately 2.7 million hectares of lost waterbodies, an area roughly the size of Albania. In comparison, waterbodies worldwide decreased slightly during the same time period, from 2.15% to 2.14%. One method for preserving water resources is to protect and restore water-related ecosystems. Increasing waterbodies would mean increasing catchment and reservoir capacity in the region.

The application of Integrated Water Resources Management (IWRM) may indicate a high level of good governance in the water sector. The majority of OIC countries have implemented IWRM practices, albeit at varying degrees. In general, OIC countries fall into the “Medium” implementation category, indicating that the majority of IWRM elements have been institutionalized. Continuous efforts in water governance are still required. The existence of transboundary waterbodies should also be taken into account when resolving water issues. Transboundary water body improvement should be prioritized due to the fact that only about half of transboundary basins in OIC countries have a shared-management agreement.

CLIMATE CHANGE CHALLENGES

Drivers and Underlying Vulnerability

The most significant driver of global climate change is GHG emissions from human activities. Despite various efforts at the economic, technical, and political levels, the rising trend of GHG emissions continues. Global GHG emissions increased by 53% between 1990 and 2019, reaching 50 Gt-CO_2 equivalent. During the same period, GHG emissions in OIC countries increased by 91%, reaching 9.2 Gt-CO_2 equivalent, which corresponds to 18.1% of total global GHG emissions.

Identifying what causes the increase in emissions has thus become critical in order to implement appropriate climate policies. Based on decomposition analysis using the Kaya identity framework, it is discovered that population and income growth, combined with a relatively stagnant trend in carbon intensity, are contributing factors to an increase in CO_2 emissions in OIC countries. This increase in CO_2 emissions also serves as a proxy for the OIC's overall rise in GHG emissions over the last two decades.

On average, OIC countries are more vulnerable and less prepared to deal with the effects of climate change. This puts them at a greater risk of climate change impacts and threatens society's wellbeing. More than half of OIC countries are more vulnerable to climate change than the global average. Furthermore, 70% of OIC countries are not adequately prepared to deal with the consequences of climate change.

The health sector is the most vulnerable in OIC countries, indicating a high risk of death from climate-related diseases. The social dimension is the weakest link in

adaptation to climate change impacts. This indicates that society is not adaptable enough to deal with the effects of climate change, as evidenced by lower levels of social equality, ICT infrastructure, education, and innovation.

Food Security and Climate Change

The crisis-induced vulnerabilities of food insecurity and malnutrition are exacerbated by the compounding effects of climate change on food systems. Agricultural production (availability), access to food (enough money), food utilisation (nutrition and quality), and stability are all negatively affected by climate change, and this trend is expected to continue.

As the primary sector of food production, agriculture is extremely susceptible to the negative effects of global climate change, as higher temperatures, lower precipitation levels, CO2 concentration, and extreme climatic events (such as droughts or floods) can result in decreased crop yields or crop failures. Food accessibility may also be negatively impacted by climate change. People's ability to get enough to eat and stay healthy is related to their financial situation. People working in the agriculture sector and the most vulnerable members of society are at high risk of not having access to sufficient food. Increased frequency of extreme events may cause food prices to rise, limiting access to nutritious food and reducing food consumption.

Increased frequency and intensity of extreme events (such as droughts and heatwaves) may also result in greater supply instability due to production losses and food transport disruptions. In addition, the variability of water, one of the primary inputs in food production, is at risk of increasing. This makes it more difficult to predict the amount of available water, which complicates water planning and management. Changes in food safety and quality will have some effect on food utilisation as a result of climate change. Changes in temperature, the intensification of extreme events, and other climate-related disturbances may affect food safety by altering the population dynamics of contaminating organisms.

Adopting "climate-smart" agricultural practises is important to realise the sustainability of food production in response to the challenge posed by climate change. The primary objective of climate-smart agriculture is to increase agricultural productivity while simultaneously reducing greenhouse gas emissions and enhancing capacity and resilience to climate shocks.

Policy Measures and Responses

The world is currently experiencing a surge in the transition to renewable energy, fuelled primarily by growing concerns about climate change and energy security. The Paris Agreement, which aims to strengthen the global response to the threat of climate change, has motivated and strengthened this transition to sustainability. Parties to the Agreement, which include 54 OIC member countries, aim to reach the global target of greenhouse gas emissions as soon as possible, with the goal of reaching net zero emissions by the second half of the 21st century. Since fossil fuels

are the largest source of carbon emissions, the energy transition and decarbonisation process revolves around ceasing new investments in fossil fuels and gradually abandoning their use for more economically and environmentally suitable solutions.

OIC member countries are becoming more aware of and concerned about climate issues. For example, OIC countries have hosted the UN Climate Conference, which is the most important global climate conference. The hosting of the conference is an important opportunity for countries to highlight their commitment to addressing climate change as well as to help shape global policies and actions on climate change. Another positive thing to highlight is that more and more OIC countries are committed to the net-zero target. At the moment, there are 35 OIC countries that have already committed to achieving the net-zero target in various stages. Out of this, three countries have stronger commitments, as reflected by formalising the net-zero target in their national policies, while five countries declared that they have reached the net-zero emissions target.

The OIC countries must mobilize resources and efforts to achieve net-zero emissions, beginning with a transition to a low-carbon energy system. Climate finance has been provided to OIC and other developing countries through bilateral (country-to-country), multilateral (via international institutions), regional, and other channels in recent years. In 2018 and 2019, OIC countries received an average of $23.9 billion in climate funds per year. Urgent climate action requires not only significant financial resources, but also money spent effectively. Climate finance, when managed properly, has the potential to bridge the gap between socioeconomic development and environmental needs.

THE WAY FORWARD

Considering the environmental issues at hand, the main take-away from this report is that recovery from the pandemic should consider policies that are not only good for the economy and society, but also for the environment. This is an excellent opportunity to "build back better" (BBB) from the crisis, where economic recovery is integrated with environmental and climate actions, and thus meets the Paris Agreement and SDG targets.

Under the BBB concept, human well-being should be prioritized, rather than focusing solely on economic growth. As a result, any environmental and climate-related project that provides long-term benefits to people's well-being should be pursued. There are five major recommendations for recovering from the pandemic and transitioning to more environmentally sustainable development:

- Recovery strategies should be consistent with long-term efforts to reduce GHG emissions.
- Invest in strengthening climate resilience.
- Pursue ambitious policies to stop biodiversity loss.
- Promote innovation that enhances long-lasting behaviour changes.
- Resiliency improvement of supply chains.

Aside from the above-mentioned recommendations to pursue BBB, the analysis in this report emphasises four key areas for focused attention: sustainable cities and urban development; waste management; strengthening environmental governance; and enhancing monitoring and data collection. These areas have been designated as crucial pillars for achieving environmental sustainability and addressing the unique challenges encountered by member countries.

Finally, recovering from the crisis and addressing environmental issues would be more effectively accomplished collectively. There is an urgent need to improve cooperation among OIC member countries and institutions through knowledge sharing, collaborative activities in research, policy, and management, as well as training and capacity building. These activities are critical for increasing member countries' capacity to address environmental issues while also recovering from the crisis.

Introduction

Climate change continues to pose severe threats to our planet, including rising temperatures, extreme weather events, sea level rise, and disruptions to ecosystems and livelihoods. According to Intergovernmental Panel on Climate Change (IPCC, 2023), during the last decade, global warming has reached to 1.1°C above pre-industrial levels with the diverse impacts already far-reaching and more severe than anticipated. Almost half of the world's population is facing water scarcity one month per year while high temperatures are increasing the incidence of vector-borne diseases. On the other hand, there is a significant loss of agricultural productivity in middle and low latitudes, with crop productivity growth shrinking by a third in Africa since 1961.

Given the fact that human-induced Green House Gas (GHG) emissions are the leading cause of global warming and environmental degradation, the COVID-19 pandemic brought a little respite for the planet earth as the social and economic activities were brought to a standstill by the preventive measures. According to the estimates, global carbon dioxide (CO_2) emissions decreased by 5.1% in 2020 (IEA, 2020). On the other hand, there was a significant improvement in air quality, a lessening of water and noise pollution and a weakening of the pressure on tourist destinations.

However, amid the pandemic, there were also some negative effects on the environment, such as the increase in medical waste, the haphazard use and disposal of disinfectants and personal protective equipment. Improper management of medical waste has the potential to harm human health and wildlife, and can contribute to pollution in communities and natural areas. Moreover, as the world undergoes the normalization process, the short-term gains of environmental restoration during the peak of the pandemic might be diminished.

At this juncture, OIC member countries are now facing the double challenge of recovering as quickly as possible from the damage to their historical development gains and adapting to a vastly changing world. On the bright side, these monumental challenges present an opportunity for "build back better" recovery, putting development on a path toward more sustainable, inclusive, and resilient growth. For the recovery to be durable and resilient, a return to conventional and environmentally destructive development pathways has to be avoided. Unchecked, global environmental emergencies such as climate change and biodiversity loss could cause social and economic damage far larger than that caused by COVID-19. Solutions to environmental issues will require multiple ongoing efforts to address their underlying risks to society; identify the policy changes needed to manage them; and keep track of progress over time.

In the meantime, as global concerns about the environment and climate change continue to develop, the OIC recognises the pressing need to include these issues on its agenda. In the OIC 2025 Plan of Action, the critical role of the environment in accomplishing sustainable development is emphasised. The document serves as a comprehensive guide for member countries to attain socio-economic development,

peace, and stability and identifies environmental protection and climate change as key priorities. In addition, recognising the importance of science, technology, and innovation (STI) in addressing environmental and climate challenges, the OIC developed the STI Agenda 2026. This Agenda aims to leverage technological developments and foster innovation in order to support sustainable development. Through the integration of environmental issues into its strategies, policies, and collaborative efforts, the OIC seeks to address pressing environmental challenges and foster a more resilient and sustainable future for its member countries.

The OIC Environment Report 2023 examines the challenges that OIC member countries face in sustainable management of environment through the latest available statistics on environment-related SDG indicators and progress towards the Paris Agreement commitments. The analysis involves examining the data of OIC countries as a group, with disaggregation for geographical regions[1] and individual member countries, usually in comparison with the developed and non-OIC developing countries as well as the global averages. Recommendations at the end of the report summarize the way forward to achieve greener development and "build back better" from the crisis.

The report is divided into four parts. Part 1, “Key Drivers of Change”, explains the primary causes of environmental changes and trends, allowing readers to comprehend why the OIC environment is changing.

The second part, “Recent Trends in Environmental Resources Management”, examines the status and development of a number of critical environmental issues in OIC member countries. This part also provides a brief analysis of the significance of natural capital to the economic development of OIC member countries. In addition, this part also shows the big picture of environmental performance in OIC member states, including the state of land, biodiversity, air, and water through the presentation of relevant SDG indicators.

Part 3, "Climate Change Challenges," details the developments and the progress made by OIC countries in their efforts to adapt to and mitigate the impacts of climate change and fulfil their commitments under the Paris Agreement. It first identifies the status and trend of GHG emissions, as well as the vulnerability and preparedness of OIC member states to the effects of climate change. Furthermore, the impacts of climate change particularly related to critical issue of food security are discussed. In the final section of this part, the measures taken by OIC countries to combat climate change, focusing on the Paris Agreement and net-zero target are further explored.

Finally, the last part summarizes the findings of the report and provides policy recommendations to "build back better" from the crisis and provide resilient recovery for a sustainable environment.

[1] See ANNEX A.

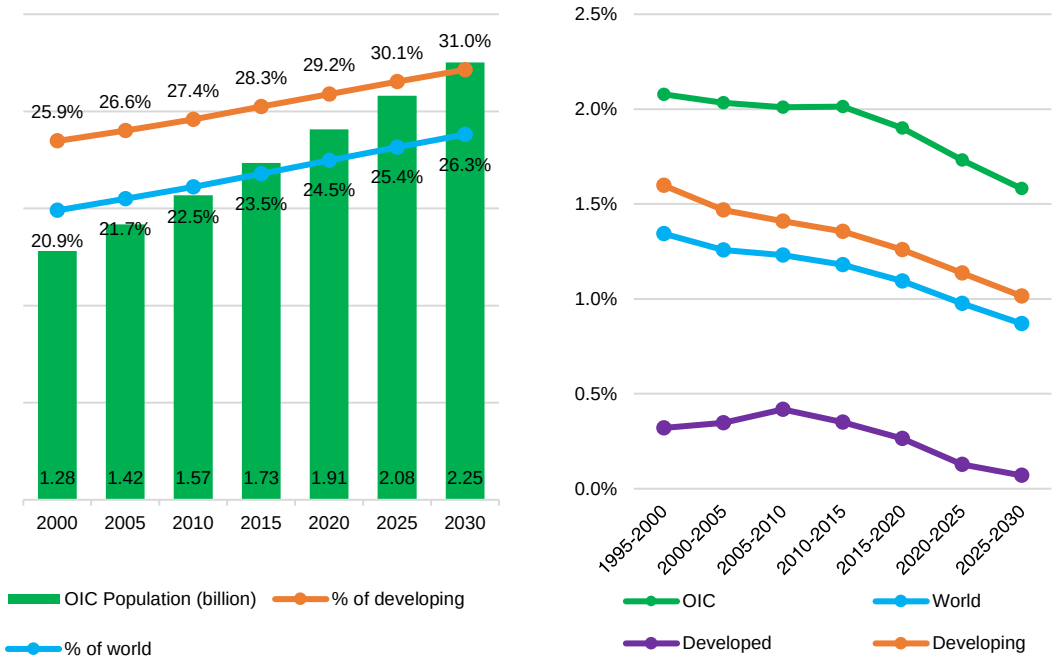
Part 1:
Key Drivers of Environmental Change

Understanding the forces that shape the environment has become increasingly important in an era of rapid global change. Part 1 of the report examines the interconnected drivers of environmental change in OIC countries, namely population growth, urbanisation, and economic expansion. As the population continues to surge, urban areas expand, and economies strive for growth, these factors exert a profound influence on the environment. It is crucial to investigate the intricate dynamics and effects of these drivers in order to gain insights into our changing world and to develop strategies for a more harmonious coexistence between humans and the environment.

1. Population Growth

Population growth has been firmly related to the natural environment and the limits or 'carrying capacity' of the planet Earth since the 18th century, when limited food production was the dominant concern, highlighted by the Malthusian predictions of catastrophes caused by population growth (Bretschger & Pittel, 2020). The linkages between population dynamics and the environmental changes are actually complex and difficult to disentangle but many environmental issues are usually associated with population growth; sometimes directly by increasing demand for food and materials accompanied by increasing waste production, and sometimes indirectly by exacerbating other conditions such as bad governance, poverty, and insufficient infrastructure. Particularly, land cover change and deforestation, agricultural land degradation, abstraction and pollution of water resources, coastal and marine environmental disturbances, and energy, air pollution, and climate change have been the major environmental issue areas in the literature concerning the population-environment relationship (Sherbinin et al., 2007).

Figure 1.1. OIC Population and Its Share in the World (Left) and Five-Year Average Growth Rate of Population (Right)



Source: UN, Department of Economic and Social Affairs, Population Division (2019). World Population Prospects 2019, Online Edition. Rev. 1. population.un.org/wpp/

The UN (2019a) expects the world population to exceed 8.5 billion by 2030 and to continuously increase –though at a significantly reduced rate– to reach 10 billion in the second half of the 2050s.[2] The population of developed countries, growing at a rate already as low as 0.26% in the last 5-year period of 2015-2020 (**Figure 1.1, Right**), is expected to enter a declining trend after the mid-2030s. Thus, almost all of the population growth until the mid-2030s and all further growth is expected to occur in the developing world. Given that the world is already concerned with the impact that even the current 7.8 billion people are having on the planet, population growth, as a stress factor on the environment, will be of particular concern to developing countries in the coming decades.

Doubled in 33 years and exceeded 1.9 billion in 2020, the population of OIC member countries accounted for 29.2% of the total population of developing countries and 24.5% of the global population (**Figure 1.1, Left**). Although the population growth rate is declining in the OIC as well (**Figure 1.1, Right**), these ratios are estimated to rise up to 31.0% and 26.3%, respectively, by 2030 and to increase even further in the following years according to the projections of the United Nations. This clearly indicates that the OIC population will grow at even higher rates than the population of other developing countries, requiring to pay more attention to controlling the potential impacts on the environment.

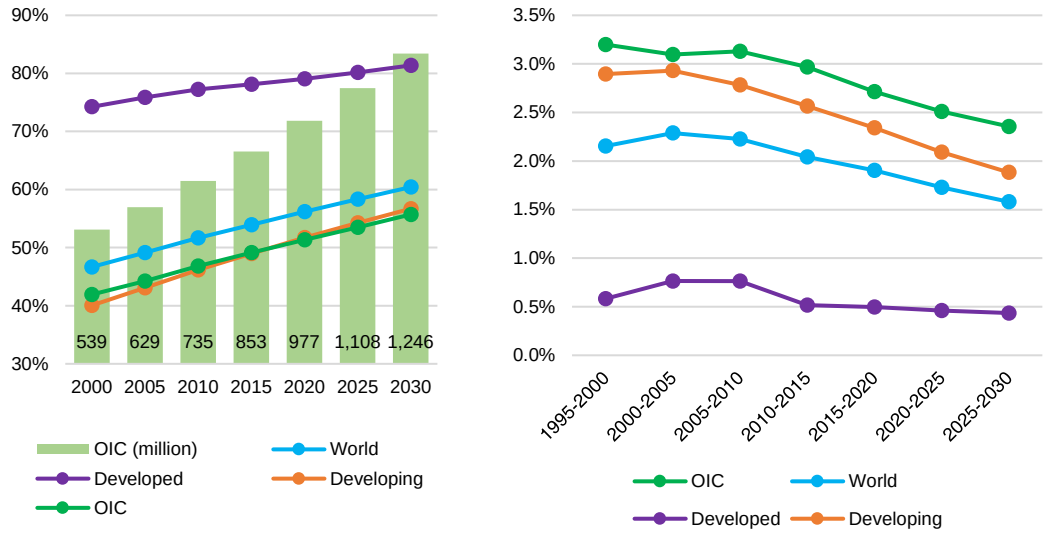
2. Urbanization

In practice, urbanization refers both to the increase in the percentage of population residing in urban areas and to the associated growth in the number of urban dwellers, in the size of cities, and in the total area occupied by urban settlements (UN, 2019b). Thus, by definition, its environmental impacts result from both (i) the geographical concentration of human population that brings with it a set of challenges associated with industrial growth, emissions, and wastes and (ii) the conversion of natural lands into urban settlements, the latter being among the most evident forms of human influence on the environment. With urban growth and sprawl, an increasing share of social and economic activities becomes concentrated in cities, which requires urbanization to be well-managed by integrated policies encompassing social, economic, and environmental aspects to minimize environmental degradation and to eventually ensure sustainable development.

Growth in the urban population could simply result from the reclassification of previously rural areas as urban areas, but more importantly, it is due to an overall population increase and people moving to settle in urban areas for various purposes. This eventual process is driven by numerous demographic, economic, political, and environmental factors (SESRIC, 2019).

[2] Under the 'medium variant' projections.

Figure 2.1. Urban Population, % of Total Population (Left) and Five-Year Average Growth Rate of Urban Population (Right)



Source: UN, Department of Economic and Social Affairs, Population Division (2018). World Urbanization Prospects: The 2018 Revision, Online Edition. population.un.org/wup/

According to data from World Urbanization Prospects (UN, 2018), the global urban population has been continuously growing and will continue to grow in the foreseeable future. As of 2020, it is estimated that about 4.4 billion people, 56.2% of the world population, live in urban areas, and this number is projected to reach 5.2 billion by 2030, increasing the share of the urban population up to 60.4%. Of this increase of approximately 800 million people in a decade, 94% will originate from developing countries, where the percentage of the urban population will increase from 51.7% in 2020 to 56.7% in 2030. Developed countries that have already been highly urbanized will also see an increase from 74.2% to 81.4% over the same period (**Figure 2.1, Left**).

As for OIC countries, urbanization has also been on the rise, following a similar trend to developing countries (**Figure 2.1, Left**). The urban population that numbered 539 million two decades ago is estimated to have reached 977 million as of 2020 and to exceed 1.2 billion by 2030. In parallel, the percentage of the urban population is estimated to have increased from 41.9% in 2000 to 51.4% in 2020, indicating that over half of the OIC population currently live in urban areas. This ratio is projected to further increase to 55.7% by 2030. Estimates also indicate that the growth rate of the urban population, despite showing a declining trend all over the world, will continue to be higher in OIC countries (**Figure 2.1, Right**), requiring them to implement comprehensive policies to plan and manage urban growth that sustainably improves the lives of both urban and rural residents.

3. Economic Growth

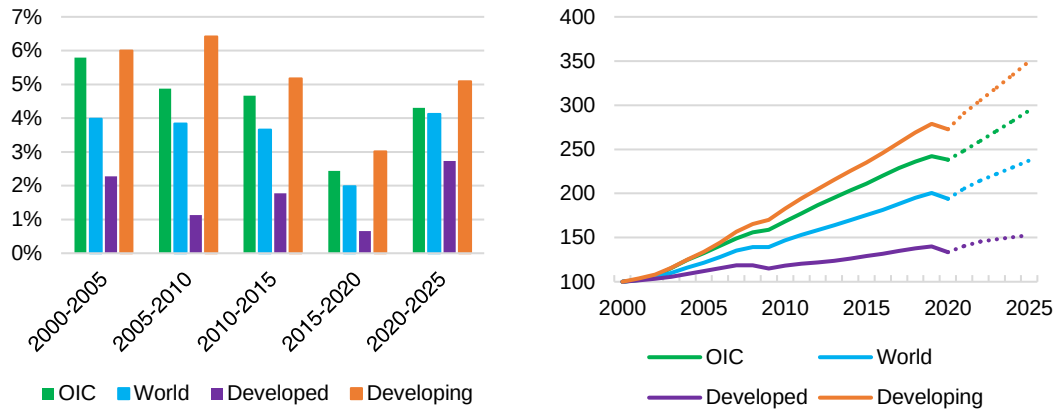
The relationship between economic growth and the natural environment has been a matter of discussion for a very long time, and this discussion has intensified especially with the popularization of the term 'sustainable development' mainly by the United Nations' report "Our Common Future" (World Commission on Environment and Development, 1987) and the World Bank's report "Development and the Environment" (1992). Both placing sustainability on the international agenda, these reports drew attention to the urgency of making progress toward economic development that could be sustained without depleting natural resources or harming the environment. Since then, numerous studies have addressed environmental issues in relation to economic growth –concerning whether environmental constraints will limit development and whether the development will cause serious environmental damage– but the varying results have clearly demonstrated how complex the relationship is.

The natural environment, without doubt, is central to economic activity, growth, and development. Besides delivering vital ecosystem services that support human life and all human activities, it provides the resources needed for production and also absorbs and processes the resulting pollution and waste. Economic growth, in turn, is needed for the wellbeing of the economy, raising standards of living, and improving quality of life in both advanced economies and in the developing world. Moreover, it is a key factor in generating the necessary level of investment in technology and infrastructure to facilitate the shift to a low carbon and resource efficient growth path (Everett et al., 2010). Nevertheless, economic growth is also responsible for the excessive depletion of natural resources and the degradation of ecosystems, posing risks of breaches in critical thresholds[3] beyond which irreversible changes may occur –natural assets cannot be replaced and can no longer support the desired level of economic activity, impairing the quality of life of the current and future generations.

Social, political, or economic, many factors play a role in the complexity of the relationship between economic growth and environmental quality, including but not limited to people's awareness of environmental issues, consumption patterns, political willingness and determination, technological progress, international competition, income level and inequality, structure of economic activity, and stage of industrial development. Income level and the structure of economic activity are of particular importance to developing countries, including OIC members. As opposed to developed countries, which have high incomes and have already industrialized, lower income developing countries cannot adequately afford or are less inclined to introduce improved technology for environmental protection, as they prioritize poverty eradication. Correspondingly, the industrialization process in developing countries, reflected in an increasing share of industrial activities in GDP as opposed to service sectors, is also associated with increasing levels of pollution.

[3] Overusing renewable resources beyond their rate of recharge and replenishment and passing the finite absorptive capacity of ecosystems as a "sink" for assimilating wastes and emissions.

Figure 3.1. Five-Year Average Real GDP Growth (Left) and Real GDP (2000=100) (Right)



Source: SESRIC staff calculation based on data from IMF, World Economic Outlook Database, April 2021.

With these in mind, statistics show that developing countries and OIC countries have been growing at much faster rates than developed countries in the last two decades, and this trend is expected to continue in the next five years until 2025 (**Figure 3.1, Left**). Consequently, although world real GDP doubled over the 2000-2020 period, the expansion in developing countries and in OIC countries was even greater, 2.7 times and 2.4 times, respectively (**Figure 3.1, Right**). Given the average growth rate estimates for the next five years, developing country output is expected to rise by 5.1% a year and, by 2025, will be 3.5 times what it was in 2000. Similarly, the output of OIC countries is expected to rise by 4.3% annually to almost triple over the same period. Thus, this high-growth performance requires more attention to be paid to its environmental reflections in the coming years with the aim of minimizing the negative impacts on human health and on the environment. This is particularly important for countries growing out of poverty, where optimal policies need to be formulated –with international support– in order to secure a balance between the protection of the environment and the development of the economy.

Part 2: Recent Trends in Environmental Resources Management

Managing natural resources in the face of a rapidly evolving global landscape requires a close look at current practices. This part explores key aspects that shape OIC countries to safeguard their environmental resources. It explores the role of natural capital in the economy, acknowledging the inherent value of nature and their services in supporting human well-being and economic prosperity. In addition, it evaluates the performance of environmental management strategies, assessing their efficacy in preventing environmental degradation and fostering sustainability. Finally, it assesses the current state of OIC water, air, land, and biodiversity, shedding light on the interconnectedness of these vital elements and the urgent need for conservation and restoration efforts. Looking closely at these developments helps shed light on the challenges and opportunities that lie ahead, allowing member countries to forge a path towards a more resilient and sustainable future.

4. Role of Natural Capital in the Economy

Capital is a fundamental concept of economics, comprising different types of stocks that contribute to the production process. Accordingly, capital is usually disintegrated into such types as financial capital, natural capital, produced capital, human capital, and social capital (Goodwin, 2003). However, in most of the economic literature, it principally refers to produced (human-made) capital that consists of physical assets –durable goods– available for use as a factor of production, such as tools, machines, buildings, and infrastructure. This is mostly attributed to the scarcity of data and the problems in estimating the values of capital stocks.

The concept of "natural capital" has gained importance in the last decades along with the increased recognition of the role of environmental resources in production as well as the rising concerns over environmental degradation and climate change. As a continuance of its work on wealth accounting, the World Bank released a new book The Changing Wealth of Nations 2021: Managing Assets for the Future (World Bank, 2021) that could be considered as a major step in providing improved estimates of natural capital. The book tracks the wealth of 146 countries between 1995 and 2018, with the objective of broadening the measures used to assess economic progress and sustainable development. In this work, natural capital –in addition to produced capital, human capital, and net foreign assets– is considered as one of the four components of wealth.

Natural capital is especially important for developing countries that heavily rely on their natural resources for economic growth and development. Therefore, accounting for the contribution of natural resources to economic output is an imperative task for sustainable development in these countries. Some of them are blessed with mineral and energy resources generating significant revenues for governments, some are rich in crop and pasture lands, and some others have forests and wild lands with abundant biodiversity, which can generate revenues by attracting tourists from all over the world (World Bank, 2011). Such revenues from natural resources account for a substantial share of GDP in some countries, and much of these earnings come in the form of "economic rents" –revenues above the cost of extracting the resources.

Based on World Bank data, this section analyses the situation in OIC member countries to shed light on the importance of environmental resources in their wealth and economic growth with a view to support their quest for sustainable economic development.

4.1 Natural Capital in Total Wealth

Implementations of wealth accounting and natural capital accounts (NCA) has gained popularity all over the world in the last two decades, in search of practical solutions to estimate and integrate them in the System of National Accounts. This is especially important for estimating economic growth in countries that significantly rely on natural resource depletion and, more importantly, for monitoring whether natural capital

assets are sufficient to keep pace with population growth and economic growth –the major concern over sustainable economic development.

Heading the work in the field of wealth accounting, the World Bank first published a book Where is the Wealth of Nations? Measuring Capital for the 21st Century in 2006, which presented estimates of comprehensive wealth accounts for nearly 120 countries, decomposing the wealth of a nation into its component pieces: produced capital, natural resources and human resources (World Bank, 2006). That was followed by a second volume in 2011, The Changing Wealth of Nations: Measuring Sustainable Development in the New Millennium, which extended and built on the previous book and presented, inter alia, the changes in wealth by income group and geographic region, with a focus on natural capital (World Bank, 2011). In continuation, the World Bank released a new book The Changing Wealth of Nations 2021: Managing Assets for the Future (World Bank, 2021), which tracked the wealth of 146 countries between 1995 and 2018 and provided improved estimates of natural capital.

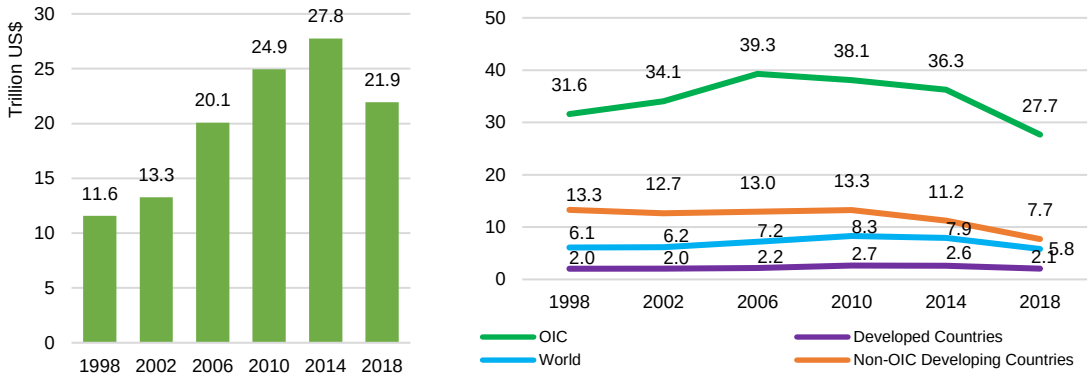
The latest book decomposed total wealth into four components: produced capital (buildings, machinery, and infrastructure); human capital (the present value of future earnings for the labor force, broken down by gender and types of employment); net foreign assets (foreign assets minus liabilities); and natural capital. Natural capital was reported in detail, consisting of the valuation of fossil fuel energy (oil, gas, hard and soft coal) and minerals (bauxite, copper, gold, iron ore, lead, nickel, phosphate, silver, tin, and zinc), agricultural land (cropland and pastureland), forests (timber and some non-timber forest products), and protected areas (a proxy for bio-diversity). Values were measured at market exchange rates in constant 2018 US dollars, using a country-specific GDP deflator.

The findings revealed that global wealth grew 91% between 1995 and 2018, from US$603 trillion to US$1,152 trillion, respectively. In the same period, the value of natural capital assets grew 68%, where most of the growth in natural capital was in non-renewables (129%), largely because of changes in both the volume and prices of minerals and fossil fuels. The renewables (forests, protected areas, and agricultural land) increased far more slowly (38%) than total wealth.

4.2 OIC Countries More Dependent on Natural Capital

The World Bank's dataset on wealth accounts included data for 48 out of the 57 OIC member countries. The available data shows that the value of natural capital assets of OIC member countries almost doubled (90%) in the period from 1998 to 2018, reaching up to US$21.9 trillion (**Figure 4.1, Left**), but its share in total wealth declined from 32% in 1998 to 28% in 2018 (**Figure 4.1, Right**). Far above the average of both developed (2.1%) and non-OIC developing (7.7%) countries, this ratio clearly indicates that OIC countries, on average, are more dependent on natural resources for wealth creation than the rest of the world.

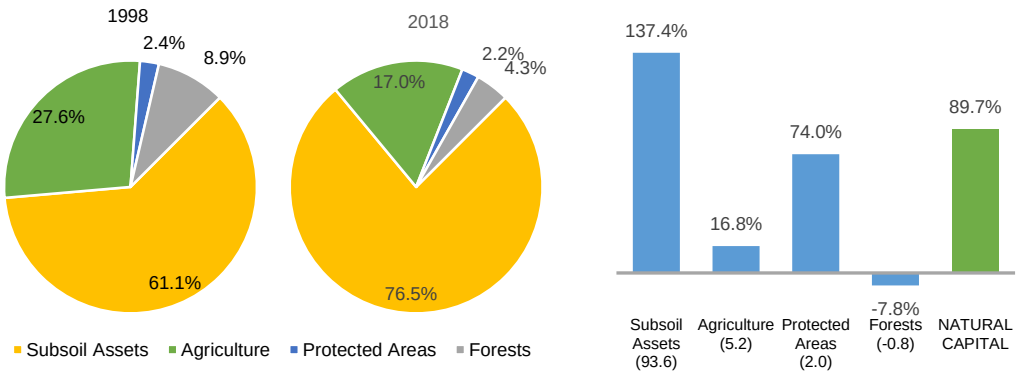
Figure 4.1. Natural Capital of OIC Member Countries (Left) and Share of Natural Capital in Total Wealth (Right), 1998-2018



Source: SESRIC staff calculation based on data from Wealth Accounts database of the World Bank.

Almost all of the increase in natural capital of OIC countries originated from the increase in non-renewable, subsoil assets (137.4%), such that these assets accounted for up to 76.5% of the natural capital in 2018 as compared to 61.1% in 1998 (**Figure 4.2**). Accounting for more than one fourth of the natural capital in 1998, agriculture increased only by 16.8% by 2018, resulting in a decline in its share in natural capital, down to 17%. Forests faced a decline not only in their share –from 8.9% to 4.3%– but also in their value (-7.8%), which indicates a threat of depletion of forest assets in the OIC countries.

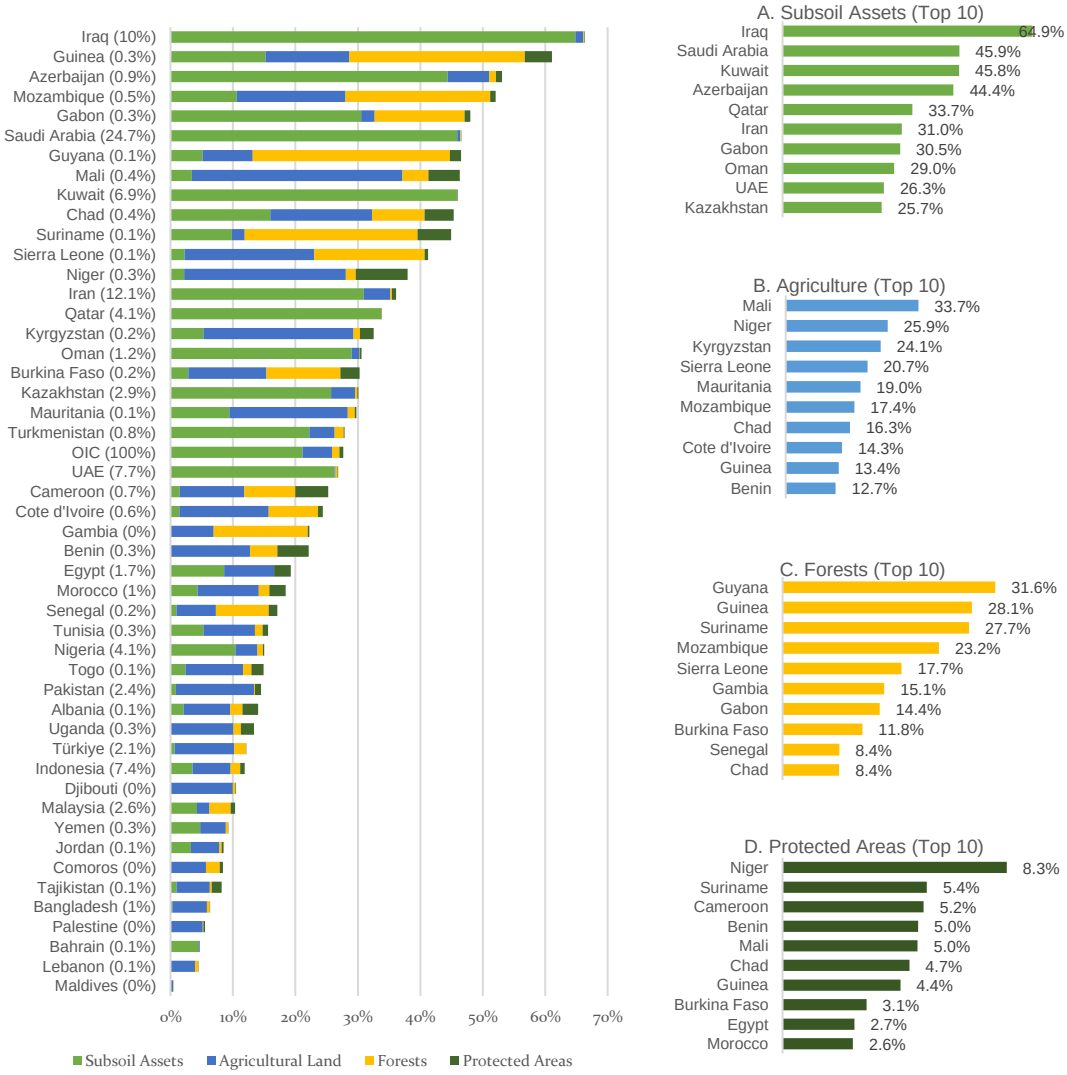
Figure 4.2. Composition (Left) and Growth (Right) of Natural Capital in OIC Countries, 1998-2018



Source: SESRIC staff calculation based on data from Wealth Accounts database of the World Bank.
Note: Subsoil assets: oil, natural gas, coal, and minerals; Agriculture: Cropland, pastureland, and fisheries; Forests: *Timber forests, ecosystem services, and mangrove. The numbers in parenthesis show each component's contribution to* the growth in total natural capital.

According to the most recent data from 2018, among the 46 OIC member countries with available data, Saudi Arabia has the most abundant natural capital, accounting for a quarter of the total natural capital (24.7%) of all OIC countries, followed by Iran (12.1%), Iraq (10%), United Arab Emirates (7.7%), and Indonesia (7.4%). Concerning the weight of natural capital in total wealth, however, Iraq takes the lead, as over 66% of its total wealth come from natural resources. In three other countries, natural capital accounts for at least half of total wealth while this ratio is as low as 0.5% in Maldives, 4% in Lebanon, and 5% in Bahrain (**Figure 4.3**).

Figure 4.3. Share of Natural Capital in Total Wealth in OIC Member Countries by Type, 2018



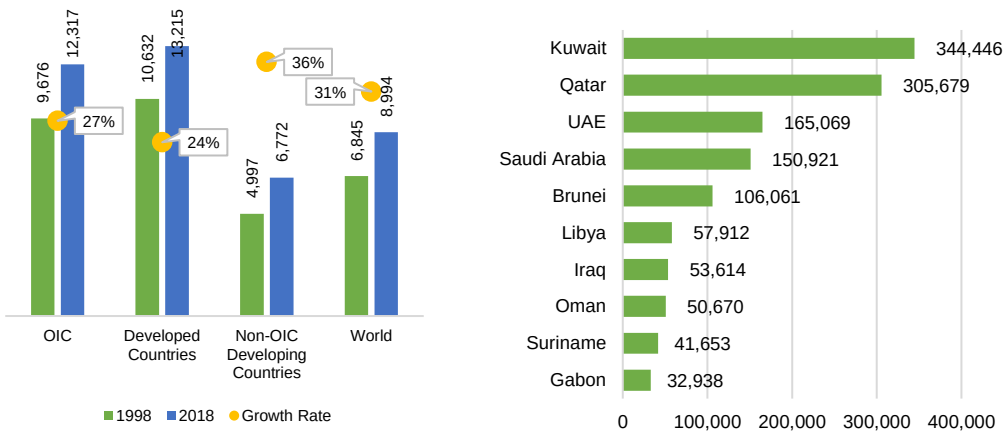
Source: SESRIC staff calculation based on data from Wealth Accounts database of the World Bank.
** The numbers in parenthesis show each country's share in total natural capital of OIC member countries.*

It is worth noting that only Maldives has a ratio below the average of developed countries (2.1%) and only Palestine, Bahrain and Lebanon are below the world average (5.8%).

Regarding the composition of natural capital, OIC member countries present significant differences. Non-renewable, subsoil assets are a primary source of wealth in many of them. In Iraq, 66% of total wealth is tied to natural capital, and a large portion of that figure (65%) comes from subsoil assets.

Among the other member countries with a relatively high share of subsoil assets in total wealth are Saudi Arabia (45.9%), Kuwait (45.8%), Azerbaijan (44.4%), and Qatar (33.7%) (**Figure 4.3/A**). Agricultural land is the dominant component of wealth particularly in Mali, accounting for more than one third of the total wealth of the country (33.7%). It is also of critical importance to the wealth of Niger (25.9%), Kyrgyzstan (24.1%), Sierra Leone (20.7%), and many other member countries (**Figure 4.3/B**). Accounting for almost one third of total wealth (31.6%) in Guyana, Forests constitute over 20% of total wealth only in three other member countries, namely Guinea (28.1%), Suriname (27.7%), and Mozambique (23.2%) (**Figure 4.3/C**). Protected areas, as a component of natural capital, contribute to wealth mostly in Niger, accounting for up to 8.3% of the total wealth of the country. This ratio is slightly over 5% in four other member countries, namely Suriname (5.4%), Cameroon (5.2%), Benin (5.0%), and Mali (5.0%) (**Figure 4.3/D**).

Figure 4.4. Natural Capital Per Capita, 1998 vs 2018 (Left) and Top 10 OIC Countries by Natural Capital Per Capita, 2018 (Right), US$



Source: SESRIC staff calculation based on data from Wealth Accounts database of the World Bank.

Although OIC countries, on average, greatly outperform the rest of the world in terms of the share of natural capital in total wealth, this advantage diminishes to a large extent when population size is taken into account. **Figure 4.4 (Left)** shows that OIC member countries had higher values of natural capital per capita than the rest of the world had in both 1998 and 2018, but the differences were less remarkable and the

per capita values became even more comparable in 2018. Natural capital per capita in OIC member countries increased from US$9,676 in 1998 to US$12,317 in 2018, corresponding to an increase of 27% over that period. However, although this increase was higher than that of developed countries (24%), it was lower than that of non-OIC developing countries (36%) and the world average (31%).

Among OIC member countries, Kuwait took the lead in natural capital per capita in 2018 (**Figure 4.4, Right**), with a value of US$344 thousand, followed by Qatar (US$306 thousand), United Arab Emirates (US$165 thousand), and Saudi Arabia (US$151 thousand). It is worth noting that all of these countries are high-income oil-exporting countries, heavily dependent on non-renewable natural resources. It is also worth noting that Nigeria, Yemen, Guyana, Guinea-Bissau, Lebanon, Maldives, and Palestine recorded a decrease in their natural capital both in overall value and in per capita terms between 1998 and 2018. In addition, 19 other OIC countries experienced a decline in their natural capital per capita in the same period.

5. Performance of Environmental Management

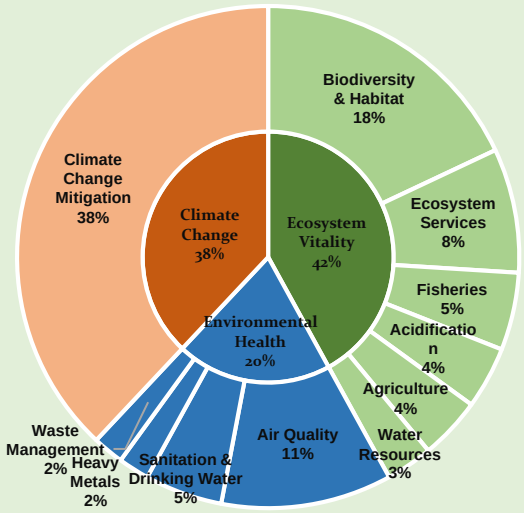
This section briefly evaluates the environmental performance of OIC countries via the 2022 Environmental Performance Index (EPI), which provides global metrics for the environment and ranks countries by their performance on sustainability issues.

BOX 5.1: The 2022 Environmental Performance Index (EPI)

Maintained by Yale Center for Environmental Law & Policy, Yale University, the 2022 Environmental Performance Index (EPI) provides a data-driven summary of the state of sustainability around the world. As a composite index, the EPI distils data on many indicators of sustainability into a single number. Initially, using the data received from various third-party sources, indicators are constructed on a 0-100 scale, from worst to best performance. Subsequently, for each country, the scores for indicators are aggregated into issue categories, policy objectives, and then, finally, into an EPI score. Currently, using 40 performance indicators across 11 issue categories, the 2022 EPI ranks 180 countries on 3 policy objectives – environmental health, ecosystem vitality, and climate change (see the figure). Accordingly, the EPI provides a scorecard that highlights leaders and laggards in environmental performance –or in addressing the environmental challenges– and offers a policy tool in support of efforts to meet the targets of the UN Sustainable Development Goals (SDGs).

Policy Objectives and Issue Categories of the 2022 EPI

(Weights within each level of aggregation)

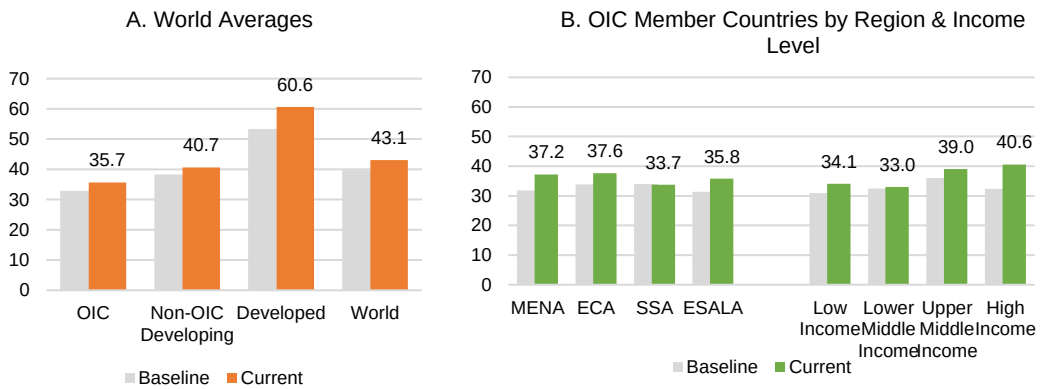


Source: Wolf, M. J, Emerson, J. W., Esty, D. C., de Sherbinin, A., Wendling, Z. A., et al. (2022). 2022 Environmental Performance Index. New Haven, CT: Yale Center for Environmental Law & Policy. epi.yale.edu.

According to the index (Wolf et al., 2022) (see **BOX 5.1**), OIC member countries, scoring 35.7 points on average, still lag behind both other developing countries (40.7) and developed countries (60.6) despite the improvement they achieved in the last decade (**Figure 5.1/A**). Member countries in the Middle East & North Africa and in Europe & Central Asia are performing relatively well and have also improved their environmental performance more than those in the other regions in the last decade (**Figure 5.1/B**).

Wealth is a determining factor in the environmental performance of countries, as highlighted in the 2022 EPI report (Wolf et al., 2022) with a strong positive correlation between the EPI score and GDP per capita. This is attributed to the fact that achieving sustainability requires sufficient economic prosperity to fund public health and environmental infrastructure. The report has also found that this relationship is especially strong for issues within the "Environmental Health" policy objective, which requires significant investments in sanitation infrastructure, waste management facilities, and air emission control technologies. The relationship between wealth and the "Ecosystem Vitality" and "Climate Change" policy objectives are weaker, which highlights the importance of sustainable development in that income growth too often comes at the cost of the environment, especially from the exploitation of natural resources –as explained above– and heightened generation of pollutants through material and energy consumption.

Figure 5.1. Change in Environmental Performance in the Last Decade: 2022 EPI Scores in the World and in the OIC by Region and Income Level

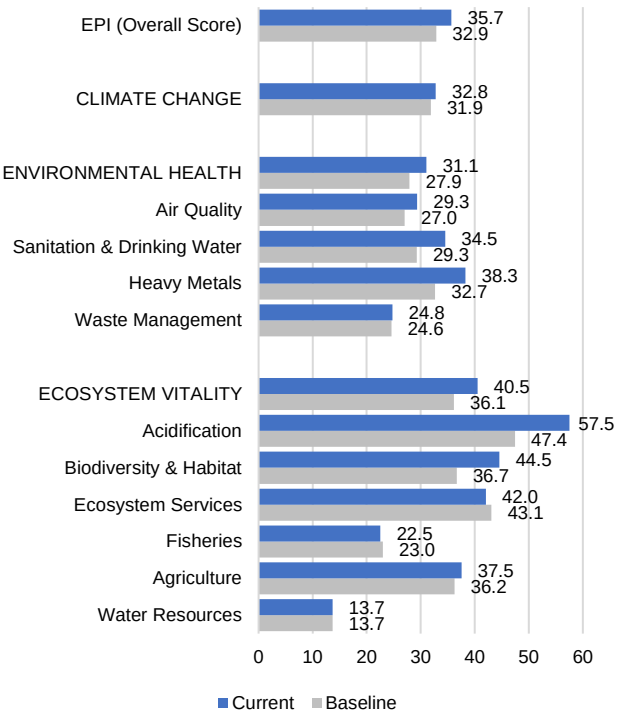


Source: SESRIC staff calculation based on data from the 2022 EPI. (epi.yale.edu)
* Current: Most recent year; Baseline: Approximately ten years prior to the most recent data.
** Income grouping is based on World Bank classification by 2021 GNI per capita.
*** MENA: Middle East & North Africa; SSA: Sub-Saharan Africa; ECA: Europe & Central Asia; ESALA: East and South Asia & Latin America

In OIC member countries, too, it is observed that EPI score increases as income level rises. Moreover, the improvement achieved in EPI score in the last decade is also larger in higher income countries.

Indeed, low-income OIC countries have an average EPI score of 34.1 points, increased by 3.1 points in the last decade. Low-middle income OIC countries score the lowest with 33 points and hardly improved over the past decade (0.6 points increase). By comparison, the score for high-income OIC countries is as high as 40.6 and it increased 8.3 points in the last decade (**Figure 5.1/B**). Thus, it becomes evident that low-income OIC coun tries, most of which are in Sub-Saharan Africa and dependent on agricultural natural capital, cannot afford to adequately fund public health and environmental infrastructure and/or mitigate the negative effects on the environment. In contrast, high-income OIC countries, which are rich in subsoil assets, have been capable of reinvesting in environmental health and ecosystem vitality, even to a greater extent in the last decade.

Figure 5.2. 2022 EPI Scores: Ten-Year Change in Environmental Performance of the OIC by Category



Source: SESRIC staff calculation based on data from the 2022 EPI. (epi.yale.edu)
** Current: Most recent year; Baseline: Approximately ten years prior to the most recent data.*

Digging into sub-categories of the 2022 EPI reveals that OIC countries score better in Ecosystem Vitality (40.5) than in Environmental Health (31.1) and Climate Change (32.8), though all policy objectives have improved in the last decade (**Figure 5.2**). Within Environmental Health, waste management emerges as the weakest field in the OIC, with a score of 24.8. Despite facing challenges in waste management, certain member countries have taken proactive steps to address the issue and lead initiatives for improved waste management practices. Türkiye serves as a noteworthy example in this regard through its efforts, including the influential Zero Waste project, to tackle waste generation and promote sustainable practices (see **BOX 5.2**).

In air quality and in access to safe sanitation & drinking water facilities, which are of utmost importance to human health, OIC member countries recorded improvement, driven by efforts around the Millennium Development Goals (MDGs) and the subsequent Sustainable Development Goals (SDGs). Nevertheless, the scores achieved (29.3 for air quality and 34.5 for sanitation & drinking water) are still below those of other developing countries and developed countries.

BOX 5.2: Türkiye's "Zero Waste" Initiative

The Zero Waste project, initiated by Türkiye's First Lady Emine Erdoğan in 2017, is a transformative environmental campaign aimed at reducing waste generation and promoting sustainable practises in Türkiye. With a vision to create a cleaner and greener future, the project focuses on raising awareness, implementing effective waste management strategies, and encouraging behavioural changes at both individual and institutional levels.

Under the project, numerous initiatives have been undertaken to tackle various aspects of waste management. One key aspect is the promotion of recycling and waste separation practises to maximise resource recovery and minimise landfill waste. Public awareness campaigns have been launched to educate citizens about the importance of reducing, reusing, and recycling materials, leading to increased participation in recycling programmes across the country.

Furthermore, the Zero Waste project has emphasised the importance of sustainable consumption and production patterns. It encourages the use of eco-friendly products, promotes responsible packaging, and advocates for the reduction of single-use plastics. By targeting both the supply and demand sides of waste generation, the project strives to create a paradigm shift towards a circular economy.

The project has made significant achievements in transforming Türkiye's waste management practises. In its 5th year, the project has managed to conserve 650 million tonnes of raw material; prevent 3.9 million tonnes of greenhouse gas emissions; and save 572 million m^3 of water. It has also fostered a culture of environmental consciousness, empowered local communities, and inspired collective action towards a more sustainable future. Through its multifaceted approach, the project continues to inspire individuals, businesses, institutions, and international communities to embrace a zero-waste lifestyle and contribute to the preservation of natural resources.

The Zero Waste project has earned global recognition for its significance. The project inspired the launch of the International Day of Zero Waste by the United Nations during a high-level event held on 30 March 2023 at the UN General Assembly Hall, where UN Secretary-General António Guterres emphasized the urgent need to address the overwhelming global waste crisis. The event, attended by First Lady Emine Erdoğan, aimed to raise awareness about the crucial transition towards a sustainable and circular economy, advocating for environmentally friendly production and consumption practices. The UN further emphasized that Zero Waste serves as the initial stride towards establishing waste-wise societies, urging individuals to take responsibility and consciously reduce their consumption of single-use plastics.

Source: Yenigün et al. (2023) and UN (2023)

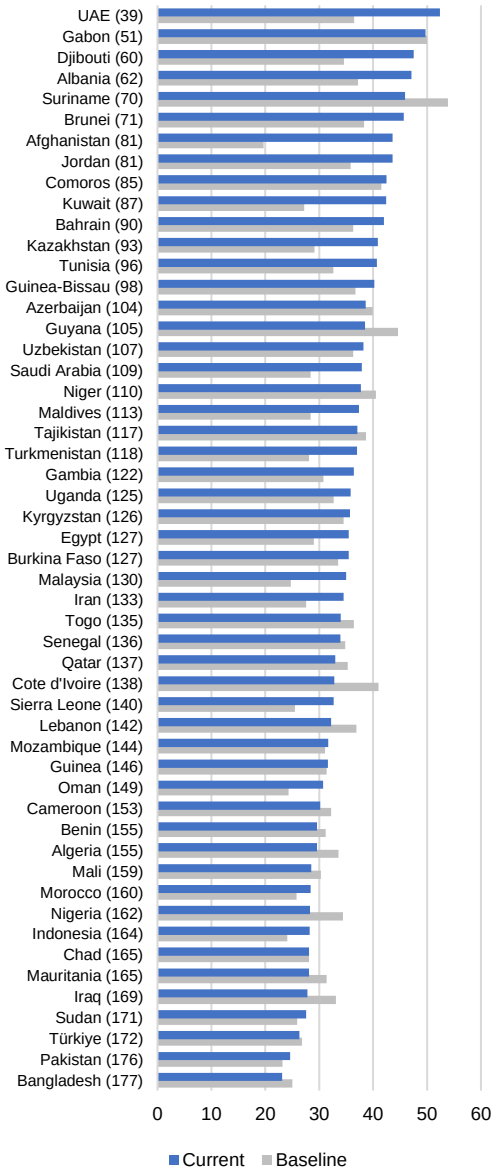
Within Ecosystem Vitality, OIC countries score relatively well in acidification (57.5) –attributable to SO_2 and NO_x pollution control efforts and regulations as well as technological improvements– and in protecting biodiversity and habitat (44.5) provided by forests, wetlands, and grasslands as a result of the rising awareness for their importance to biodiversity and climate change mitigation. On the other hand, OIC countries have had the lowest score in 'water resources' (13.7) due to low performance in wastewater treatment.

However, the expansion of road transport accompanied by increasing vehicle use, industrial processes, and the use of fossil fuels in energy production continue to contribute to increasing emissions in many member countries, limiting the improvement in 'Climate Change' policy objective in the last decade to only 0.9 points.

Among the 52 OIC member countries covered in the 2022 EPI, United Arab Emirates had the highest score (52.4), securing the 39th position in the global rankings, mainly due to strong results on Environmental Health and high scores on indicators in Biodiversity & Habitat as well as Water Resources. Gabon (51st), Djibouti (60th), and Albania (62nd) followed next closely.

Afghanistan has emerged as the top country in the world to improve its EPI score (+23.9 points) over the last decade, largely thanks to the improvement in Climate Change as a

Figure 5.3. Environmental Performance of OIC Member Countries (2022 EPI Scores)



Source: The 2022 EPI. (epi.yale.edu)

** Current: Most recent year; Baseline: Approximately ten years prior to the most recent data.*

*** The numbers in parenthesis show each country's global rank in 180 countries.*

result of efforts to reduce emissions of greenhouse gases and other air pollutants. United Arab Emirates (+15.9), Kuwait (+15.2), Djibouti (+12.9), Kazakhstan (+11.8), and Malaysia (+10.3) are among the top countries that have made significant improvements (**Figure 5.3**).

On the other side of the spectrum, among OIC countries, Cote d'Ivoire's EPI score has dropped the most (-8.2 points) due to deterioration in several areas such as climate change, tree cover loss, and pollution emissions. Nineteen more OIC countries, mostly low-income Sub-Saharan African, have slipped in environmental performance in the last decade: Suriname (-8), Guyana (-6.1), Nigeria (-6.1), Iraq (-5.3), Lebanon (-4.7), Algeria (-4), Mauritania (-3.3), Niger (-2.8), Togo (-2.4), Qatar (-2.3), Cameroon (-2), Bangladesh (-1.9), Mali (-1.8), Tajikistan (-1.6), Benin (-1.6), Azerbaijan (-1.3), Senegal (-0.9), Türkiye (-0.5), Gabon (-0.3) (**Figure 5.3**).

6. State of Water, Air, Land, and Biodiversity

6.1 Water

The sustainable management of water resources is crucial for the OIC member countries to address complex and multidimensional developmental issues, including, but not limited to, poverty, gender inequality, economic disparity, food insecurity, and global health pandemics. Access to water is a basic human right, but the preservation of this right is highly contingent upon effective and sustainable management of water resources and the development of adequate infrastructure and policy regulations.

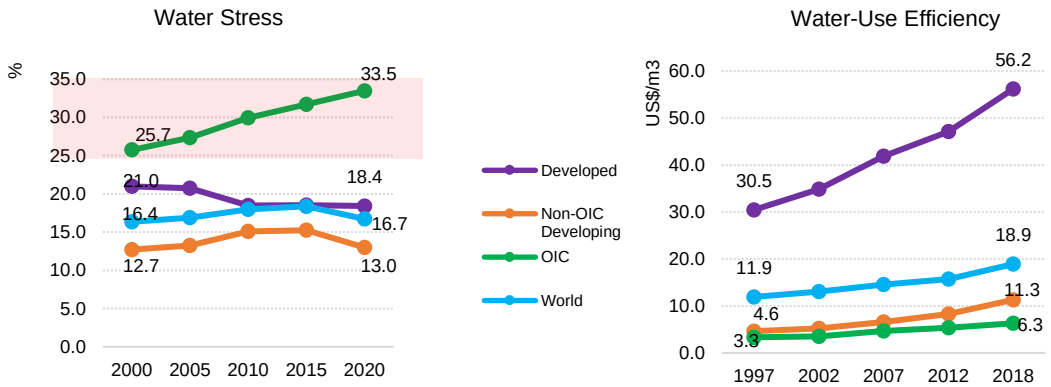
This sub-section reviews the latest status and progress on achieving SDG targets concerning water. Water is directly related to SDG 6: Clean Water and Sanitation for all, with the official wording of "Ensure availability and sustainable management of water and sanitation for all" (UN, 2017, p. 10). More detailed discussions of the water sector in OIC member countries can be found in the OIC Water Report 2021 (SESRIC, 2021).

SDG 6 is in line with the OIC-2025 Programme of Action and emphasizes the need to improve and develop infrastructure and the utilization of modern technologies to address challenges pertaining to the optimal use of water resources. This need is enshrined under three different priorities of the OIC-2025 Programme of Action: Priority 5 on the Environment, Climate Change and Sustainability, Priority 8 on Agriculture and Food Security, and Priority 12 on Health, along with a need to minimize the destructive impact of water and strengthen cooperation in the domain of water resource management. Furthermore, the OIC Water Vision (OIC, 2012), which focuses on OIC member countries' "working together for a water secure future", recognizes access to water as an important milestone in improving water security, human health, and overall development in OIC member countries.

Water Scarcity & Use

Water scarcity can be measured by the level of water stress. The level of water stress describes the proportion of water withdrawal by all sectors from the available water resources, taking into consideration the water requirements for sustaining the natural environment as well. The indicator provides information on whether water is sufficient to be consumed for both the environment and society at large, thereby indicating the water security status of the region. A high level of water stress not only jeopardizes the natural environment's sustainability, but may also have a negative impact on socioeconomic development and food security due to competing water use.

Figure 6.1. Water Stress, 2000-20 (Left) and Water-use Efficiency, 1997-2018 (Right) by World Region



Source: SESRIC staff calculations based on FAO AQUASTAT database

By definition of the indicator, countries begin to experience water stress at a 25% level, while above 70% is considered critically stressed (UN-Water & FAO, 2018). **Figure 6.1 (Left)** shows the trend of water stress in various world regions between 2000 and 2020. During that period, all regions except developed countries were undergoing increasing trends of water stress. Globally, water stress increased from 16.4% in 2000 to 16.7% in 2020. In comparison, water stress has risen significantly in the OIC countries, from 25.7% to 33.5%. At the current level, the OIC is considered a region experiencing water stress.

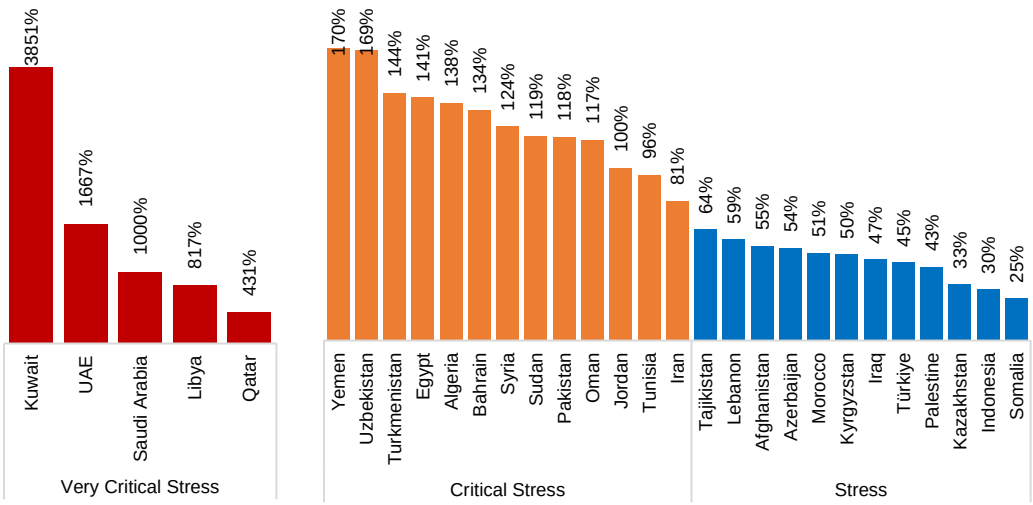
At the individual country level, in 2020, there are 30 OIC member countries undergoing water stress, 14 of which are at critical stress levels and five countries are at a very critical stress level (see **Figure 6.2**). The majority of water-stressed countries are located in arid and semi-arid regions where water resources are scarce. At the sub-regional level, MENA and ECA are the regions with the most countries under a serious threat of water stress.

Water stress is worsening over time as water demand rises due to population growth and shifting consumption patterns. On the other hand, the impacts of climate change will most likely change the availability of water in the future. By 2040, most OIC regions are projected to see an increase in the water stress level by at least 1.4 times (SESRIC, 2021). That being said, the regions that are already experiencing water stress will be more distressed, while some regions will start to undergo water stress.

Given the levels of water stress in OIC countries, the management of water will require improvements in water-use efficiency through calculated use and other water-use reduction measures. The use of water in the OIC continues to be less efficient, despite some improvement in recent years. **Figure 6.1 (Right)** illustrates the trends of water-use efficiency (WUE), which measures the value-added in US$ per volume of water withdrawn by various economic sectors in a region. The OIC as a group has

the least water-use efficiency level compared to all the world regions under consideration. In 2018, OIC countries generated US$6.3 per one m^3 of water, which is only one-third of the global average level of US$18.9 per m^3. In comparison, non-OIC developing and developed countries managed to generate US$11.3 and US$56.2 per m^3 of water respectively.

Figure 6.2. Water Stress in OIC Countries, 2020



Source: FAO AQUASTAT database

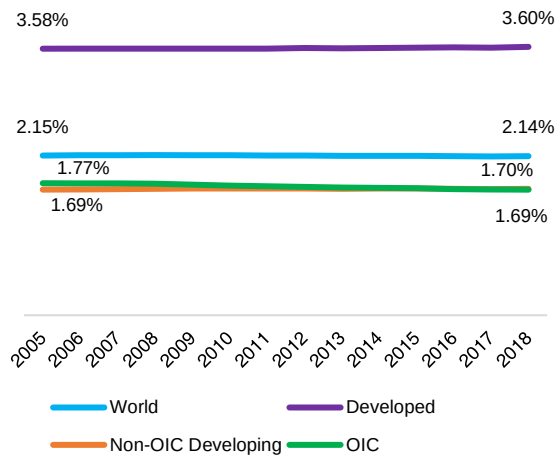
At the country level, 17 OIC countries have WUE values above the world average, particularly Qatar (US$200.8), Kuwait (US$101.6), Gabon (US$95.1), Bahrain (US$78.1), and the UAE (US$74.2). On the contrary, the rest of OIC countries had WUE values lower than the global average, with Somalia, Tajikistan, the Kyrgyzstan, Afghanistan, and Syria having the lowest (less than US$1 per m3).

Agriculture, as the most water-intensive sector, is in need of efficiency improvement to meet future food demand. This could be achieved through practising conservation, reusing water, and implementing various modern approaches to increase water use efficiency. Using efficient irrigation techniques is vital for boosting food production and thereby ensuring food security in the OIC region. However, available data on the irrigation techniques used in OIC countries indicates that surface irrigation, which is the most water-consuming technique, is by far the most widely used technique in 74.4% of the total area equipped for irrigation. Consequently, huge amounts of water diverted to irrigation in these countries are wasted at the farm level through either deep percolation or surface runoff. In contrast, sprinkler irrigation, which is more water-saving than surface irrigation, is practised in 4.6% of the total area equipped for irrigation in the OIC countries, and the localized irrigation technique, which is the most water-saving technique, is practised in only 3.1% of the total area equipped for irrigation in the OIC countries (SESRIC, 2021).

Ecosystem Protection

Over the last century, it is estimated that the global natural wetland has lost 70% of its area, which includes a significant loss of freshwater species (Davidson, 2014). Considering the importance of ecosystem services, it is essential to protect and restore water-related ecosystems and to ensure continuous benefits to society. To get an idea of how water-related ecosystems are preserved, it can be seen through the change in the extent of water bodies.

Figure 6.3. Water Body Extent (Permanent and Maybe Permanent) % of Land Area, 2005-2018



Source: UNSTAT SDG Indicators

The change of water bodies over time can be seen in **Figure 6.3**. Various regions demonstrated different trends between 2005 and 2018. Globally, the proportion of water bodies relative to the land area has declined slightly from 2.15% in 2005 to 2.14% in 2018. During the same period, developed countries have managed to increase their water bodies from 3.58% to 3.60%, while in non-OIC developing countries the proportion of water bodies was relatively stable at 1.69%. OIC countries, however, showed a sharp declining trend, where their water bodies declined from 1.77% in 2005 to 1.70% in 2018. This equates to approximately 2.7 million hectares of lost water bodies, an area roughly the size of Albania.

The individual country levels show a diverse picture as can be seen in **Figure 6.4**. There were 27 OIC countries, which recorded an increase in their water bodies during the 2005-2018 period. The highest increases occurred in Algeria (72% increase), Sudan (55%), and Pakistan (42%). On the other hand, the countries with the highest loss of water bodies were Uzbekistan (47% decrease), Afghanistan (34%), and Somalia (25%).

Protection and restoration of water-related ecosystems is one way to preserve water resources. Increasing water bodies would mean increasing the catchments and reservoirs for water in the region. This is important for all water-related ecosystems, such as vegetated wetlands, rivers, lakes, reservoirs and aquifers, and those found in mountains and forests that play a special role in storing freshwater and maintaining water quality.

Figure 6.4. Change in Water Body Extent (Permanent and Maybe Permanent), 2005-2018

Source: UNSTAT SDG Indicators

Water Governance

The myriad of issues faced in the water sector requires responsive interventions that efficiently combine technical expertise, prescriptive governance, and effective management. The modern approach to water resource management stresses the need to fulfil the water needs of present and future generations by incorporating sustainable development approaches into the water sector. This can be achieved through multi-sector integration, broader stakeholder involvement, and raising awareness about the importance of the economic, social, and ecological values of water (Schoeman et al., 2014). Furthermore, the system also needs to be adaptable to future shocks and uncertainties, including climate change.

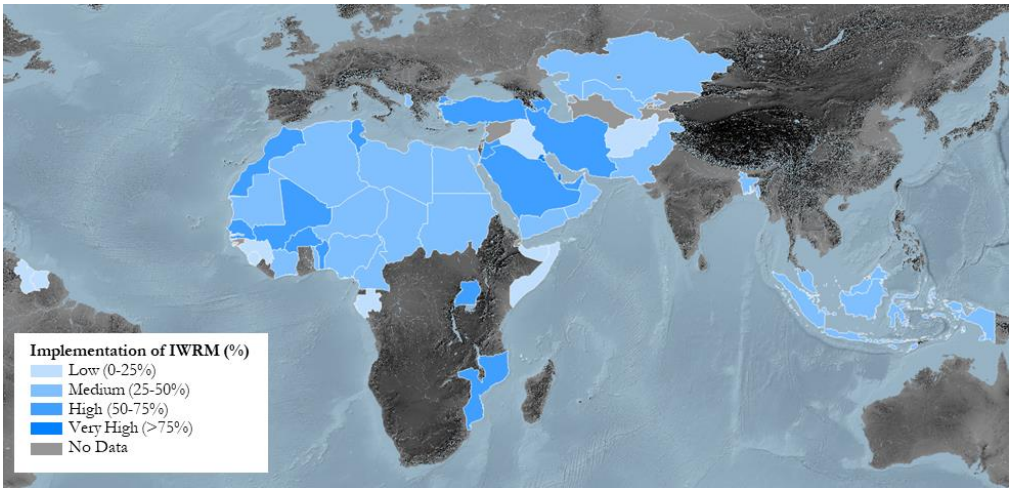
The failure of traditional physical/extraction-based water planning has encouraged international society to bring to the table a water management solution that incorporates ecological and societal values into water decision making. Integrated Water Resources Management (IWRM) is perhaps the gold standard of a water resources management framework, which tries to bridge the gap between sustainable development and cross-sectoral planning (Jeffrey & Gearey,

2006). IWRM recognizes the highly interrelated relations between water and other sectors; therefore, involving various stakeholders to form water policies is deemed necessary. In practice, the application of IWRM consists of basin-scale management of water resources, establishing water rights, water pricing for allocation, and participatory decision-making.

Implementation of IWRM, therefore, may indicate the level of good governance in managing the water sector. UNEP (2012) reports that, since 1992, 80% of countries have started reforming procedures to improve the enabling environment for water resource management based on the application of IWRM. Over the past decades of implementation, countries that have adopted integrated approaches have been reported to boost infrastructure development, provide diverse financing sources, and improve institutional frameworks, which has led to better water management practices and socio-economic benefits (UNEP, 2012). The economic benefits are suggested through efficiency improvement, mostly in water-use in the agriculture sector. Social and environmental benefits are also reported in terms of improved access to water and improved water quality through wastewater treatment.

OIC member countries are also implementing IWRM. For instance, Kazakhstan, Kyrgyzstan, Azerbaijan, Tajikistan, and Turkmenistan have undergone IWRM implementation, such as the transition to a basin management approach, institutional setup, and regulatory reform, since the 2000s (OECD & United Nations, 2014). Furthermore, many other OIC countries are also undergoing implementation at differing stages. **Figure 6.5** shows the status of IWRM implementation with scores categorized into "Low" (0-25% implementation), "Medium" (25 - 50%), "High" (50 - 75%), and "Very High" (>75%). The majority of OIC countries fall into the "Medium" category, indicating that most aspects of the IWRM have been institutionalized. Eight countries are in the "Low" category, meaning they have started developing elements of IWRM. In the "High" category, there are 13 OIC countries. These countries have been implementing most elements of the IWRM in their long-term programmes. Finally, the remaining three countries, which are generally achieving their water-policy objectives, fall under the "Very High" category. These countries are Kuwait (82% IWRM implementation), Qatar (82%), and United Arab Emirates (75%). Collective action that builds on the multi-stakeholder monitoring and reporting processes is needed to set national targets to accelerate water resource development and management in a sustainable and equitable way.

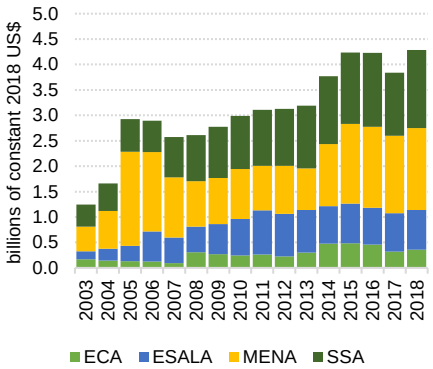
Figure 6.5. Implementation of Integrated Water Resources Management (%), 2018



Source: UNSTAT SDG Indicators

The fact that there are 153 countries with trans-boundary rivers, lakes, and aquifers should not be overlooked in global efforts to solve water issues. Shared water basins are estimated to cover around 62 million km^2 of land (42% of global land), shelter over 2.8 billion people, and account for 54% of global river discharge (UNEP, 2016). One of the major impediments to addressing global water problems is a failure to cooperate appropriately in the management of shared basins. UN & UNESCO (2018) reported that while there have been around 450 transboundary water treaties adopted since 1820, there are still many shared basins which lack the necessary arrangements to support their management.

Figure 6.6. Water Sector ODA in OIC Regions, 2003-2018



Source: UNSTAT SDG Indicators

Globally, the percentage of transboundary basins covered by an operational arrangement was 59.2% in the period 2017-2018 for countries with data available (UNEP, 2019b). For comparison, developed countries have 82.2% of their shared basins covered by agreements, while non-OIC developed countries have covered 53.3% of their basins. OIC countries, on average, have the least coverage of basins under agreement with a share of 44.1%. Note that Bahrain, Comoros, Kuwait, Maldives, Oman, Qatar, Saudi Arabia, United Arab Emirates and Yemen are the OIC

countries with no shared surface watercourses (SESRIC, 2018). On a country-by-country basis, Niger (90%), Cameroon (88.6%), Benin (81.5%), Mali (75.4%), Tunisia (80%), and Uganda (83.6%) have already covered more than 70% of their shared basins.

The progress in SDG 6 would not be achieved without strong financial support. There is a need to scale-up funding for projects in the water sector to tackle water issues. This would need an increase in funding both through internal and external channels. To be sustainable, investments in the water sector should be supported through an appropriate business model and various alternative financial sources, such as blended finance, loans, and revolving funds.

According to UNEP (2019), total water sector overseas development assistance (ODA) disbursements were raised from US$7.4 billion in 2011 to US$9.0 billion in 2016. OIC countries, in this regard, have increased ODA disbursements from US$1.24 billion in 2003 to US$4.3 billion in 2018. **Figure 6.6** illustrates the trends of the water sector ODA in the OIC regions. MENA and SSA regions received the most ODA, accounting for 73% of total ODA in the OIC. The need to improve basic drinking water and sanitation in most SSA countries was the main target for ODA. On the other hand, the water-scarce MENA region needs to ensure the continued supply and distribution of water from scarce resources.

Table 6.1. Users/Communities Level of Participation in Rural Drinking-Water Supply Planning Programs, 2019

Participation Level	OIC Member Countries
High (12)	Afghanistan, Albania, Azerbaijan, Bangladesh, Burkina Faso, Guinea, Kazakhstan, Mali, Mauritania, Morocco, Palestine, Syria
Moderate (24)	Cameroon, Chad, Côte d'Ivoire, Gabon, Gambia, Indonesia, Iran, Jordan, Kyrgyzstan, Malaysia, Maldives, Mozambique, Niger, Nigeria, Oman, Pakistan, Senegal, Sierra Leone, Sudan, Tajikistan, Togo, Tunisia, Uganda, Yemen,
Low (2)	Comoros, Guyana
N/A (5)	Benin, Egypt, Guinea-Bissau, Lebanon, Uzbekistan

Source: UNSTAT SDG Indicators

Governance of water should also ensure the fulfilment of the basic drinking water needs of society. Rural populations, in most cases, lack the necessary infrastructure and resources to have adequate access to clean drinking water. SESRIC (2021) reports that 84.6% of the population in OIC countries had access to at least basic drinking water in 2017 – relatively low as compared to non-OIC developing countries (88.3%) and developed countries (99.5%). Regionally, there were disparities in the coverage of basic drinking water between the various OIC regions. For instance, member countries in MENA, ECA, and ESALA achieved 90% or higher coverage of basic drinking water services, whereas those in the SSA recorded a coverage level

of only 64%. In fact, in Chad, Burkina Faso, and Uganda, less than 50% of the population had access to at least basic drinking water in 2017.

Community participation is a key component of increasing sustainable water, sanitation and hygiene (WASH) service provision, particularly in rural areas and for promoting IWRM. Achieving this can contribute towards increased participation of women in political, economic and public life. It can also contribute towards ensuring the conservation, restoration, and sustainable use of freshwater ecosystems and their services and ensuring responsive, inclusive, participatory, and representative decision-making at all levels (UNEP, 2019b). As shown in **Table 6.1**, the majority of OIC countries are reported to have moderate to high levels of community participation in rural drinking water supply planning programs. This is a positive indication of the improvement of WASH services, especially in rural areas.

6.2 Air

Air pollution and its serious consequences for human health are increasingly being recognized as one of the most pressing environmental issues of the 21st century. A recent report (Health Effects Institute, 2020) indicated that in 2019, air pollution was placed 4th as a leading risk factor for death globally, surpassing other widely recognized risk factors such as obesity, high cholesterol, and malnutrition. Ambient air pollution caused an estimated 6.7 million deaths worldwide in 2019 (Health Effects Institute, 2020). Even in the European Union (EU), air pollution is recognized as the number one environmental cause of premature death (EU, n.d.).

Recently, various restrictions and reduced social mobility during the COVID-19 pandemic have been observed to have an impact on local air pollution. While significant economic and social costs have to be paid, clear skies and starry nights are visible in many countries, which is sometimes a rare sight. Globally, air pollution, in terms of nitrogen dioxide (NO_2) and particulate matter (PM) levels, has declined by about 60% and 31% (Venter et al., 2020). The decreases are primarily the result of significant reductions in emissions from the transportation sector. However, as various restrictions are lifted and economic activities resume, air pollution has again risen. Nonetheless, the temporary improvement in air quality during the lockdown periods served as a stark reminder of what emissions deprive us of. Various restrictions to halt the spread of COVID-19 only provide a short-term solution; long-term solutions to air pollution are deemed necessary.

This sub-section discusses the state and trends of the air in OIC countries based on the relevant SDG targets. There is no specific SDG for air pollution, although the problem is mentioned in two targets under SDG 3 (Good Health and Well-Being) and SDG 11 (Sustainable Cities and Communities). Accordingly, this sub-section is divided into two parts, covering the status of air pollution and its health impacts.

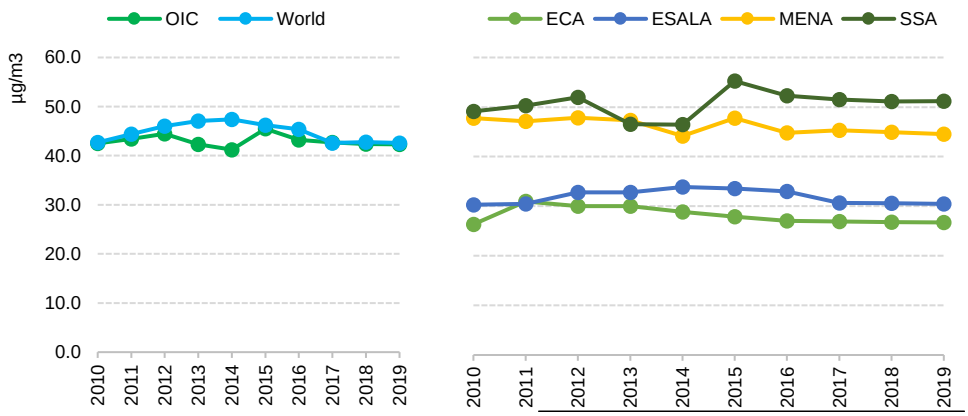
Air Pollution

The quality of the air is indicated by its levels of pollutants. The amount of fine particulate matter (PM) is one of the most common indicators of air quality. These particles are generally the product of combustion from vehicles, coal-power plants, industrial activities, waste burning, and other natural and human sources. Continuous exposure to these airborne particles, especially high concentrations of PM2.5[4], leads to an increasing risk of health and mortality, especially from cardiovascular and respiratory diseases.

The WHO Air Quality Guidelines (WHO, 2006) recommend an annual mean PM2.5 concentration of 10 µg/m^3. Globally, little has been done to address the high levels of PM. The Health Effects Institute (2020) estimated that the world's annual average levels of PM2.5 have improved only modestly, declined from 42.7 µg/m^3 in 2010 to 42.6 µg/m^3 in 2019. That being said, in 2019, more than 90% of the global population is still living in places where PM levels are above the WHO Air Quality Guidelines (AQG) value.

The trend in OIC countries is parallel to the global trend. As shown in **Figure 6.7 (Left)**, on average, PM2.5 exposures in OIC declined slightly from 42.5 µg/m^3 in 2010 to 42.3 µg/m^3 in 2019. However, within the OIC regions, diversity exists. In 2019, the highest annual average exposures were seen in SSA (51.2 µg/m^3) and MENA (44.6 µg/m^3), while the lowest were in ECA (26.7 µg/m^3) and ESALA (30.5 µg/m^3) (**Figure 6.7, Right**). The fact that many OIC countries have made slow progress in reducing PM2.5 exposure demonstrates that many countries lack national standards for PM and do not monitor PM levels.

Figure 6.7. Annual Mean PM2.5 Concentrations in World Region (Left) and OIC Regions (Right), Population-weighted, 2010-2019

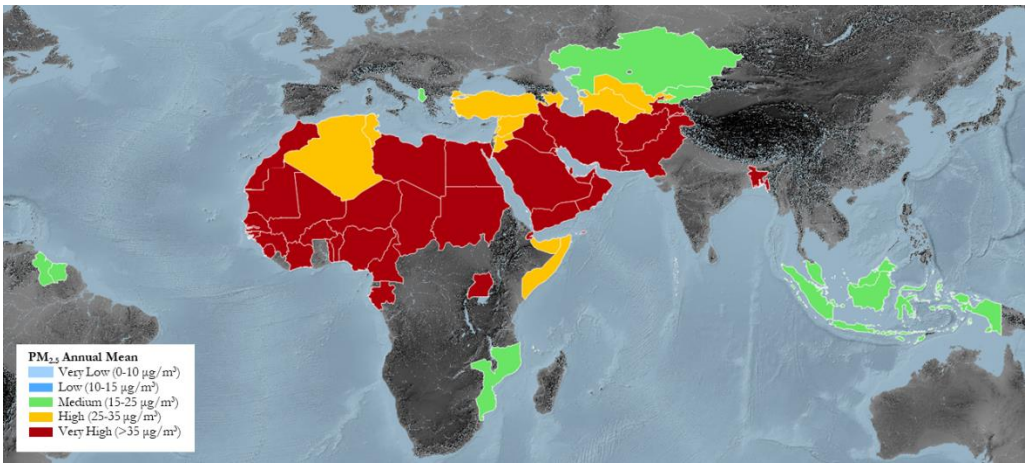


Source: Global Burden of Disease Study 2019

[4] Fine particulate matter smaller or equal to 2.5 micrometers (µm) in diameter.

Figure 6.8 shows the status of annual mean PM2.5 exposure in individual OIC countries, categorized based on the WHO Air Quality Guidelines (WHO, 2006)[5]. There were 35 OIC countries having a very high level of PM2.5 exposures, thereby having a very high mortality risk due to PM2.5 related diseases. The remaining OIC countries managed to reach at least the WHO interim target 1 (25-35 µg/m^3). There were only two countries that met (and almost met) the WHO AQG, namely the Maldives (10.9 µg/m^3) and Brunei Darussalam (7.7 µg/m^3).

Figure 6.8. Annual Mean Levels of PM2.5, 2019



Source: SESRIC staff generated map based on data from Global Burden of Disease Study 2019

It is worth noting that the most severe air pollution is observed in countries located in SSA and MENA regions. The top five OIC countries with the worst annual PM2.5 levels in 2019 were Niger (80.1 µg/m^3), Qatar (76 µg/m^3), Nigeria (70.4 µg/m^3), Egypt (67.9 µg/m^3), and Mauritania (66.8 µg/m^3). Countries with extremely high PM2.5 concentrations (greater than 35 µg/m^3) would have a 15% higher chance of long-term mortality risk compared to the AQG level. One of the reasons for the high level of pollution is because air pollution has not yet become a top priority in these countries' policies. For instance, according to Amegah & Agyei-Mensah (2017), the main challenges in establishing policies to control air pollution in many SSA countries are the absence of air quality monitoring and evidence of its associated health risk. Therefore, setting up plans for national air quality monitoring is the first step toward

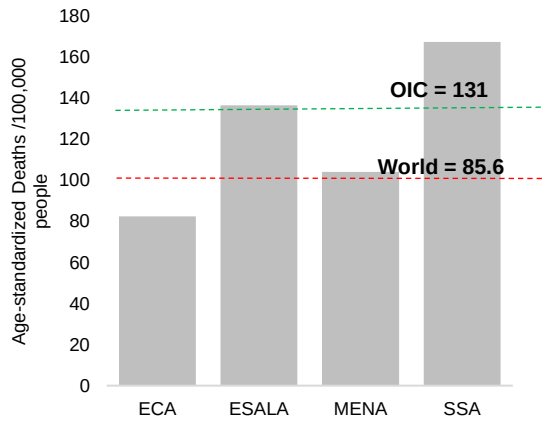
[5] **Very Low/Air quality guideline (AQG)**: These are the lowest levels at which total, cardiopulmonary and lung cancer mortality have been shown to increase with more than 95% confidence in response to long-term exposure to PM2.5.
Low/Interim target-3: In addition to other health benefits, these levels reduce the mortality risk by approximately 6% [2-11%] relative to the Interim Target-2 level.
Medium/Interim target-2: In addition to other health benefits, these levels lower the risk of premature mortality by approximately 6% [2–11%] relative to the Interim Target-1 level.
High/Interim target-1: Associated with about a 15% higher long-term mortality risk relative to the AQG level.
Very High: More than 15% higher long-term mortality risk relative to the AQG level.

improving the national response to the air pollution problem and providing a health impact assessment related to air pollution.

Health Impact

Exposure to air pollution is known to affect the immune system, making an individual more susceptible to respiratory and other infections (Health Effects Institute, 2020).

Figure 6.9. Mortality Rate Attributed to Ambient Air Pollution, 2019



Source: Global Burden of Disease Study 2019

Recently, air pollution has also moved up to the fourth position in terms of the leading risk factor for death globally, exceeding other well-known risk factors for chronic diseases, such as obesity, high cholesterol, and malnutrition. Furthermore, air pollution affects the quality of life indirectly through loss of working hours, decreasing productivity and forced migration (Oliva et al., 2019). According to OECD (2016), the global welfare costs from premature deaths from outdoor air pollution reached US$3 trillion in 2015 and are projected to be US$25 trillion in 2060.

Health Effects Institute (2020) reported that in 2019, air pollution was responsible for the premature deaths of 6.7 million people worldwide. During the same period, 1.6 million people died as a result of air pollution in OIC countries. Although total numbers of deaths are useful for identifying the magnitude of the health impact, age-standardized rates[6] of death are important for comparing the health burden among regions. The health impact attributable to air pollution varies widely between regions, reflecting variation in exposures and the underlying prevalence of disease and other population susceptibilities. The age-standardized rate of death attributable to air pollution in OIC countries was 131 deaths/100,000 people, significantly higher than the global average of 86 deaths/100,000 people (**Figure 6.9**).

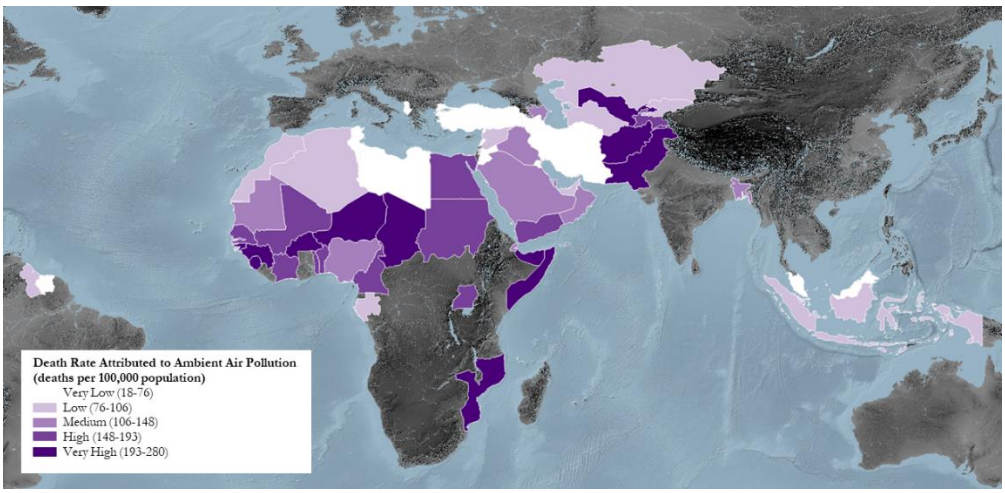
Variation in the death rate exists within OIC regions as illustrated in **Figure 6.9**. Death rates were quite alarming, especially in the ESALA and SSA regions, which had the

[6] Age-standardized rates: The total number of deaths per 100,000 people, calculated based on a standard distribution of population across age categories. Age-standardized rates allow direct comparison of the health burden among countries with very different population sizes and distributions of ages in the population. Higher air pollution-attributable age-standardized rates of disease reflect a combination of higher air pollution levels and/or sicker populations.

highest rates of deaths in the OIC regions, with 137 and 168 deaths/100,000 people, respectively. In comparison, the number of deaths per 100,000 people in the MENA and ECA regions was 104 and 83, respectively.

The burden of health due to air pollution also varies depending on the country. As shown in **Figure 6.10**, OIC countries in SSA and ESALA experience the highest death rates due to air pollution. For example, Somalia, Guinea-Bissau, Afghanistan, Chad and Niger were the top five countries with the highest death rates in the OIC, having a level of 280, 244, 238, 225, and 223 deaths per 100,000 people respectively. In contrast, the lowest levels of air pollution-attributable deaths occurred in Brunei Darussalam (18.1 deaths/100,000), the Maldives (29.9/100,000), Malaysia (45.5 /100,000), Türkiye (53.3/100,000), and Suriname (53.6/100,000). It is worth noting that Brunei Darussalam and the Maldives have the lowest levels of PM2.5 air pollution in OIC. This is clear evidence that controlling air pollution levels can prevent significant deaths.

Figure 6.10. Mortality Rate Attributed to Ambient Air Pollution in OIC Countries, 2019



Source: SESRIC staff generated map based on data from Global Burden of Disease Study 2019

The burden attributable to air pollution varies widely around the regions, reflecting variation in exposures and the underlying prevalence of disease and other population susceptibilities. Countries with a high level of air pollution might have low death rates, for instance, due to well-equipped health systems. As a result, a population exposed to air pollution is less likely to develop chronic diseases. Therefore, mitigating the health risks posed by air pollution should be accomplished simultaneously with both air pollution prevention and healthcare system improvement.

6.3 Land and Biodiversity

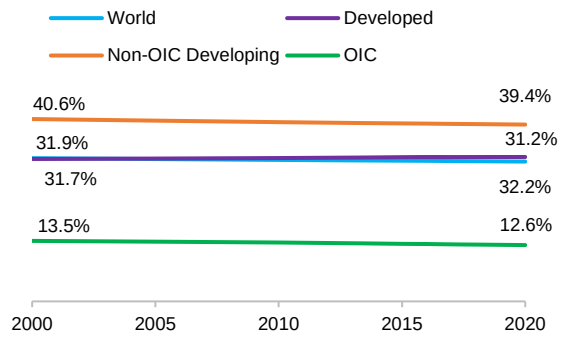
Conservation of land ecosystems and biodiversity has continuously become an unsolved issue globally. Despite an increase in the number of protected areas around the world, land areas are still degrading at an alarming rate, threatening the survival of many species. For instance, one fifth of the Earth's land area is degraded, undermining the wellbeing of billions of people, driving the loss of biodiversity, and intensifying climate change (UN, 2020).

This sub-section reviews the latest status and progress of OIC countries on achieving SDG targets concerning land and biodiversity. Land and biodiversity are directly related to SDG 15: Life on Land, with the official wording of *"Protect, restore and* promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity *loss"* (UN, 2017, p. 19). The goal includes 12 targets that need to be achieved, varying between 2020 and 2030. The progress in achieving these targets is measured by 14 indicators.

In this sub-section, the analysis is divided into three topics, namely, Conservation of Land Ecosystems, Land Degradation & Desertification, and Biodiversity Protection & Genetic Resources. The analysis is done through related SDG targets and their corresponding indicators for each theme.

Conservation of Land Ecosystems

Figure 6.11. Forest Area by World Region (% of land area), 2000-2020

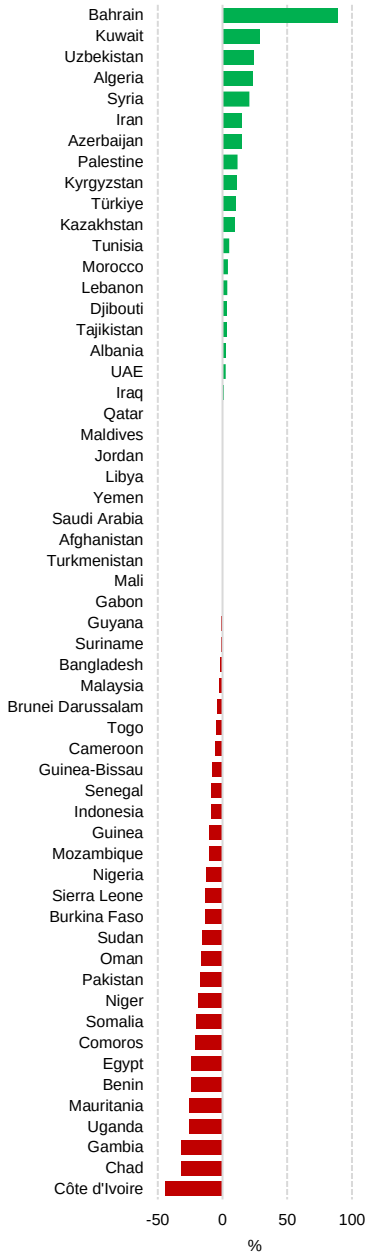


Source: UNSTAT SDG Indicators

The conservation of land ecosystems is relevant to SDG target 15.1, 15.2, and 15.4. The targets place a special emphasis on protecting forest and mountain ecosystems in order to preserve biodiversity and continue to provide ecosystem services to society.

Forests are home to most of the earth's terrestrial biodiversity. Despite important ecosystem services (e.g., water supply, livelihoods, climate change, and food production sources), forest degradation and deforestation continue at an alarming rate. This problem contributes significantly to the ongoing loss of biodiversity, which has a negative impact on people's livelihoods.

Figure 6.12. Forest Area Gain/Loss (%), 2000-2020



Source: UNSTAT SDG Indicators

In 2020, the total forest area in OIC is 392.4 million ha, equivalent to around 10% of the global forest area. Forest areas are not distributed evenly, as countries with wetter climates have larger forests, whereas drier countries, such as countries in MENA, have little to none. More than half of the OIC's forests are found in five countries, namely, Indonesia (92.1 million ha), Mozambique (36.7 million ha), Gabon (23.5 million ha), Türkiye (22.2 million ha), and Nigeria (21.6 million ha).

As a group, the OIC already has the lowest forest cover compared to its total land area. The OIC's forest area share was 12.6% of their total land area in 2020, which is lower than the global average of 32.2%. Furthermore, continued deforestation contributes to a downward trend in forest areas in the OIC (see **Figure 6.11**). The forest area in OIC has decreased by 0.9 percentage points from 13.5% in 2000 to 12.6% in 2020. The degree of forest loss is slightly higher than the global average level of forest loss, which accounts for a decrease of 0.8 percentage points. In comparison, during the same period, non-OIC developing countries recorded a 1.2 percentage decrease, while developed countries made slight gains in their forest areas by 0.4 percentage points.

Globally, around 420 million ha of forest have been lost since 1990 due to conversion to other land uses, although the deforestation rate has declined over the past decades (FAO & UNEP, 2020). In the period between 2010 and 2020, the global rate of deforestation was estimated at 0.12% forest area loss per year, down from 0.13% per year in 2000-2010. While the global deforestation rate is improving (somewhat), the OIC is showing an opposite trend. The deforestation rate in OIC was 0.27% per year during 2000-2010, and significantly rose to 0.44% per year for the period 2010-2020. This shows that deforestation in the OIC is increasing at a very alarming rate.

Figure 6.12 shows the gain or loss of forest areas in OIC countries for the year 2020 relative to the year 2000. There are 29 OIC countries showing a loss of forest areas, 9 countries with relatively no change, and 19 countries showing a positive gain. Bahrain (+89.2%), Kuwait (+28.9%), Uzbekistan (+24.6%), Algeria (+23.4%), and Syria (+20.8%) had the highest increases in forest areas. On the other hand, the highest losses occurred in Côte d'Ivoire (-44.3%), Chad (-32.1%), Gambia (-32.1%), Uganda (-26.1%), and Mauritania (-25.8%).

BOX 6.1: Climate change-induced Wildfire Intensifies

Forest fires are consuming nearly twice as much tree cover as they did twenty years ago, according to new data compiled by Global Forest Watch and the World Resources Institute research group. In fact, 2021 was one of the worst years for forest fires since the turn of the century, resulting in an alarming 9.3 million hectares of tree cover loss worldwide — more than a third of the total tree cover loss that year. Between 2001 and 2021, 27% of the global tree cover was lost due to fires.

Climate change is likely a significant factor in the rise in fire activity. Extreme heat waves are already five times more likely than they were 150 years ago, and as the planet continues to warm, their frequency is expected to increase. Warmer temperatures dry out the landscape, creating the ideal conditions for larger and more frequent forest fires. As a result, forest fire emissions increase, exacerbating climate change and contributing to the spread of fires as part of a fire-climate feedback loop.

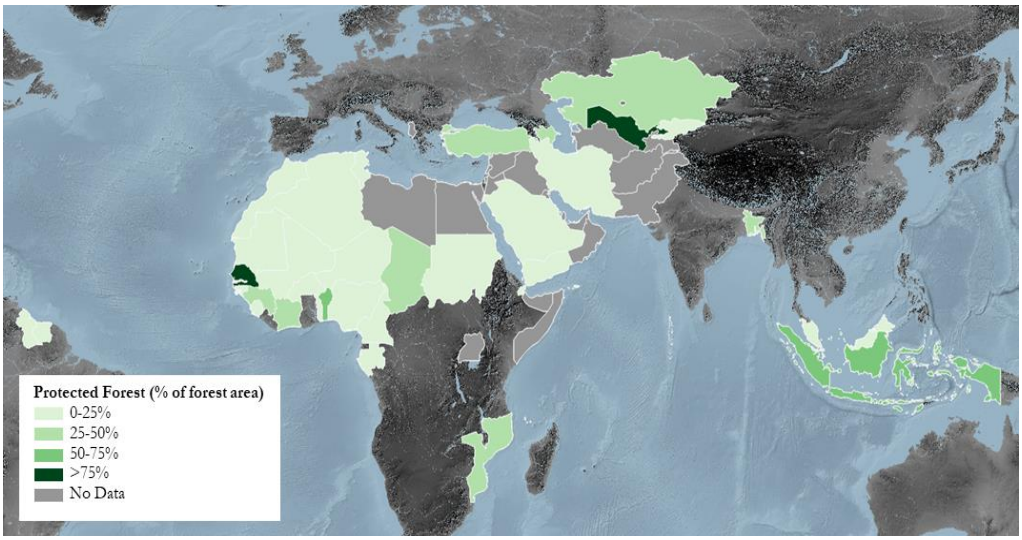
Source: Adapted from MacCarthy et al., (2022)

Deforestation is mostly occurring in OIC countries located in the Sub-Saharan Africa (SSA) and East and South Asia and Latin America (ESALA) regions. This is due to rapid socioeconomic development, which motivates people to clear more land. Forests are being converted to other uses such as agriculture, land, housing, and industry. For instance, the expansion of subsistence and commodity agriculture, coupled with the expansion of the urban population, are the main drivers of deforestation in many SSA countries (Ordway et al., 2017; Rudel, 2013). On the other hand, in the ESALA region, deforestation is taking place due to the expansion of large-scale commodity agriculture. In Indonesia, for instance, the past decades of deforestation have been mainly due to the expansion of large-scale oil palm and timber plantations (Austin et al., 2019).

Given the nature of the problem, a long-term solution is required. One of the governance tools to create barriers to deforestation and pursue biodiversity objectives is through the creation of protected areas (Watson et al., 2014). The latest statistics indicate that globally there are more than 700 million hectares of forests (equivalent to 18% of global forests) that are legally protected, such as national parks, conservation areas and game reserves (FAO & UNEP, 2020). In OIC, 31% of forests are protected or equivalent to more than 120 million ha forest areas. Furthermore, there has been an additional 5.7 million hectares of protected forests since 2000.

Figure 6.13 depicts the proportion of protected forest areas in OIC member countries. There are 4 countries having at least half of their forests area protected, namely, Uzbekistan (99.7%), Senegal (90.8%), Benin (74.5%), and Indonesia (54.5%). Furthermore, some OIC countries with a large share of forests still do not have adequate levels of protected forests. Suriname, Guyana, and Gabon, for example, are OIC countries with the highest forest cover, accounting for more than 90% of their total land area. However, only less than 15% of its forests are protected. Protected forest areas might have multiple benefits to the society through their important ecosystem services, such as provider of resources (e.g. food and water); ecosystem support and regulation; and cultural services (e.g. aesthetic values, recreation, and provide peace and mental wellbeing) (Stolton et al., 2015).

Figure 6.13. Protected Forest Area, 2020



Source: SESRIC staff generated map, based on UNSTAT SDG Indicators

Land Degradation & Desertification

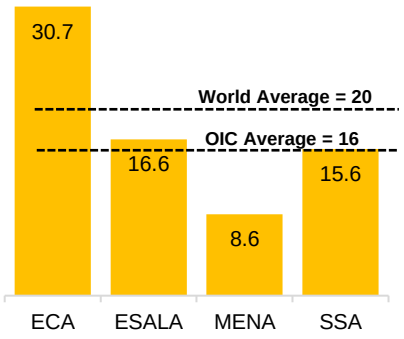
UNCCD (1994, p.4) defined land degradation as “the reduction or loss of the biological or economic productivity and complexity of rainfed cropland, irrigated cropland, or range, pasture, forest and woodlands resulting from a combination of pressures, including land use and management practices”. Desertification, on the other hand, is part of land degradation where fertile land turns into a desert.

Between 2000 and 2015, approximately one-fifth of the Earth’s land surface covered by vegetation showed persistent and declining trends in productivity, primarily due to poor land and water management (UN, 2020). This is equivalent to around 2,600 million ha of degraded land. In comparison, 16% of the land area in the OIC is degraded, which is equivalent to around 500 million ha of degraded land. In OIC regions, the land degradation status is not equal, as seen in **Figure 6.14**. The highest

rate of land degradation is occurring in ECA (30.7%), while the least is in the MENA region (8.6%). ESALA and SSA, in contrast, are close to the OIC average level, having land degradation levels of 16.6% and 15.6% respectively.

At the country's level, the status of land degradation can be seen in **Figure 6.15**. There are four countries having land degradation at an alarming level (land degradation of more than 50%), namely Tajikistan (97%), Bangladesh (65%), Kuwait (64%), and Benin (53%). Except for Bangladesh, these are countries with the majority of dry land. Further land degradation would result in desertification.

Figure 6.14. Degraded Land by Regions (% of total land area), 2000-2015

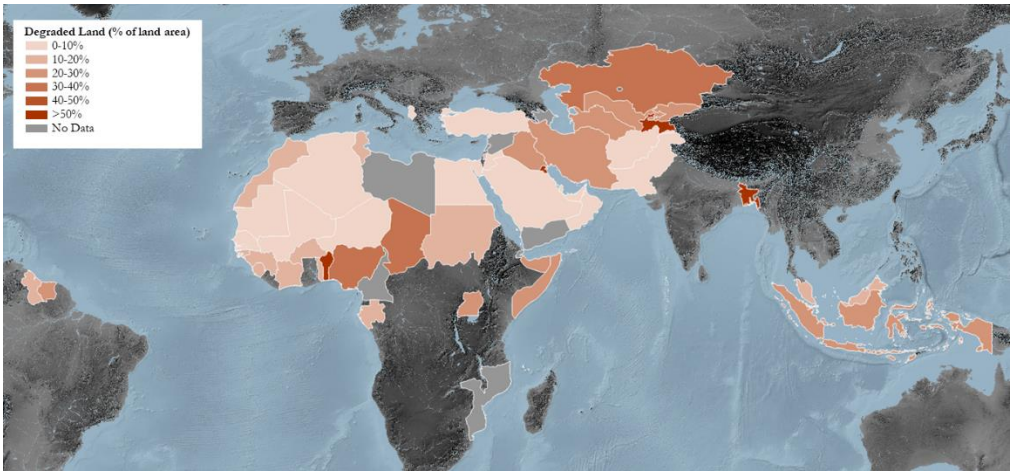


Source: UNSTAT SDG Indicators

Nature is not the only cause of land degradation. It also occurs due to a human-induced footprint on the land. Factors such as unsuitable agricultural practices, rapid urbanization, weak land governance, and expansion of agricultural areas led to uncontrolled land-use change, which contributed to land degradation. In Tajikistan, for example, severe land degradation occurred due to inappropriate land management practices, poor irrigation, overgrazing, and deforestation. These factors combined have resulted in land abandonment and loss of productivity, as a result, intensifying the incidence and intensity of rural poverty in the country (UNDP-UNEP, 2012). Without intervention in good land management practices, degraded land may worsen in the future as a result of both climate change and rapidly expanding economic development.

Managing and restoring degraded land involves good governance of the dryland ecosystem. Currently, the concept of land degradation neutrality (LDN) needs to be implemented by member countries, especially those having high levels of degraded land. The LDN framework aims to achieve a "state whereby the amount and quality of land resources, necessary to support ecosystem functions and services and enhance food security, remains stable or increases within specified temporal and spatial scales and ecosystems" (UNCCD, 2015, p.4). Appropriate targets and measures need to be set to achieve measurable progress. Up to now, 43 OIC countries have defined LDN targets. It is therefore critical to implement, monitor progress, and make more ambitious LDN commitments in the future.

Figure 6.15. Degraded Land by Country (% of total land area), 2000-2015



Source: SESRIC staff generated map, based on UNSTAT SDG Indicators

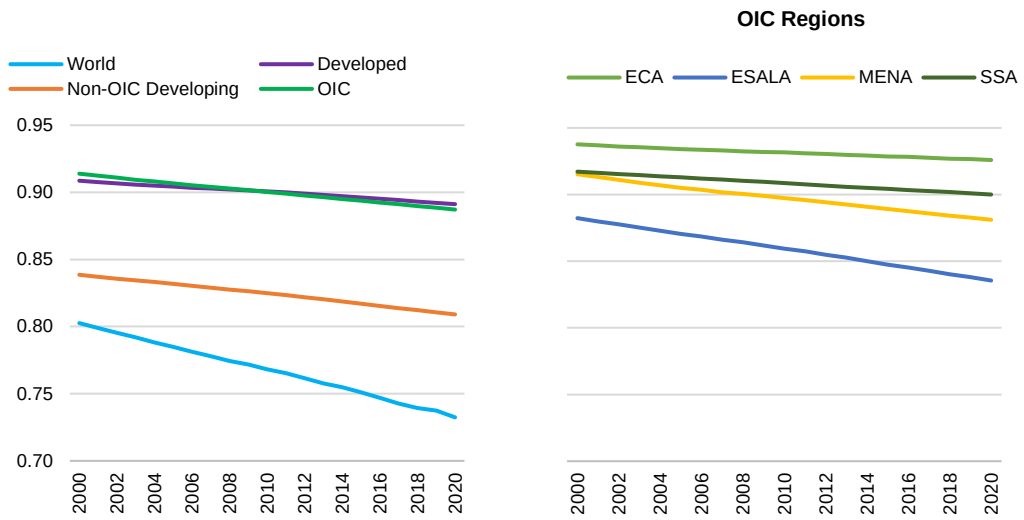
Biodiversity Protection & Genetic Resources

The loss of biodiversity would be disastrous for human beings as the richness of biodiversity provides humankind with ecosystem services that are needed for survival. Biodiversity provides food, shelter, maintains water cycles, and maintains ecosystem balance. Currently, human activities have contributed to the loss of biodiversity worldwide. Climate change is also hastening this trend.

During the last decade, biodiversity in all world regions has shown a declining trend, as indicated by the Red List Index (RLI). The RLI categorizes the conservation status of major species groups based on the risk of extinction and measures trends in the proportion of species expected to remain extant in the near future without additional conservation action (IUCN, n.d.). **Figure 6.16** shows the trend of the RLI aggregated for all species in the world and the OIC regions. Globally, species are moving towards increased extinction risk, as shown by a decrease in the RLI value from 0.8 in 2000 down to 0.73 in 2020. In comparison, the OIC region, on average, is also showing an increase in extinction risk for its entire species, although at a slower pace. In 2020, the RLI levels of OIC were 0.89, decreasing slightly from the RLI levels of 0.91 in 2000. The OIC's rate of species extinction is comparable to that of developed countries. Despite having the least risk of extinction, the decline of species should be addressed.

Despite the OIC as a group shows a relatively lower risk of species extinction compared to other world regions, within OIC, the trends in species extinction risks are diverse. The fastest rate of extinction occurred in ESALA, where the RLI has declined from 0.88 in 2000 to 0.84 in 2020. In contrast, Europe and Central Asia (ECA) was the region with the lowest risk of species extinction, with RLI remaining relatively stable between 2000 and 2020 at 0.94 and 0.93, respectively.

Figure 6.16. Red List Index of All Species, 2000-2020



Source: UNSTAT SDG Indicators

Note: An RLI value of 1.0 equates to all species qualifying as Least Concern (i.e., not expected to become Extinct in the near future). An RLI value of 0 equates to all species having gone extinct.

In general, OIC countries are performing relatively better compared to other world regions. However, the trend still shows an increasing risk of species extinction. Continued ecosystem degradation will result in even more biodiversity loss. As a result, it endangers society's future well-being due to the economic costs of disrupted ecosystem services, increased vulnerability to food security, disease spread, loss of livelihoods, and accelerated climate change.

Part 3: Climate Change Challenges

Climate change poses as one of the most formidable challenges of our time, requiring a comprehensive examination of its drivers, underlying vulnerability, and policy responses. This part explores the multifaceted dimensions of the climate change challenge in OIC member countries, encompassing the intricate interplay between its drivers and the inherent vulnerabilities of societies and ecosystems. Furthermore, it explores the critical intersection of climate change with global food security, unravelling the complex dynamics that threaten agricultural systems and livelihoods. Finally, it examines the policy measures and responses applied by OIC member countries, delving into the intricate web of international agreements, climate finance, and emerging net-zero target. By navigating these crucial aspects, this part aims to provide a deeper understanding of the climate challenge and inspire innovative approaches to forge a sustainable and resilient future in OIC member countries.

7. Drivers and Underlying Vulnerability

7.1 Greenhouse Gas Emissions Trend

Climate change is one of the biggest challenges of the 21st century, and today's actions will determine the state of the future world we are going to live in. According to the IPCC (2023), global warming has increased by 1.1°C above pre-industrial levels over the past decade. Unless adaptive and mitigative policies are reinforced, global warming is projected to rise to 1.5°C between 2030 and 2035, and eventually to reach between 2.2 and 3.5°C by 2100. This continuous warming will pose an unprecedented level of climate challenges, with developing nations disproportionately bearing the burden.

The OIC is one of the most vulnerable regions due to its high exposure and low adaptive capacity. According to modelling results (IPCC, 2014a), some of the highest increases in temperatures are estimated to occur in arid and semi-arid regions, particularly in SSA, MENA, and Central Asia, where many OIC countries are located. The same regions will also have to bear the negative impact of climate change on renewable water resources, as global climate change is projected to increase the frequency of extreme events (such as heatwaves, drought, and floods) and climate variability (IPCC, 2014b). Moreover, changes in water quantity and quality due to climate change are expected to put further pressure on food security and access to clean water and sanitation and disturb the operation of water infrastructure (e.g. irrigation systems, hydropower, etc.), thus threatening the well-being of society.

This sub-section reports trends in greenhouse gas (GHG) emissions in the OIC countries. Historical GHG emissions, as well as CO_2 emissions (as the major contributor to GHG), are presented and analysed by presenting their major sources and types. Furthermore, CO_2 emissions are decomposed into four factors to identify the main reason for the emissions trend.

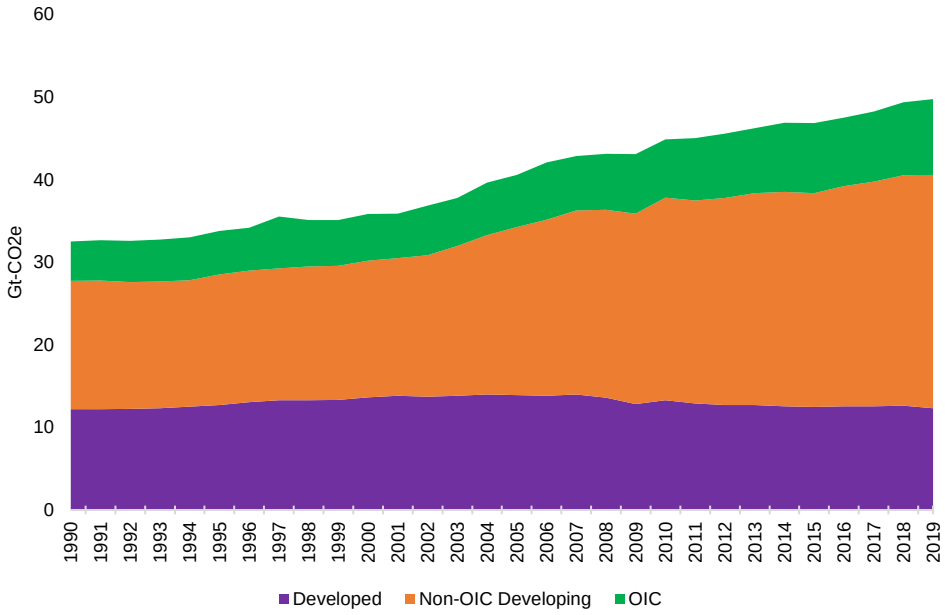
GHG Emissions

According to IPCC (2013) anthropogenic GHG emissions are the most significant driver of observed climate change since the mid-20th century. Increasing GHG emissions in the atmosphere have warmed the climate and led to other environmental changes that affect human lives.

Global GHG emissions increased 53% between 1990 and 2019, reaching a total of 50 Gt-CO_2 equivalent (CO_2e) in 2019. In the same period, GHG emissions in OIC countries increased by 91%, while in non-OIC developing countries, they increased by 82%. For comparison, developed countries only increase their GHG emissions by 1%. **Figure 7.1** presented the historical GHG emissions trend in world regions between 1990 and 2019. It is apparent that the OIC and other developing countries

have contributed the most to the increase in global GHG emissions. In 2019, GHG emissions from OIC countries was 9.2 Gt- CO_2e, accounting for 18.4% of global GHG emissions. In comparison, non-OIC developing countries emit 28.3 Gt- CO_2e (56.8% of global GHG emissions).

Figure 7.1. Historical Global GHG Emissions by Region, 1990-2019

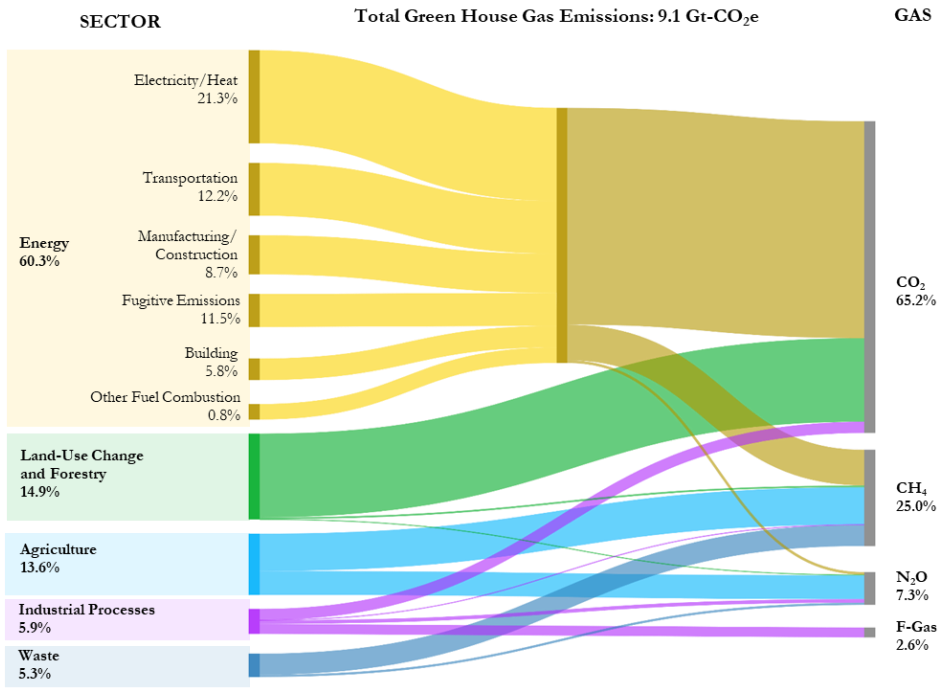


Source: WRI CAIT

Anthropogenic GHG emissions come from various economic sectors, with energy consumption accounting for most of the share. As shown in **Figure 7.2**, in 2019, the energy sector was attributed to more than half of the GHG emissions in the OIC countries. The majority of emissions come from electricity/heat production (21.3%), followed by transportation (12.2%), fugitive emissions (11.5%), manufacturing/construction (8.7%), buildings (5.8%), and other fuel combustion (0.8%). In non-energy sectors, land use change and forestry contributed to 14.9% of total emissions, while the agricultural, industrial, and waste sectors contributed to 13.6%, 5.9%, and 5.3% of total emissions respectively.

On the other end, CO_2 remains the largest GHG emissions, accounting for almost 70% of total GHG emissions in OIC countries. Other GHG emissions, such as methane, N2O, and F-gas, have a smaller share, amounting to 25.0%, 7.3%, and 2.6% respectively.

Figure 7.2. GHG in OIC by Sector and Gas, 2019



Source: SESRIC staff calculations based on WRI CAIT

CO_2 Emissions

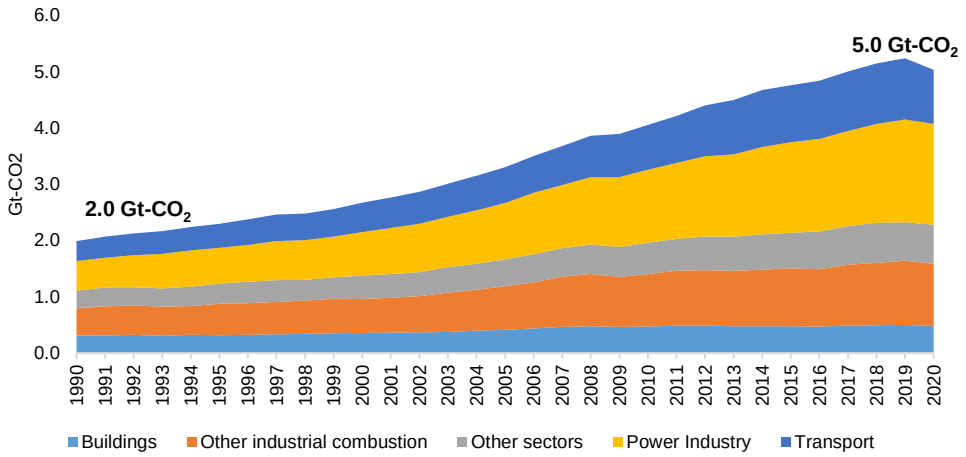
The fact that CO_2 plays a major role in overall GHG emissions (and therefore climate change) requires a closer look at this gas in particular. As seen in **Figure 7.2**, CO_2 emissions from anthropogenic sources come from mainly three sources: energy (i.e., fossil fuel combustion), land-use change and forestry, and industrial processes. This part especially discusses CO_2 emissions from fossil fuel combustion, which is the largest source of CO_2 in OIC countries.

Based on the Emissions Database for Global Atmospheric Research (EDGAR)[7], between 1990-2020, global CO_2 emissions from fossil fuel combustion increased annually by 1.5%, reaching a total of 36.0 Gt-CO2. In comparison, during the same period, CO_2 emissions grew faster in OIC countries, which have an average annual growth of 3.1%. This level is also higher than the non-OIC developing countries' annual CO_2 emissions growth rate of 2.6%.

[7] EDGAR is a database under European Commission, which provides independent emission estimates compared to what reported by European Member States or by Parties under the United Nations Framework Convention on Climate Change (UNFCCC), using international statistics and a consistent IPCC methodology. See https://edgar.jrc.ec.europa.eu/ for more details.

Figure 7.3 presents historical CO_2 emissions in OIC countries in terms of their sectors from 1990 to 2020. During the period, CO_2 emission grew more than double from 2.0 Gt-CO_2 to 5.03 Gt-CO_2. The power sector, transportation, and other industrial combustion contribute to more than 70% of the total CO_2 emissions in the OIC.

Figure 7.3. Historical CO_2 Emissions in OIC by Sector, 1990-2020



Source: EDGAR V6.0 GHG Emissions Database

Figure 7.4 depicts the growth in emissions from each sector in the OIC over the last decade. Growth of emissions from the power sector was the highest, with an increase of 38.4% in 2020, relative to the 2010 level. Furthermore, CO_2 emissions from fossil fuel combustion have grown by more than 18% in transportation, other industrial combustion, and other sectors. The least growth in emissions is observed from the building sector (+2.2%).

Looking at the level of emissions in individual OIC countries, CO_2 is emitted unevenly. In 2020, half of the CO_2 emissions in OIC came from only 5 countries, namely Iran (0.69 Gt-CO_2), Saudi Arabia (0.59 Gt-CO_2), Indonesia (0.57 Gt-CO_2), Türkiye (0.41 Gt-CO_2), and Egypt (0.27 Gt-CO_2). Furthermore, almost half of OIC countries emit CO_2 for less than 0.01 Gt-CO_2.

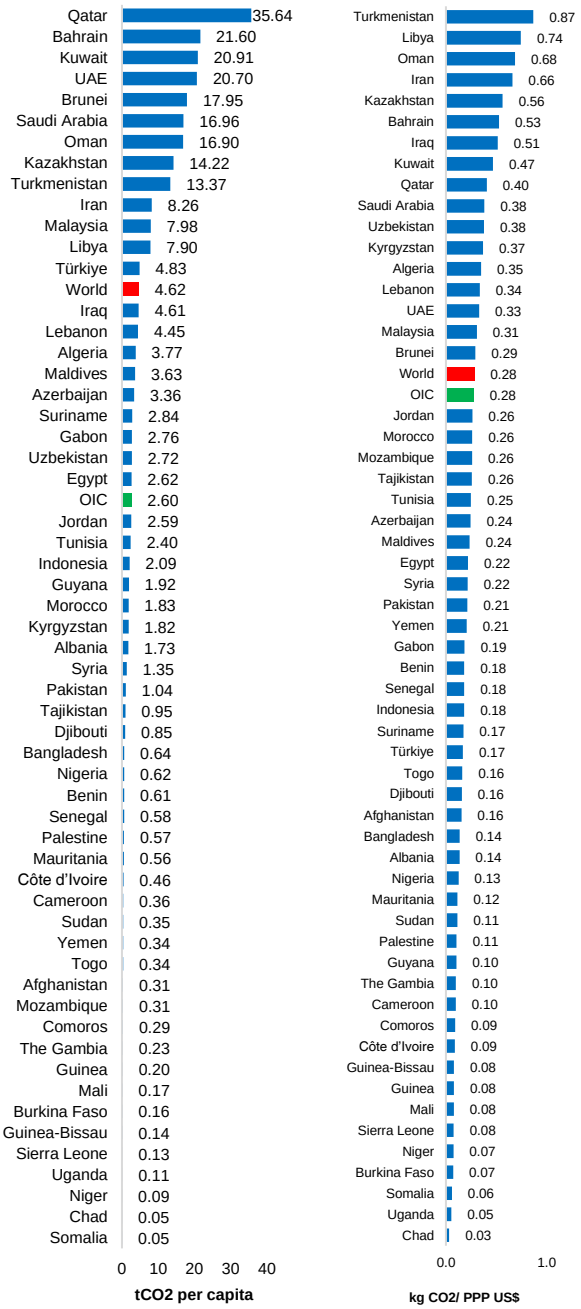
Figure 7.4. CO_2 Emission Growth in OIC, 2010 vs 2020

Power Sector	+38.4%
Transport	+20.6%
Other Industrial Combustion	+18.1%
Other Sectors	+24.7%
Buildings	+2.2%

Source: EDGAR V6.0 GHG Emissions Database

Country level comparison is more meaningful in terms of relative value. The relative comparison of CO_2 emissions

Figure 7.5. CO_2 Emissions Relative to Population (Left) and GDP (Right) in OIC Countries, 2020



Source: SESRIC staff calculation based on EDGAR V6.0 GHG Emissions Databas

in OIC countries can be seen in **Figure 7.5**. On average, per capita emissions in OIC countries in 2020 were 2.60 tCO_2, lower than the global emissions per capita average of 4.62 tCO_2. On the other hand, emissions per unit of GDP in OIC reached 0.28 kg CO_2/PPP US$ similar to the global average level.

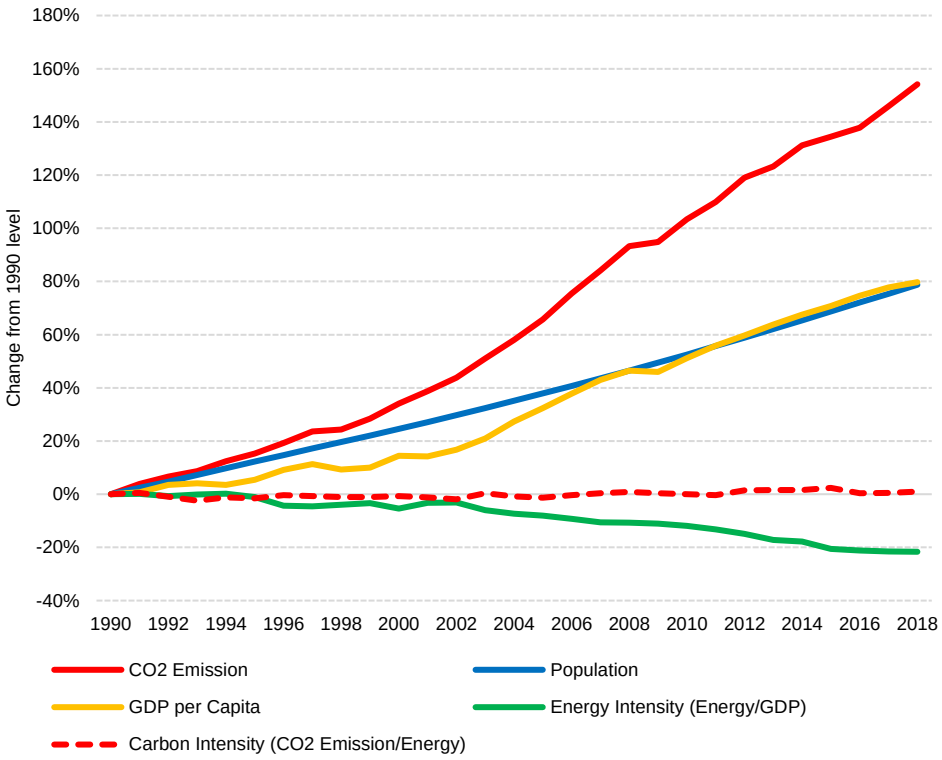
At the country level, 13 OIC countries recorded higher per capita emissions than the global level. The highest per capita emissions happen mostly in MENA countries, as indicated by the top 5 highest emissions per capita, namely Qatar (35.64 tCO_2), Bahrain (20.91), Kuwait (20.91), United Arab Emirates (20.70), and Brunei (17.95) (**Figure 7.5, Left**).

In terms of emissions per GDP, 17 OIC countries recorded emissions more than the world average. The top five most emission-intensive economies in OIC countries are Turkmenistan (0.87 kg CO_2/PPP US$), Libya (0.74), Oman (0.68), Iran (0.66), and Kazakhstan (0.56) (**Figure 7.5, Right**).

Emissions Drivers

The identification of emissions drivers can serve as a good starting point for developing a well-targeted climate action plan. Analysing the emission driver is commonly done using Kaya identities (Kaya, 1990). Within the framework, overall changes in emissions are decomposed into four underlying factors (see **BOX 7.1** for a brief description of Kaya identity).

Figure 7.6. Four Factor Decomposition of CO_2 Emission in OIC, 1990 – 2018



Source: EDGAR V5.0 GHG Emissions Database

Figure 7.6 presents the increase in fossil energy CO_2 decomposed into four factors, namely population, per capita GDP, energy intensity and CO_2 intensity of energy between 1990 and 2018. Looking at **Figure 7.6**, the population increased by 78.8%, GDP per capita was 79.7%, carbon intensity was 0.9%, and energy intensity decreased by 21.6%. All of these factors contributed to a 154% increase in CO_2 emissions. **Figure 7.6** suggests that the improvements in the energy intensity of GDP that the OIC has achieved over the last decades could not keep up with the continuous growth of the population and the vastly growing income. The increasing trend of carbon intensity also suggests that the transition to a sustainable energy system is not yet taking place in the OIC countries. However, the decreasing trend of energy intensity indicates a more efficient means of energy utilization, where less energy is utilized in generating GDP.

Overall, together with the growth in population and income, and the relatively stagnant trend of carbon intensity, CO_2 emissions from fossil energy in OIC countries have maintained a stable upward trend. This is also a proxy for the overall increase in the OIC's GHG emissions over the last two decades.

BOX 7.1: Kaya Four-Factor Decomposition

The Kaya identity is a special case of the more general IPAT identity which decomposes an impact (I, e. g., total GHG emissions) into population (P), affluence (A, e. g., income per capita) and technology (T, e. g., GHG emission intensity of production or consumption). The Kaya identity deals with a subset of GHG emissions, namely CO_2 emissions from fossil fuel combustion, which is the dominant part of the anthropogenic GHG emissions and their changes at a global level. The Kaya identity for CO_2 emissions can be written as:

$$\boldsymbol{CO2\ Emission = Population \times \frac{GDP}{Population} \times \frac{Energy}{GDP} \times \frac{CO2\ Emission}{Energy}}$$

In other words, CO_2 emissions are expressed as a product of four underlying factors: (1) population, (2) per capita GDP (GDP / population), (3) energy intensity of GDP (Energy / GDP), and (4) CO_2 intensity of energy (CO_2 emissions / energy).

Source: Adapted from IPCC (2015)

BOX 7.2: The Notre Dame Global Adaptation Initiative (ND-GAIN) Composite Index

The ND-GAIN composite index outlines countries' vulnerability to climate change together with their readiness to improve resilience. Within the index, vulnerability is defined as "propensity or predisposition of human societies to be negatively impacted by climate hazards" (Chen et al., 2015, p.3) through the interactions of three dimensions: **the exposure** to climate-related hazards; **the sensitivity** to the impacts of the hazard; and **the adaptive capacity** to cope with these impacts.

- **The exposure** dimension of the index measures the extent to which human society and its supporting sectors are stressed by the future changing climate conditions. Less exposure means future climate would not change the water resources so significantly.
- **The sensitivity** dimension of the index tells the degree to which society is affected by climate-related impacts on the water sector.
- **The adaptive capacity** dimension tells the ability of society and its supporting sectors to adjust to reduce potential damage and to respond to the negative consequences of climate events.

On the other end, the readiness index is meant to measures the country's ability to leverage investments to adaptation actions. The three main components of the readiness index are **economic readiness, governance readiness, and social readiness**.

- **Economic readiness** measures the investment climate that facilitates mobilizing capital from the private sector.
- **The Governance readiness** tells about the stability of the institutional arrangements that contribute to the investment risks.
- Finally, **Social readiness** evaluate the social conditions that encourage the efficient use of investment.

Source: Based on Chen et al. (2015)

7.2 Vulnerability and Readiness

Climate change impacts are unavoidable, and it will affect different countries in different ways. Therefore, there is a need to understand the level of vulnerability and readiness to deal with climate change. According to IPCC (2023), almost half of the world's population lives in regions that are highly vulnerable to global warming and climate change. The global hotspots of high human vulnerability are found particularly in West-Central-and East Africa, South Asia, Central and South America, Small Island Developing States and the Arctic.

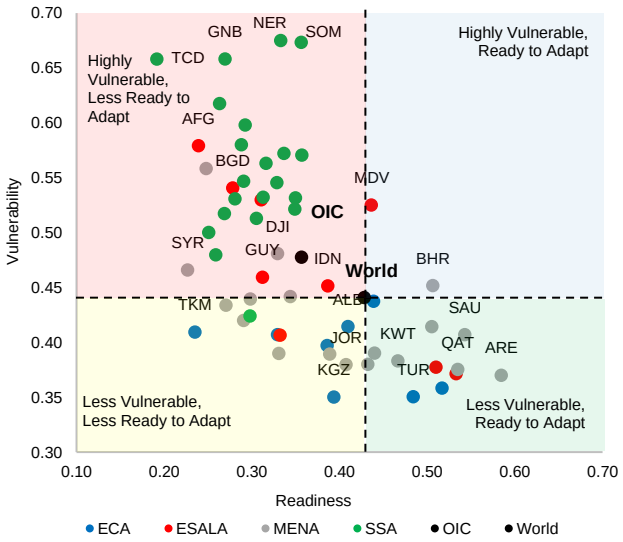
With the so far 1.1°C warming the diverse impacts of climate change are already far reaching and more severe than anticipated. Almost half of the world's population is facing water scarcity one month per year while high temperatures are increasing the incidence of vector-borne diseases. On the other hand, there is a significant loss of agricultural productivity in middle and low latitudes, with crop productivity growth shrinking by a third in Africa since 1961. Since 2008, extreme floods and storms have also forced over 20 million people from their homes every year (IPCC, 2023).

This sub-section examines the vulnerability and preparedness of OIC countries using data from the Notre Dame Global Adaptation Initiative (ND-GAIN) index. The general description of the index can be seen in **BOX 7.2**.

Overall Status

Vulnerability to climate change is defined as the "propensity or predisposition of human societies to be negatively impacted by climate hazards" (Chen et al., 2015, p.3). While, the readiness dimension measures the country's ability to leverage investments into adaptation actions with three main components: economic readiness, governance readiness, and social readiness. To quickly assess the OIC countries' state of vulnerability and readiness for climate change, a scatter plot

Figure 7.7. OIC Vulnerability and Readiness to Climate Change Impacts, 2020



Source: SESRIC staff calculation based on ND-GAIN

matrix is presented in **Figure 7.7**. Four quadrants on the plot delineated by the world's average level of vulnerability and readiness indicate the different levels of OIC countries compared to the world's average level. The countries are coloured depending on their regions to see the regional distribution on the plot. **Figure 7.7** also indicates the positioning of individual countries and a general overview of the OIC regions more clearly in terms of their vulnerability and readiness for climate change. The full results of the index can be seen in **ANNEX B**.

On average, in 2020, OIC had vulnerability levels of 0.48 and readiness of 0.36, while the world's average level of vulnerability and readiness were 0.44 and 0.43 respectively. This demonstrates that OIC countries are more vulnerable and underprepared for the effects of climate change than the rest of the world.

At the individual country level, it is observed that more than half of the OIC countries are more vulnerable than the world average, while 70% of OIC countries have readiness levels below the world average. Furthermore, several points can be drawn: First, the most vulnerable countries are Niger, Somalia, and Guinea-Bissau, while the countries with the least readiness for climate change are Chad, Syria, and Turkmenistan. Second, the top left box (red zone), which indicates highly vulnerable and less ready countries, comprises countries in all regions except ECA. Third, most MENA countries are both in the bottom left and right box (yellow and green zone), suggesting countries that are less vulnerable with varying levels of readiness. Fourth, all of SSA countries (except Gabon) and half of ESALA countries are in the red zone. Fifth, all ECA countries are in yellow and green zones. Lastly, only two countries are in the blue zone – the top right zone, which indicates they are highly vulnerable and ready to adapt, namely Bahrain and Maldives.

The countries in the red zone are the ones needing special attention since the risks of getting climate change impacts are the largest. Countries in the yellow zone, despite their low level of vulnerability, need to improve their economic, social, and governance readiness to be more ready to adapt to climate change. As for the blue zone, despite its high vulnerability, the fact that countries have enough resources to adapt is beneficial for reducing future risks. Finally, the green zone has the lowest risks of climate change impacts as they are less vulnerable and have sufficient capacity to adapt.

Vulnerability & Readiness

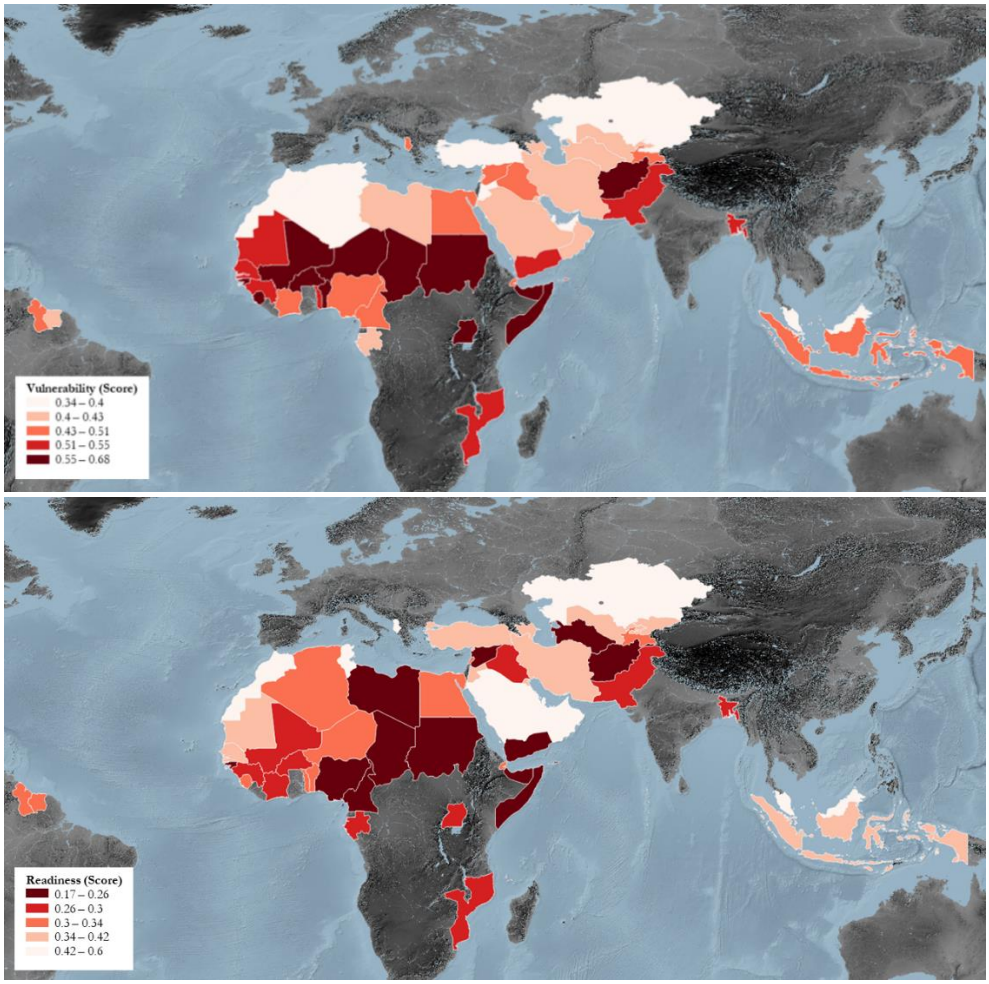
This part delves deeper into each aspect of vulnerability and readiness in OIC countries. The vulnerability to the impacts of climate change in a region depends on its levels of exposure, sensitivity, and adaptive capacity. Higher vulnerabilities indicate a greater risk of societal impact from climate change.

Figure 7.8 (Upper) shows the overall level of vulnerability in OIC countries. It indicates that the vulnerability to climate change in OIC countries is quite diverse. Countries with high vulnerability should be aware of the deteriorating effects of climate change on their communities. Niger, Somalia, Guinea-Bissau, Chad, Sudan,

Mali, Uganda, Afghanistan, Benin, Mauritania, Sierra Leone, Yemen, Burkina Faso, and Gambia, for example, have the highest levels, ranging from 0.55 to 0.68. Unfortunately, some of the most vulnerable OIC countries are also categorised by the UN as the least developed countries. There is a need for these countries to improve their adaptive capacity to deal with climate change impacts.

The overall degree of vulnerability is calculated by aggregating vulnerability levels from six life-sustaining sectors: food, water, health, ecosystem services, human habitat, and infrastructure. As a result, the level of vulnerability in each sector can also be identified.

Figure 7.8. Vulnerability* (Upper) and Readiness** (Lower) to Climate Change in OIC Countries, 2020



*Lower scores are better
** Higher scores are better
Source: SESRIC staff generated map based on ND-GAIN

Table 7.1 shows the overall and sectoral level vulnerability in the world and OIC regions. On average, the OIC as a group is more vulnerable than the rest of the world in all sectors, with the health sector being the most vulnerable. Vulnerability in the health sector means that OIC countries are highly vulnerable to climate-related diseases while also lacking adequate healthcare services. It is also worth noting that vulnerability levels in the food and human habitat sectors are quite alarming. Growing population and urbanization in OIC countries necessitate increased food production and resilient urban environments in order to prepare society for climate change.

Looking at the OIC regions, there is a diversity of sectoral vulnerabilities. SSA was the most vulnerable region in OIC while ECA and MENA regions are less vulnerable than the world. On a sectoral basis, the health sector is the most vulnerable in SSA and ESALA, while ecosystem services are the most vulnerable in ECA and MENA. It is critical to identify the most vulnerable sectors in order to respond in a targeted manner and reduce the risk of climate change impacts.

Table 7.1. Vulnerability to Climate Change by Region and Sector (lower scores are better), 2020

Region	Overall	Sectoral					
		Ecosystem	Food	Habitat	Health	Infrastructure	Water
World	0.44	0.46	0.46	0.51	0.47	0.35	0.36
OIC	0.48	0.48	0.52	0.52	0.53	0.36	0.40
ECA	0.39	0.45	0.39	0.44	0.36	0.33	0.34
ESALA	0.47	0.48	0.51	0.51	0.51	0.37	0.40
MENA	0.42	0.47	0.45	0.46	0.46	0.33	0.35
SSA	0.56	0.51	0.64	0.61	0.67	0.40	0.46

Source: SESRIC staff calculation based on ND-GAIN

Figure 7.8 (Lower) shows the overall level of readiness in OIC countries. Countries with a low level of readiness should be aware of their inability to respond to the adverse impacts of climate change. Chad, Syria, Turkmenistan, Afghanistan, Yemen, Nigeria, Cameroon, and Sudan, for example, have the lowest level of readiness among OIC countries, with a score of between 0.17 and 0.26.

Similar to the vulnerability to climate change, some of the less ready OIC countries are also categorised by the UN as the least developed countries. Improvement in terms of economic, governance, and social development in various sectors is needed to better adapt to the impact of climate change.

Table 7.2. Readiness to Climate Change by Region and Component (higher scores are better), 2020

Region	Overall	Component		
		Economic	Governance	Social
World	0.43	0.43	0.49	0.36
OIC	0.36	0.40	0.37	0.30
ECA	0.40	0.50	0.37	0.37
ESALA	0.37	0.37	0.44	0.30
MENA	0.40	0.48	0.39	0.32
SSA	0.30	0.30	0.33	0.26

Source: SESRIC staff calculation based on ND-GAIN

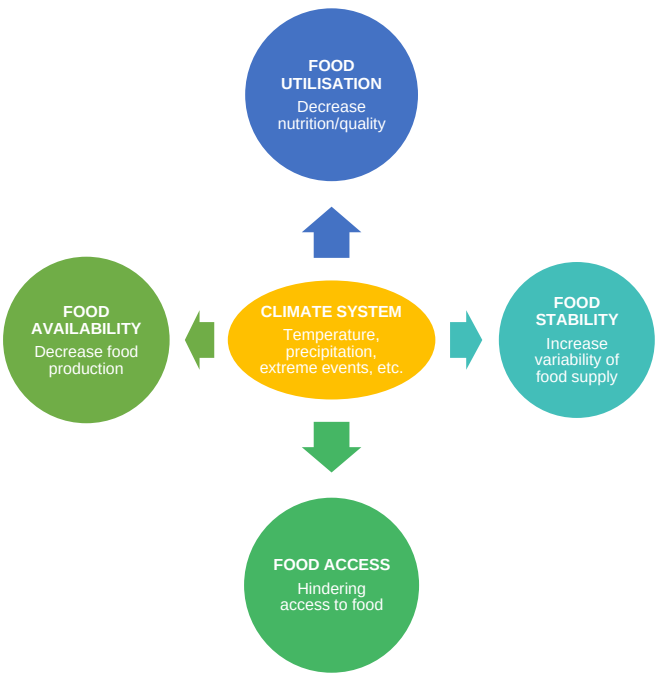
Table 7.2 presents the level of readiness based on each component in the OIC and the world average as a comparison. OIC as a group has a lower level of readiness in all components. Globally, the social dimension is the least ready sector with a level of 0.36, while the governance and economic readiness levels are 0.49 and 0.43 respectively. In comparison, OIC countries have an average level of economic readiness of 0.4, governance readiness of 0.37, and social readiness of 0.3. The fact that the social dimension is the least ready component means society is not adaptable enough to deal with climate change impact, as indicated by the lower level of social inequality, information and communications technology (ICT) infrastructure, education, and innovation.

In terms of OIC regions, all regions have overall readiness levels lower than the world. It also observed that there is a variation in readiness within each component across regions. MENA and ECA are better at economic readiness, surpassing the global level. In ESALA, governance readiness is better than in other OIC regions. Finally, SSA has a lower level of readiness in all components compared to the OIC average.

8. Food Security and Climate Change

During the past decades, there has been steady progress towards improving global food security, though in the same period the population has increased significantly. However, the pandemic that started in early 2020 has posed quite a challenge and is threatening the food security gains of the past decades. The total number of undernourished people has continued to increase globally during the pandemic. Between 720 and 811 million people worldwide battled hunger in 2020, which corresponds to between 70 and 161 million more people risking hunger in 2020 than in 2019 (FAO et al., 2021). This makes it harder to reach the goal of ending hunger by 2030, since the number of people who are not getting enough food has gone up from 8.4% in 2019 to between 9.2% and 10.4% in 2020.

Figure 8.1 Climate Change and Food Security



A similar trend occurs in OIC countries. Following the historic low level Prevalence of Undernourishment (PoU) of 10.3% in 2019, the COVID-19 has increased the PoU in the OIC group by 0.7 percentage points to 11.0% in 2020. This corresponds to 191.9 million people experiencing hunger, or 14.5 million more undernourished people than the previous year (SESRIC, 2022). At the individual country level, food security in the majority of OIC countries has deteriorated where PoU levels have increased. Only seven OIC countries managed to decrease the PoU levels, including Albania, Cameroon, Guyana, Gabon, Togo, Bangladesh, and Kazakhstan. In comparison, the largest increase in PoU has been observed in Nigeria, Mali, Afghanistan, Somalia, Lebanon, Burkina Faso, Chad, Jordan, and Gambia. Other crises, such as conflict and insecurity, economic insecurity, and extreme weather events, have also contributed to an increase in hunger in these countries (FSIN, 2021).

The present vulnerabilities of food insecurity and malnutrition due to the crisis are further pressured through the compound impacts of climate change on the food systems. In fact, climate change is already contributing to reduced food security and nutrition and will continue to do so through its direct and indirect impacts on all four dimensions of food security: agricultural production (availability), access to food (sufficient income), utilization (nutrition, quality), and stability (**Figure 8.1**). This section will discuss the impacts of climate change on four dimensions of food security along with the adaptation measures to increase resilience to the impacts of climate change.

8.1 Food Availability and Access

Climate change impacts to food availability relates to the supply side of food, from the farmers level all the way to food processing, supply and distribution of foods. Agriculture, as the primary sector of food production, is highly vulnerable to the adverse impacts of global climate change since higher temperatures, lower precipitation levels, CO_2 concentration, and extreme climatic events (such as drought or floods), can lead to reduced crop yields or even crop failures.

Without any interventions to the current trend of greenhouse gas emissions, average global temperature is expected to increase more than 2^{o}C above pre-industrial levels by the end of this century. All world regions will also have to bear the negative impact of climate change on renewable water resources, as global climate change will very likely change rainfall patters and increase frequency and intensity of heatwaves, heavy precipitation, and agricultural and ecological drought (IPCC, 2021). Heat and drought worsen land degradation in some areas and cause a decrease in crop and animal productivity and soil fertility (IPCC, 2019). It is estimated that climate change will decrease agriculture productivity to between 2% - 15% by 2050 (Delincé et al., 2015).

Climate change has been observed to have impacts on food availability in OIC countries. In Pakistan, climate warming is seen to be the reason of the change in crops growing pattern. During 1980-2014, the spring maize growing season has moved forward by an average of 4.6 days per decade, while the sowing of autumn maize has been pushed back by an average of 3.0 days per decade (Abbas et al., 2017). There is growing evidence that climate change is reducing crop yields in Africa, including for staple foods like maize, wheat, sorghum, and fruit crops like mangoes, which is contributing to already severe food insecurity throughout the continent (Ketiem et al., 2017). The livelihoods of arable crop farmers in Nigeria were negatively affected by changes in rainfall pattern and increasing heatwaves. (Onyeneke et al., 2018). There is a growing problem with malnutrition in Sahel region. This is in part due to the effects of climate change, as harsh climatic conditions that result in extreme drought have a negative effect on agriculture (Chabejong, 2016).

BOX 8.1: Desert Locust Outbreak

Desert locust swarms infested Eastern Africa at the end of 2019 and caused extensive damage to crops and pastures, endangering food security and livelihoods. According to the FAO, over 200,000 hectares of cropland and pastureland were destroyed, making it extremely difficult for 2 million people in the region to obtain food.

Although desert locusts have existed in this region for centuries, this recent outbreak can be attributed to a unique characteristic of the positive Indian Ocean Dipole event (IOD), which was partially caused by long-term sea surface temperature trends. The western Indian Ocean's warming has increased the frequency and intensity of severe weather, including tropical cyclones. Extreme positive IODs are anticipated to occur twice as frequently under a 1.5 °C warmer climate, which could also increase the frequency of pest outbreaks.

Climate change increases the need for robust adaptation measures, such as transnational early warning systems, biological control mechanisms, crop diversification, and additional technological advancements in the fields of sound and light stimulants, remote sensing, and modelling for tracking and predicting movement.

Source: Adapted from IPCC (2019)

Climate change may also have negative impacts on access to food. Access to food relates to income and ability of individuals to acquire sufficient food and nutrition. During the COVID-19 crisis, access to food is the main source of food insecurity in many OIC countries, notably due to loss of jobs and income in the midst of the outbreak of the disease. In the case of climate change, people working in agriculture sector as well as most vulnerable part of the society is highly at risk of not able to access sufficient food. Increase number of extreme events may lead to increase food price hindering access to nutritious food as well as lower the food consumption. In the farmers' level, increased drought and flood events, as well as an increase in pests and disease due to rising temperatures, result in a loss of agricultural income due to lower crop yields and higher input costs. (IPCC, 2019).

Furthermore, increased extreme events may disrupt agricultural trade and transportation infrastructure. Climate change has caused increasingly unprecedented extreme weather conditions and natural hazards during the past decades. According to the latest data from the Centre for Research on the Epidemiology of Disasters (CRED), the number of natural disasters globally increased from 3,374 in 1992–2001 to 3,802 in 2012–2021, with a peak of 4,300 in 2002–2011. A similar trend is happening in OIC countries. The number of natural disasters has increased from 820 in 1992–2001 (24% of the global total) to 911 in 2012–2021 (26% of the world total), peaking at 1,114 occurrences of disasters in 2002–2011 (24% of the world total). The rising number of natural disasters in OIC countries was driven by climate-related disasters such as floods, earthquakes, storms, wet mass earth movements, and droughts, suggesting a clear link to climate change. These disasters have caused major economic and human losses. Between 1992 and 2021, around 600 million people in OIC countries were impacted, with more than half a million mortalities and over $200 billion in economic damage.

In the longer run, it is estimated that food security will continue to be a problem of access rather than availability. While future extreme weather events and emerging diseases are projected to threaten food production and supply, the overall risks to food systems are more likely to be caused by demand side effects (FAO, 2021b). Job losses and reduced earnings connected with the global economic recession are likely to result in more fundamental changes in food consumption, shifting away from higher-value foods, such as animal-sourced products, towards more affordable staples (FAO, 2021a).

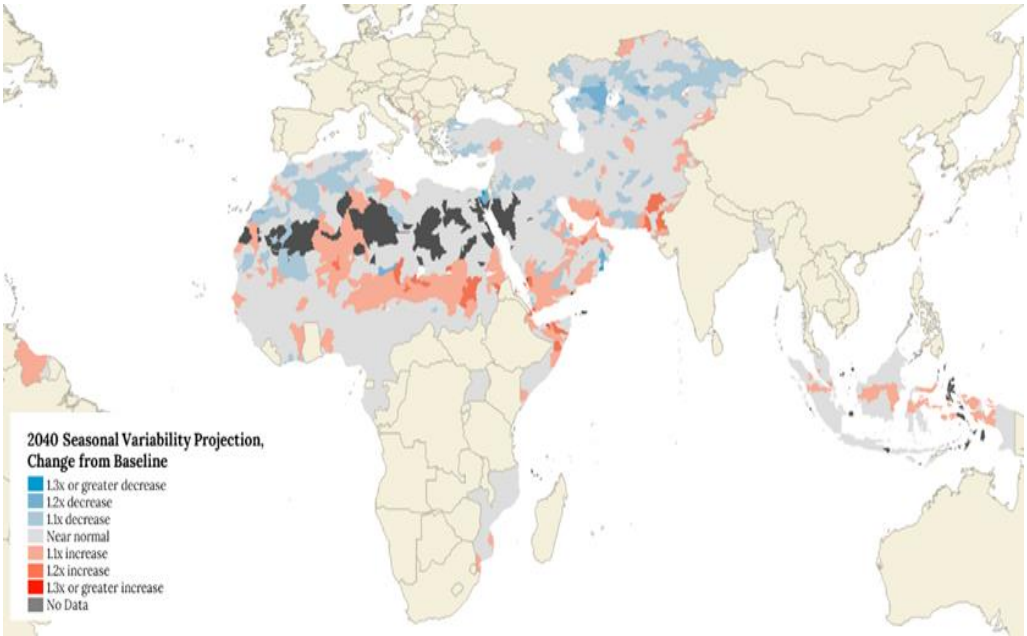
8.2 Food Stability and Utilization

Production and import trends are also significantly affected by shocks such as uneven economic recovery, economic recession, natural disasters, pandemics, conflicts, etc. – especially in low- and middle-income economies. A core element of food security – 'food stability' – is directly related to shock factors that can affect both, national and household, food security. Food stability is ensured when "a population, household or individual have access to adequate food at all times, i.e. they should not risk losing access to food as a consequence of sudden shocks (e.g. an economic or climatic crisis) or cyclical events (e.g. seasonal food insecurity)" (FAO, 2006). Events affecting food stability also have an impact on both the availability and access to food, which makes them particularly important for policy makers.

Increased frequency and severity of extreme events (e.g., droughts and heatwaves) lead to greater instability of supply through production losses and disruption to food transport. Furthermore, water, as one of the primary inputs in food production is at risk of increasing its variability. The variability makes water availability less predictable, thereby constraining the effectiveness of water planning and management.

Variability of water supply in some areas in OIC is already high and the future supply of water is predicted to be more erratic and uncertain due to increasing water supply variability. **Figure 8.2** shows that some areas in SSA, MENA, and ESALA are expected to have an increase in seasonal variability of at least 1.1 times relative to the baseline level. The areas that have high supply variability coincide with the ones that already have high water stress, implying that climate change will put more stress on these areas. Climate-related disturbance on water systems is already being felt in various OIC regions. For instance, degradation of quality and quantity of water resources is recorded in OIC countries in North Africa (Hamed et al., 2018), while an important basin in SSA such as Lake Chad is already experiencing significant decrease in its surface area (Mahmood et al., 2019). A further change in climate, as a result, will potentially deteriorate the water resources in OIC even further, which will potentially result a disturbance on steady supply of food in the region.

Figure 8.2. Projected Change in Seasonal Water Supply Variability by 2040



Source: SESRIC (2021)

The food utilization indices, the fourth core factor contributing to food security, determine the quality of food being consumed and its impact on individuals' nutritional status. In theory, 'food utilization' looks at how adequate access to water, sanitation, healthcare, feeding practices, food preparation, diet diversity, and household distribution of food is optimally utilized to generate energy and nutrients required by individuals to lead a healthy life (FAO, 2008). For instance, a lack of purchasing power leads households to change their eating habits, resorting to cheaper, unhealthier foods. When combined with the quality and distribution of food supply, this can have impacts on meeting the average dietary energy supply of populations.

To some extent, climate change will have an impact on food utilisation through changes in food safety and quality. A change in temperature, increase intensity of extreme events, and other climate-related disturbance may influence food safety through changing the population dynamics of contaminating organisms (IPCC, 2021). For instance, the prevalence of pathogens (such as mycotoxins), the occurrence of harmful algal blooms, and the bioaccumulation of contaminants will all increase as temperatures and CO_2 levels rise, posing a threat to human health through pollutant contamination of food (IPCC, 2019). Increased CO_2 concentrations in the atmosphere would also diminish the nutritional value of grains, some fruits, and vegetables. Moreover, the rising frequency and severity of extreme events drives up the price of healthy produce compared to alternatives that are lower in nutrients.

8.3 Improving Agri-Food System Resilience

Climate change is a global problem needing local actions in various economic sectors as a solution. When all the above-mentioned adverse impacts of climate change are taken into account, it is apparent that the agricultural capacities of OIC countries will have to be reinforced. Efforts to mitigate and adapt to climate change will not only contribute to reducing stress to the environment but will also provide various socio-economic benefits and increase food security. According to (McKinsey & Company, 2020) reducing GHG emissions through improved farming practises has the potential to reduce total emissions by up to 4.6 $GtCO_2e$ by 2050—about 20% of total emissions from agriculture, forestry, and land-use change. Furthermore, those efforts would increase food production and resiliency towards the future changing climate. It may also have co-benefits (improved efficiency, reduced cost, environmental co-benefits) which could give positive spill over effects to other sectors in the economy.

To cope with climate change challenge, the solution, as suggested by (FAO, 2017), is through the realization of the sustainability of food production by adopting a "climate-smart" agricultural practices. Climate-smart agriculture has the main aim to increase agricultural productivity while at the same time reducing GHG emissions and increasing the capacity and resiliency to climate shocks (FAO, 2016a). Several practical measures are available such as cropland management, grazing land management, and livestock management (**Table 8.1**).

Table 8.1. Various Sustainable Agriculture Practices

Categories	Practices
Cropland Management	
Croplands — plant management	- High input carbon practices, e.g., improved crop varieties, crop rotation, use of cover crops, perennial cropping systems, and agricultural biotechnology.
	- Improved N use efficiency.
Croplands — nutrient management	- Fertilizer input to increase yields and residue inputs (especially important in low-yielding agriculture).
	- Changing N fertilizer application rate, fertilizer type, timing, precision application, inhibitors.
Croplands — tillage / residues management	- Reduced tillage intensity; residue retention.
Croplands — water management	- Improved water availability in cropland including water harvesting and application.
	- Decomposition of plant residues.
	- Drainage management to reduce emissions, reduce N runoff leaching.
Croplands — rice management	- Straw retention.
	- Water management, mid-season paddy drainage.
	- Water management, N fertilizer application rate, fertilizer type, timing, and precision application.
Rewet peatlands drained for agriculture	- Ongoing CO2 emissions from reduced drainage (but CH4 emissions may increase).
Croplands — set-aside and land-use change	- Replanting to native grasses and trees. Increase C sequestration.
	- N inputs decreased resulting in reduced N2O.
Biochar application	- Soil amendment to increase biomass productivity, and sequester C
	- Reduced N inputs will reduce emissions.

Grazing Land Management		
Grazing lands — plant management	-	Improved grass varieties/sward composition, e.g., deep rooting grasses, increased productivity, and nutrient management. Appropriate stocking densities, carrying capacity, fodder banks, and improved grazing management.
Grazing lands — animal management	-	Appropriate stocking densities, carrying capacity management, fodder banks and improved grazing management, fodder production, and fodder diversification.
	-	Stocking density, animal waste management.
Grazing land — fire management	-	Improved use of fire for sustainable grassland management. Fire prevention and improved prescribed burning.
Revegetation	-	The establishment of vegetation that does not meet the definitions of afforestation and reforestation (e.g., Atriplex spp.).
	-	Increased grazing by ruminants may increase net emissions.
	-	Reduced N inputs will reduce emissions.
Organic soils — restoration	-	Soil carbon restoration on peatlands; and avoided net soil carbon emissions using improved land management.
	-	May increase.
Degraded soils — restoration	-	Reclamation (afforestation, soil fertility management, water conservation soil nutrients enhancement, improved fallow).
Bio solid applications	-	Use of animal manures and other bio solids for improved management of nitrogen; integrated livestock agriculture techniques.
Livestock		
Livestock — feeding	-	Improved feed and dietary additives to reduce emissions from enteric fermentation; including improved forage, dietary additives (bioactive compounds, fats), ionophores/antibiotics, propionate enhancers, archaea inhibitors, nitrate and sulphate supplements.
Livestock — breeding and other long-term management	-	Improved breeds with higher productivity (so lower emissions per unit of product) or with reduced emissions from enteric fermentation; microbial technology such as archaeal vaccines, methanotrophs, acetogens, defaunation of the rumen, bacteriophages and probiotics; improved fertility.
Manure management	-	Manipulate bedding and storage conditions, anaerobic
	-	Manipulate livestock diets to reduce N excreta, soil-applied and animal fed nitrification inhibitors, urease inhibitors, fertilizer type, rate and timing, manipulate manure application practices, grazing management.

Source: Smith P. et al. (2014)

While the practices mentioned in **Table 8.1** mostly show the options for reducing GHG emissions (i.e. climate change mitigation), those efforts are also relevant as climate change adaptation. Both mitigation and adaptation efforts in the agriculture sector might occur simultaneously with different spatial and temporal characteristics. For example, in the case of nutrient management, it can also be seen as adaptation efforts as it improves the resiliency of the farmers to adapt to the future changing climate. It is also important to integrate weather information generation and dissemination with agricultural market development to equip farmers' preparedness on their farming practices from the coming weather shocks (Maggio & Sitko, 2019).

Several OIC member countries indeed have implemented commendable practices in various aspects of sustainable agriculture. For instance, Conservation Agriculture has been successfully adopted in Azerbaijan, Kazakhstan, and Uzbekistan, promoting soil conservation and enhancing agricultural productivity (FAO 2016b). Agroforestry practices have found success in Indonesia and Malaysia, combining tree cultivation with agricultural activities to promote biodiversity and ecosystem resilience (FAO,

2021c). Climate-resilient crop varieties are being developed and utilized in various member countries, particularly in Sub-Saharan Africa, aiding in adaptation to changing climate conditions (Acevedo et al., 2020). Furthermore, notable specific initiatives such as the "Green Morocco Plan" in Morocco and the "System of Rice Intensification" (SRI) in Indonesia have displayed innovative approaches towards sustainable agricultural development. In Bangladesh the innovative "Floating Gardens" initiative is implemented, aiming to enhance agricultural resilience in the face of climate change. These examples highlight the commitment and progress made by various OIC member countries in implementing sustainable agriculture practices and addressing environmental challenges.

Furthermore, these initiatives not only demonstrate successful practices within specific OIC member countries but also present valuable opportunities for knowledge and experience sharing among member countries. Through this collaborative effort, member countries can capitalize on each other's strengths and collectively work towards achieving sustainable development goals in the fields of agriculture and waste management.

9. Policy Measures and Responses

Climate change is a global problem requiring action at a local level. Despite the unequal gap between countries in terms of their GHG emissions, a transition to a less carbon-based economy is deemed required not only to prevent the adverse effects of climate change, but also to ensure the well-being of society.

In an effort to reduce GHG emissions and address climate change issues, the world community is gathering together and trying to come up with a global consensus. Under the United Nations Framework Convention on Climate Change (UNFCCC), in 2015, the Paris Agreement on climate change was adopted by more than 160 countries with the prime objective of limiting the global temperature increase to well below 2°C above the pre-industrial level by the end of the century.

This section discusses policy measures and responses in OIC countries to respond to the challenges of climate change. First, the OIC countries' progress and commitments in terms of compliance with the Paris Agreement are discussed. Second, intergovernmental cooperation in OIC countries is analyzed in terms of climate finance. Finally, the forward-looking policy to achieve net zero by 2050 is laid out and presented as a future climate-policy reference for OIC countries.

9.1. Progress towards Paris Agreement Targets

There is a widespread awareness in the OIC countries about climate change and its negative consequences and they actively participate in the climate related summits, treaties, events, and projects. All 57 OIC member countries have ratified the UNFCCC convention, although three countries (Iran, Libya, and Yemen) have not ratified the "Paris Agreement".

Table 9.1. Paris Agreement Status and NDC Submissions

Status	Yes	No
Paris Agreement Ratification	Rest of OIC	(3) Iran, Libya, Yemen
INDC and/or First NDC	Rest of OIC	(1) Libya
Updated NDC and/or Second NDC	(40) Albania, Bahrain, Bangladesh, Benin, Burkina Faso, Cameroon, Chad, Comoros, Gambia, Guinea, Guinea Bissau, Indonesia, Côte d'Ivoire, Jordan, Kuwait, Kyrgyzstan, Lebanon, Malaysia, Maldives, Mali, Mauritania, Morocco, Mozambique, Niger, Nigeria, Oman, Pakistan, Palestine, Qatar, Saudi Arabia, Sierra Leone, Somalia, Sudan, Suriname, Tajikistan, Togo, Tunisia, Uganda, UAE, Uzbekistan	Rest of OIC

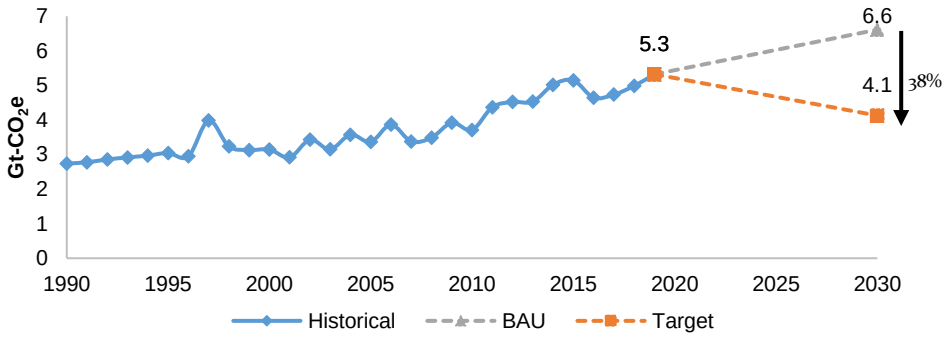
Source: WRI CAIT NDC Tracker. As of June 2022.

Under the umbrella of the Paris Agreement, parties to the agreement are required to submit their plans to address climate change in a document known as the Intended Nationally Determined Contribution (INDC). Accordingly, the INDC is converted to a Nationally Determined Contribution (NDC) when a country decides to formally join

the agreement by submitting an instrument of ratification, acceptance, approval or accession. Parties to the agreement will also have an opportunity to enhance their climate commitment through an update to their NDCs by 2020 and will continue to do so every five years.

All OIC countries, except Libya, have submitted their INDC, some of which were converted to NDC after formally joining the agreement. However, two OIC countries (Iran and Yemen) have opted out of the Paris Agreement because they have yet to ratify it. Among OIC countries in the Paris Agreement, 40 OIC countries either have updated the first NDC or submitted their second NDC (**Table 9.1**).

Figure 9.1. OIC Countries Paris Agreement Target



Note: Based on 35 OIC countries, which clearly mentioned quantified BAU GHG emissions and reduction target in 2030.

Source: Historical emissions based on WRI-CAIT. BAU and target are based on UNEP Pledge Pipeline.

Countries submitted their emission reduction targets as part of the NDC, demonstrating their commitment to reduce GHG emissions and adapt to the impacts of climate change. Based on latest available NDCs of 35 OIC countries[8] that have clearly defined their quantified GHG emissions and reduction targets for 2030, OIC countries must reduce 38% of their GHG emissions relative to the Business as Usual (BAU) emission trajectory. As a result, GHG emissions should be decreased by 23% compared to 2019 level (**Figure 9.1**).

Even though the current NDC's target of reducing emissions is important effort for stopping climate change, countries' overall targets are still not ambitious enough. According to the Emissions Gap Report 2021 (UNEP, 2021), current national climate pledges combined with other mitigation measures are projected to lead to a global temperature rise of 2.7 °C by the end of the century, which is significantly higher than the Paris Agreement target of 1.5 °C. To keep warming in check, in the next decade, annual greenhouse gas emissions must be reduced by nearly half, and thus, more ambitious policies and measures are required.

[8] Countries included are Afghanistan, Albania, Bangladesh, Benin, Brunei, Burkina Faso, Chad, Comoros, Côte d'Ivoire, Djibouti, Gambia, Guinea-Bissau, Indonesia, Iraq, Jordan, Kyrgyzstan, Lebanon, Mali, Mauritania, Morocco, Niger, Nigeria, Oman, Qatar, Saudi Arabia, Senegal, Sierra Leone, Somalia, Tajikistan, Togo, Tunisia, Türkiye, Uganda, United Arab Emirates, and Yemen. These countries combined covers 58% of OIC GHG emissions in 2019.

BOX 9.1: OIC Countries Hosted UNFCCC COP

The United Nations Framework Convention on Climate Change (UNFCCC) Conference of Parties (COP) is an annual meeting of countries that have ratified the UNFCCC, a treaty that aims to address climate change. The conference is held in different countries each year, and in recent years, several OIC countries have hosted the conference. The hosting of the conference is an important opportunity for countries to highlight their commitment to addressing climate change, as well as to help shape global policies and actions on climate change. The OIC countries that have hosted the UNFCCC COP conference include:

- Morocco (COP7, 2001 and COP22, 2016): Morocco was the first OIC country to host the UNFCCC COP conference. The COP7 in 2001 completed a package of decisions known as the Marrakech Accords, which set the stage for countries to ratify the Kyoto Protocol (a legally binding treaty to reduce greenhouse emissions). The COP22 in 2016 focused on the implementation of the Paris Agreement.
- Indonesia (COP13, 2007): Indonesia hosted the UNFCCC COP conference in Bali. The conference focused on the Bali Roadmap, which laid the groundwork for the negotiation of the Paris Agreement.
- Qatar (COP18, 2012): Qatar hosted the UNFCCC COP conference in Doha. The conference focused on issues related to finance, technology transfer, and the Green Climate Fund.
- Egypt (COP27, 2022): Egypt hosted the UNFCCC COP conference in Sharm El-Sheikh. The conference led to an agreement on Loss and damage, under which funding for vulnerable countries hit hard by floods, droughts and other climate disasters is set to be provided.

Furthermore, the UNFCCC COP28, 2023 is scheduled to take place in Dubai, United Arab Emirates. COP28 is of particular significance as it marks the conclusion of the first Global Stocktake, a comprehensive assessment of the progress made in achieving the goals of the Paris Agreement.

Source: https://unfccc.int/process/bodies/supreme-bodies/conference-of-the-parties-cop

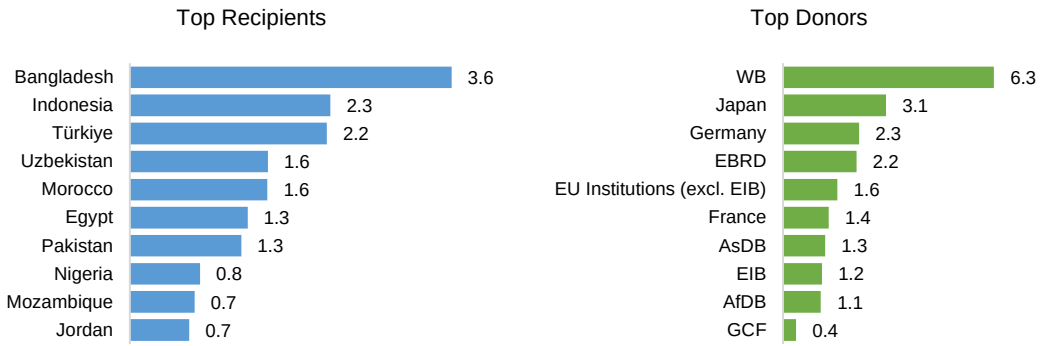
9.2. Financing Climate Actions

Climate finance is one of the core issues in the UNFCCC negotiations. “Climate Finance” refers to funds – either from public or private sources – which are utilized for climate change mitigation and adaptation projects. Under the UNFCCC, since 2009, developed countries have committed to providing US$100 billion a year in climate finance to developing countries by 2020. According to the OECD (2020b), climate-related finance has reached close to US$80 billion in 2018.

Latest statistics from OECD (2020b) reveals that OIC received climate funds totalling US$22 billion[9] in 2018 and US$25.7 billion in 2019, which corresponds to a two-year average of US$23.9 billion/year. Bangladesh was the largest recipient on average, receiving US$3.6 billion/year during the 2018-2019 period. It was followed, in order, by Indonesia (US$2.3 billion/year), Türkiye (US$2.2 billion/year), Uzbekistan (US$1.6 billion/year), and Morocco (US$1.6 billion/year) (**Figure 9.2, Left**).

[9] Unless otherwise stated, all dollar amounts in this sub-section refer to the constant 2019 USD.

Figure 9.2. Top 10 Largest Climate Finance Recipients (Left) and Donors for OIC Countries (Right), Billion US$, Yearly Average 2018-2019



Note: WB=World Bank; EBRD= European Bank for Reconstruction and Development; EIB= European Investment Bank; AsDB=Asian Development Bank; AfDB=African Development Bank; GCF=Green Climate Fund
Source: SESRIC staff calculation based on OECD (2021)

Climate finance includes financial support provided through bilateral (country to country), multilateral (via international institutions), regional and other channels. The largest climate finance donor to OIC countries was the World Bank, providing on average US$6.3 billion/year over the 2018-2019 period. It was followed by Japan (US$3.1 billion/year), Germany (US$2.3 billion/year), EBRD (US$2.2 billion/year), and EU Institutions (excl. EIB) (US$1.6 billion/year) (**Figure 9.2, Right**).

The figure shows that multilateral development banks (MDBs) play an important role in overall climate finance in OIC countries. Indeed, according to a recent report by the Group of Multilateral Development Banks (2021), in 2020, the MDBs committed a total of (current) US$66 billion in climate finance in all economies, where almost 60% of which was intended for low-income and middle-income economies. The same report revealed that climate finance received by OIC countries increased by 1.5 times from US$8.5 billion in 2015 to US$13.0 billion in 2020.

Within the OIC systems, Islamic Development Bank (IsDB) also provides importance on Climate financing. During 2013-17, a total of US$4.72 billion was allocated to climate financing across 88 projects in four sectors, constituting 19% of the overall IsDB approvals. Notably, the energy sector received the largest share of climate financing at US$1.71 billion, followed by water, sanitation, and urban services at US$1.3 billion, transportation at US$908.83 million, and agriculture at US$810.33 million. Among the climate financing, 48% was directed towards climate mitigation, 40% towards climate adaptation, and 12% towards projects that aimed for both adaptation and mitigation benefits. In terms of project distribution, 38 projects with climate benefits were funded in member countries in Africa and Latin America, accounting for 43% of the total projects receiving climate finance, while 36 projects were financed in MENA and Europe (IsDB, 2020).

In terms of the type of project, according to OECD (2021), around US$16 billion/year went to mitigation-related projects, compared to US$10 billion/year for adaptation-related projects. The energy sector received the most climate financing, an average of US$6.9 billion per year. Energy and other sectors such as 'Transport & Storage,' 'Water Supply & Sanitation,' 'Agriculture, Forestry, Fishing', and 'Disaster Risk Reduction' account for more than 70% of OIC receiving sectors.

Urgent actions to address climate challenges necessitate not only significant financial resources, but also money spent wisely. If properly managed, climate finance can be a bridge between socio-economic development and environmental needs. There is still a gap between countries receiving climate funds in the OIC. Therefore, OIC countries need to take steps that further enable the environment for climate finance and climate projects to come.

Table 9.2. The Component of Climate Finance Readiness

	Financial Planning	Accessing Finance	Delivering Finance	Monitor, Report & Verify
Levels of National Capacities	❖ Assess needs and priorities ❖ Identify sources of financing	❖ Programming finance ❖ Direct access to finance ❖ Blend and combine finance ❖ Catalyse private finance	❖ Project, program, sector-wide implementation ❖ Local supply of expertise and skills ❖ Coordination systems	❖ Monitor, report, and verify flows ❖ Performance-based payments
Policy Level	Formulation of green, low-emission and climate resilient development strategies and implementation plan, including costing	Sectoral policy incentives and regulations to catalyse private investments		
Institutional Level	Effective national multi-stakeholder coordination mechanisms	Implementing entities with fiduciary systems and safeguards; national banking institutions	Implementing &executing entities with fiduciary systems and safeguards; project-level multi-stakeholder mechanisms; climate-aware public financial management systems	Centralised unit to compile and quality control reporting; communications unit
Individual Level	Baseline assessments; Investment and Financial Flows (I&FF) Assessments; expenditure reviews; cost-benefit analysis	Financial management (combining/blending) skills; project development skills; expertise in private sector pricing incentives	Specialist technology skills; Project management skills	Expenditure review methodology; GHG inventory skills; Independent verification skills

Source: Adapted from Vandeweerd et al. (2012)

Several enabling environments can be implemented in order to effectively benefit from climate finance (Zou & Ockenden, 2016). First, climate change should be at the forefront of the development agenda, integrating it into development planning and policies. Second, recipient countries should create a well-coordinated and clear system for tracking and monitoring of climate finance. Third, countries should increase their capacity to access and deliver climate finance. Improving climate finance readiness can be accomplished by considering its components, as shown in **Table 9.2**. Finally, the engagement of civil society, local government, and the private sector is needed to effectively implement climate projects.

9.3. Climate Policies and Net-Zero Target

A more ambitious effort to reduce GHG emissions is still needed to deal with climate change. These ambitious commitments will take the shape of a new NDC, Long-Term Strategies (LTS), setting out a pathway to net zero emissions; climate finance commitments to support the most vulnerable; and ambitious adaptation plans and underlying policies. These commitments will also help to build towards a green and resilient recovery from COVID-19. Current analysis by UNEP (2021) show that if countries comply with current pledges and targets in their NDCs, the global temperature could still rise by 2.7°C by the end of the century, thereby will miss the target agreed in Paris.

To limit global warming to 1.5°C (as called for in the Paris Agreement), emissions must be reduced by 45% by 2030 and reach ne-zero by 2050. Governments throughout the world are becoming increasingly aware of the necessity to incorporate net-zero ambitions into their climate policies.

Table 9.3 shows the OIC countries' current climate policies as well as their long-term strategy or net-zero commitment. Climate laws and policies must be in place in order to mainstream climate change on the development agenda. There are 38 OIC countries currently having specific climate framework laws or policies. Furthermore, most of OIC countries already have in place sectoral laws or policies addressing climate change. The majority of sectoral policies are aimed at the energy and environmental sectors in general.

The Net-zero target of 2050 is being campaigned as a proper pathway to meet the Paris Agreement target. A significant commitment has been made by 35 OIC member countries to achieve a net-zero target in various stages within the period of 2050 to 2070. Out of this, three countries have stronger commitments reflected by formalizing net-zero target in their national policies, such as Tunisia, Maldives and Türkiye. Türkiye for instance, has prepared a roadmap for achieving net-zero target in 2053. On the other hand, five countries already declared that they have already reached net-zero targets, such as Benin, Comoros, Gabon, Guyana, and Suriname. This pledge reflects the recognition and urgency to address climate change and reduce GHG emissions. However, the majority of countries with a net-zero target are still in

the preliminary stages of internal discussions. There is an urgent need to formalize the net-zero target into policy documents in order to effectively implement climate policies.

Table 9.3. Climate Policies in OIC Countries

Country	Climate Framework	Sectoral Laws or Policies	Net-Zero Target	Country	Climate Framework	Sectoral Laws or Policies	Net-Zero Target
Afghanistan	NA	Y	D	Malaysia	Y	Y	D
Albania	Y	Y	NA	Maldives	Y	Y	P
Algeria	Y	Y	NA	Mali	Y	Y	D
Azerbaijan	NA	Y	NA	Mauritania	NA	Y	D
Bahrain	NA	Y	D	Morocco	Y	Y	NA
Bangladesh	Y	Y	D	Mozambique	Y	Y	D
Benin	Y	NA	A	Niger	Y	Y	D
Brunei	Y	Y	NA	Nigeria	Y	Y	D
Burkina Faso	Y	Y	D	Oman	Y	Y	D
Cameroon	Y	Y	NA	Pakistan	Y	Y	D
Chad	Y	Y	D	Palestine	Y	Y	NA
Comoros	Y	NA	A	Qatar	NA	Y	NA
Cote d'Ivoire	Y	Y	NA	Saudi Arabia	Y	Y	D
Djibouti	NA	Y	NA	Senegal	NA	Y	D
Egypt	Y	Y	NA	Sierra Leone	Y	Y	D
Gabon	Y	Y	A	Somalia	Y	Y	D
Gambia	Y	Y	D	Sudan	NA	Y	NA
Guinea	Y	Y	D	Suriname	Y	Y	A
Guinea-Bissau	NA	Y	D	Syria	NA	Y	NA
Guyana	Y	Y	A	Tajikistan	Y	Y	NA
Indonesia	Y	Y	D	Togo	NA	Y	D
Iran	Y	Y	NA	Tunisia	NA	Y	P
Iraq	NA	Y	NA	Türkiye	Y	Y	P
Jordan	Y	Y	NA	Turkmenistan	Y	NA	NA
Kazakhstan	NA	Y	D	UAE	Y	Y	D
Kuwait	NA	Y	NA	Uganda	Y	Y	NA
Kyrgyzstan	Y	Y	D	Uzbekistan	NA	Y	NA
Lebanon	NA	Y	D	Yemen	NA	Y	D
Libya	NA	Y	NA				

Note: Data as per May 2023. Climate Framework includes policy documents such as action plan, strategy, framework related specific to address climate change. Sectoral Laws or Policies include climate policy documents targeting only specific sector(s) in the economy.
Key: Y=Yes/Available, D=Proposed/in discussion or declaration/pledge, P=in policy document, A=Achieved (self-declared), NA=Not available.
Source: Climate and sectoral policy based on Grantham Research Institute. https://climate-laws.org/legislation_and_policies. Net-zero target based on Net-Zero Tracker. https://zerotracker.net/.

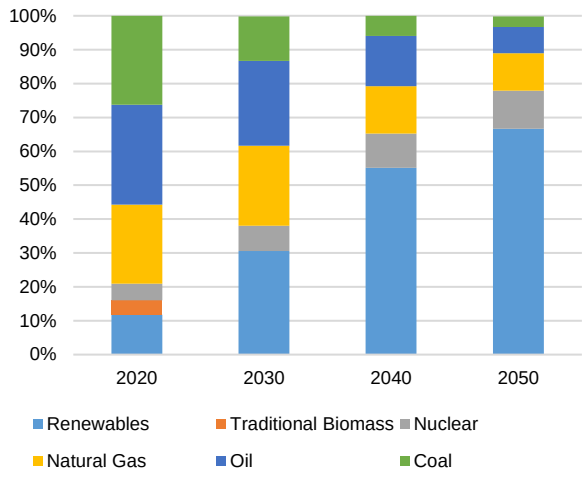
The Need for Energy Transition and Decarbonisation

The world is currently undergoing a surge in transition to renewable energy. In addition to the energy security concerns arising from the depletion of non-renewable energy sources, this process is mainly driven by concerns over climate change that

is directly or indirectly attributed to human activities leading to a rise in carbon and greenhouse gas (GHG) emissions and global warming.

The International Energy Agency (IEA, 2021) reports that the number of countries that have pledged to reach net-zero emissions by mid-century or soon after continues to grow, and achieving this target requires a total transformation of the energy systems –how energy is produced, transported, and used. Revealing a comprehensive road map "to guide the global journey to net zero by 2050", the IEA sets out more than 400 milestones for technologies, infrastructure, investment, and policy that include an immediate end to investments in new fossil fuel supply projects. Thus, since fossil fuels are the largest source of carbon emissions, the energy transition process revolves around ceasing new investments in fossil fuels and gradually abandoning their use for more economically and environmentally suitable solutions. As of 2020, fossil fuels (oil, natural gas, and coal) account for about 80% of the total energy supply globally, and according to the IEA's Net-Zero Emissions by 2050 scenario, this share should drop to around 20% by 2050 in favour of renewable sources (**Figure 9.3**), particularly solar and wind.

Figure 9.3. Total Energy Supply by Source: Projections for Net-Zero Emissions by 2050



Source: International Energy Agency (2021), Net Zero by 2050, IEA, Paris: Net Zero by 2050 Scenario - Data product - IEA.

In addition to the transition to renewables in the energy sector, electrification emerges as a critical complement of the energy transition process. As the electricity sector becomes cleaner with the shift towards using renewable sources in electricity generation, electrification will be a crucial tool for reducing emissions. The currently flourishing electric-vehicle market and the plans to end sales of new internal combustion engine cars in the near future are a vibrant indication of the electrification trend in the transportation sector. Increasing electrification of end-uses in the industry and buildings (e.g. space and water heating, cooking, machinery & appliances) will also contribute to the decarbonisation process.

Although countries are increasingly discussing climate change and the need to reduce carbon, substantial transitions are difficult to implement. On one hand, the

energy transition and decarbonisation process requires strong support from governments and businesses, with a change of mindset towards a green economy. Technological innovations for improvement in energy efficiency to reduce energy demand growth, and changes in behavioural patterns for energy conservation to reduce demand for energy services are also important to support the transition towards a greener future. On the other hand, all of these requirements translate into a set of challenges even for wealthy, developed countries, but an even more serious situation for developing countries with developmental priorities, where advocating the implementation of environmental policies is more challenging given that millions of people still lack access to reliable and affordable energy. Therefore, given the vast differences in income, vulnerability, and resilience between countries, the worldwide transition and decarbonisation process also requires unprecedented international cooperation that recognizes differences in the stages of development of different countries and the varying situations of different parts of society (IEA, 2021).

According to studies, such a transition in energy systems is both technically and economically feasible. For example, Fathurrahman (2019) shows that a sustainable energy transition in Türkiye where at least 62% of electricity generation comes from renewables could technically be achieved by 2050 at a cost of between US$18.42 billion and US$31.27 billion per year, or equivalent to just between 2.2% and 3.7% of Türkiye's GDP in 2018. OIC member countries in SSA, on the other hand, despite still having a lack of technical and financial capacity, the renewable energy potential in the region is high (Suberu et al., 2013). With proper energy system planning, management, and investment, the transition to a sustainable energy system is attainable in SSA countries (Adulugba, 2021).

It is worth noting a particular concern for resource dependent countries, like oil-exporter OIC countries. The energy transition changes the relative roles of energy resources and poses a challenge for the built, energy-related infrastructures. The decline in the use of fossil fuels across the world and the consequent fall in their international prices may dramatically reduce incomes (rents) of producer economies, which finance a significant share of their national budget through hydrocarbon revenues (IEA, 2021). In addition to channelling investments to the renewable energy transition, these countries may need to design structural reform policies aimed to diversify the economy and reduce its vulnerability to decreasing resource rents.

Conclusions & Policy Suggestions

Concluding Remarks

Having a higher weight of natural capital in their total wealth, OIC member countries, particularly the oil exporters, heavily rely on their environmental resources for economic growth and development. Therefore, accounting for the contribution of natural resources to economic output is an imperative task for sustainable development in these countries. Measuring and valuing natural capital and ecosystem services is also essential for integrating environmental sustainability into both public and private decision-making processes.

Despite their high dependency on environmental resources for wealth creation, OIC member countries still lag behind both other developing countries and developed countries in environmental performance. The positive correlation observed between EPI score and income level and the better improvements achieved by higher income countries in the last decade indicates that wealth is a determining factor in the environmental performance of OIC countries. Accordingly, it becomes evident that low-income OIC countries, most of which are in Sub-Saharan Africa and dependent on agricultural natural capital, cannot afford to adequately fund public health and environmental infrastructure and/or mitigate the negative effects on the environment. In contrast, high-income OIC countries, which are rich in subsoil assets, have been capable of reinvesting in environmental health and ecosystem vitality, even to a greater extent in the last decade.

Population growth, although predicted to continue to decelerate in the next decade all over the world, remains higher in OIC countries than in the rest of the world. This situation requires paying more attention to controlling its potential impacts on the environment, such as land cover change and deforestation, agricultural land degradation, abstraction and pollution of water resources, coastal and marine environmental disturbances, air pollution, and climate change.

Urbanization has also been on the rise in OIC countries, following a similar trend to developing countries. Over half of the OIC population currently live in rural areas and this ratio is estimated to increase further in this decade. Estimates also indicate that the growth rate of the urban population, despite showing a declining trend all over the world, will continue to be higher in OIC countries, requiring them to implement comprehensive policies to plan and manage urban growth that sustainably improves the lives of both urban and rural residents.

The report also investigated the status and trends in specific key environmental areas, such as land and biodiversity, air, and water, through the latest available statistical indicators of relevant SDGs. It is found that OIC member countries still have a lot of work to do to ensure environmental sustainability. Environmental issues such

as land degradation, loss of biodiversity, air pollution, and water insecurity continue to threaten the well-being of the population in many OIC countries.

Deforestation in the OIC is increasing at a rate faster than the global average, while degraded land has continued to become a crucial issue in some member countries, driving further loss of biodiversity. During the last two decades, biodiversity in the OIC has shown a declining trend, indicating the continuous extinction of species.

The global problem of air pollution is also happening in OIC member countries. While, on average, the state of air pollution in the OIC is similar to the global average, the death rate due to air pollution is higher. The majority of OIC countries are still not able to meet the FAO-recommended AQG for PM2.5 levels, whilst the healthcare system is also not well developed.

In terms of the water sector, the present situation shows that OIC countries are experiencing increasing water scarcity, facing high water-related risk and stress, and lacking drinking water and sanitation services. The future of water security is also unfavourable unless significant changes take place. The water-secure future in OIC countries faces challenges in the form of intensifying pressure on water due to population growth, rapid urbanization, socio-economic development, changing consumption patterns, and climate change.

Climate change is another major environmental challenge that member countries must address. The OIC is one of the most vulnerable regions due to its high exposure and low adaptive capacity to climate change. Therefore, efforts to mitigate the severe impact of climate change, as well as increase adaptive capacity, should be pursued by member countries. In recent decades, the growth rate of anthropogenic GHG emissions – the primary driver of climate change – has been faster in OIC countries than in non-OIC developing countries. While this could indicate progress in economic development, this also shows that socio-economic development still follows conventional trajectories where environmental degradation is involved. Through decomposition analysis, it was found that the main drivers of increasing emissions in OIC countries were population growth, raising income, and stagnated efforts at decarbonisation.

The majority of OIC countries are signatories to the Paris Agreement, which aims to provide collective action to reduce GHG emissions in order to keep temperature rises manageable. Ambitious commitments to fight climate change are expected through the submission of updated NDCs. There are currently 40 countries that have submitted second or updated NDCs. Increasing ambitious commitments is important for OIC member countries to ensure the path of greener development. In the future, socio-economic development should take into consideration the long-term climate ambition to fully implement a net-zero carbon economy, thereby achieving a world less impacted by climate change and, at the same time, ensuring a climate-resistant society.

Policy Recommendations

Similar to developing countries, OIC member countries have been recording much faster economic growth rates than developed countries in the last two decades, and this trend is expected to continue in the next five years until 2025. Although higher incomes seem to be associated with higher environmental performance, this high-growth performance requires more attention to be paid to its environmental reflections in the coming years, with the aim of minimizing the negative impacts on human health and on the environment. This is particularly important for countries growing out of poverty, where optimal policies need to be formulated –with international support– in order to secure a balance between the protection of the environment and the development of the economy.

The recent trend of decarbonisation and transition to renewable energy, spearheaded by developed countries, is likely to have significant ramifications, particularly in the energy sector, with the potential to result in significant improvements in environmental quality. This long-term transition process, however, involves a number of difficulties to overcome. On one hand, it requires strong support from governments and businesses, with a change of mindset towards a green economy. Technological innovations for improvements in energy efficiency to reduce energy demand growth, and changes in behavioural patterns for energy conservation to reduce demand for energy services, are also important to support the transition towards a greener future. On the other hand, all of these requirements translate into a set of challenges even for wealthy, developed countries, but an even more serious situation for developing countries with developmental priorities, where advocating the implementation of environmental policies is more challenging given that millions of people still lack access to reliable and affordable energy. Therefore, given the vast differences in income, vulnerability, and resilience between countries, the worldwide transition and decarbonisation process also requires unprecedented international cooperation that recognizes differences in the stages of development of different countries and the varying situations of different parts of society.

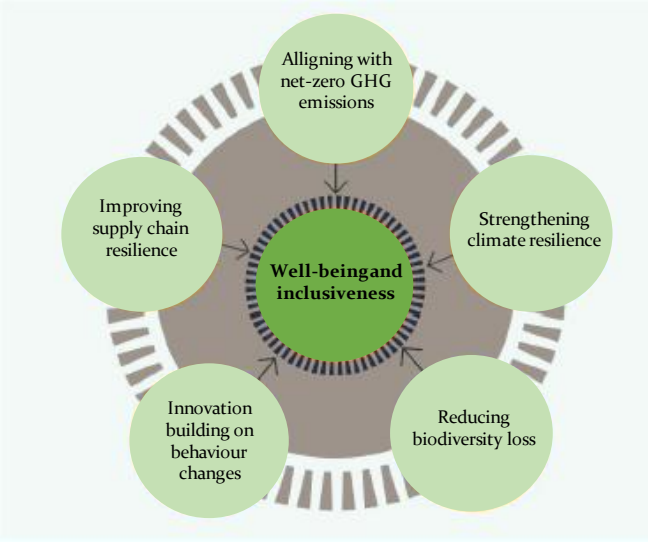
Oil-exporting OIC countries are most likely to be negatively affected by the transition process, given that the decline in the use of fossil fuels across the world and the consequent fall in their international prices may dramatically reduce their incomes (oil rents). In addition to channelling investments to the renewable energy transition, these countries may need to design structural reform policies aimed at diversifying the economy and reducing its vulnerability to decreasing resource rents.

The COVID-19 pandemic, with reduced social and economic activity, may contribute to the restoration of the ecological system. However, it also poses some negative effects on the environment. Since economic activities is resuming as the pandemic fades away, the short-term environmental effects might change. Achieving long-term environmental benefits will be highly dependent on the extent to which environmental concerns are integrated into policy responses, wastes are reduced within the circular

economy, and economic agents (governments, energy companies, investors, and consumers) contribute to clean energy transition.

Considering the environmental issues at hand, the recovery should take into account policies that are not only good for the economy and society, but also good for the environment. This is an excellent opportunity to "build back better" from the crisis, where economic recovery is integrated with environmental and climate actions, and thereby meet the Paris Agreement and SDG targets.

Figure 10.1. Components of "Build Back Better"



Source: Adapted from OECD (2020)

Build Back Better (BBB) is a concept coined during the Sendai Conference on Disaster Risk Reduction in 2015, which provides measures aimed at reducing the risk to the people of nations and communities in the wake of disasters. Officially, BBB is described as "The use of the recovery, rehabilitation and reconstruction phases after a disaster to increase the resilience of nations and communities through integrating disaster risk reduction measures into the restoration of physical infrastructure and societal systems, and into the revitalization of livelihoods, economies, and the environment." (UN Secretary-General, 2016, p.11). The BBB could provide the greatest benefits for communities and countries through the achievement of a stronger, faster, and more inclusive post-disaster reconstruction (World Bank, 2018).

Member countries are encouraged to adopt the BBB approach to achieve economic recovery and societal well-being that is sustainable, inclusive, and resilient. The BBB has five dimensions, as illustrated in **Figure 10.1**.

People should be the central focus of recovery, with the goal of improving their well-being and inclusiveness. Recovery should not solely focus on economic recovery-i.e., economic growth. Other factors that improve well-being, such as better health-care services, job quality, housing, and the environment, should be pursued. Any policies with environmental objectives should also consider their economic impacts, provide social inclusiveness, reduce inequalities, and ensure the well-being of

society. While measures to achieve this goal can be context specific for each country, in general, following policy actions can be pursued by the OIC member countries:

- **Recovery measures should consider and align with long-term efforts for reducing GHG emissions.** Maintain a line of sight towards long-term development goals and preventing the worst impact of climate change is one of the key components of a more resilient future. Any investments made during the recovery period should consider the long-term implications for the climate. Therefore, careful consideration of stimulus packages on future GHG emission pathways is critical, particularly in order to gradually transition to net-zero emissions.
- **Invest in strengthening climate resilience. Improving climate resilience and adaptation efforts is as important as mitigating the worst climate change impacts.** OIC countries have already become vulnerable to the impact of climate change, through increasing water supply variability, increasing food security, pressure on ecosystems and biodiversity loss. Member countries are encouraged to take advantage of various climate-financing opportunities, either through bilateral or multilateral channels. For example, MDBs have already committed US$38 billion to climate projects in low- and middle-income countries in 2020, with plans to increase the funds to US$50 billion by 2025 (Group of Multilateral Development Banks, 2021).
- **Pursue ambitious policies to stop biodiversity loss.** Degradation of ecosystems and loss of biodiversity in OIC countries should be considered when applying recovery measures. Various approaches that integrate ambitious policies to restore ecosystems and biodiversity should be pursued. For example, the modern approach to water resources management stresses the need to fulfil the water needs of present and future generations by incorporating sustainable development approaches into the water sector. This can be achieved through multi-sector integration, broader stakeholder involvement, and raising awareness about the importance of the economic, social, and ecological values of water (SESRIC, 2021). To do this, concepts such as Integrated Water Resource Management (IWRM) or Nature-based Solutions (NbS) can be applied by member countries to form a sound policy for ecosystem and biodiversity protection.
- **Promoting innovation that enhances long-lasting behaviour changes.** The pandemic has highlighted the critical importance of being highly adaptable to a changing environment on short notice. Technological innovation is one of the factors that contributes to adaptability and resilience. For instance, progress in the digital world has prevented the worst impact of COVID-19 on people, where production and services can still operate even with certain disruptions. In the future, continued technological and process innovation will play a more vital part in achieving climate and sustainability goals.
- **Resiliency improvement of supply chains.** COVID-19 and its containment measures have disrupted global supply chains, setting off an interest in more

diversified and localised production and shorter supply chains in certain sectors. Therefore, recovery from the pandemic should also ensure an improvement in supply chains. This can be done through increased adherence to circular economic principles, where the local supply chain is strengthened. Governments can include stimulus packages to ensure that local supply chains improve resilience and reduce environmental impacts, including resource efficiency improvement and increasing the circularity of supply chains.

In addition to the general policy recommendations to pursue BBB discussed above, the analysis in this report emphasises four key areas for focused attention: sustainable cities and urban development, waste management, strengthening environmental governance, and enhancing monitoring and data collection. These areas have been identified as critical pillars for achieving environmental sustainability and addressing the unique challenges faced by member countries.

Sustainable Cities and Urban Development: Member countries should prioritise sustainable urban planning by integrating environmental considerations into city development plans. Governments should prioritise and invest in public transportation systems to reduce reliance on private vehicles. Furthermore, member countries should incentivize and enforce green building practises, such as energy-efficient designs, the use of renewable energy, and water conservation measures.

Waste Management: Member countries should prioritise the development and implementation of comprehensive waste management systems. This includes policies and programmes to encourage recycling practises, including the establishment of recycling centres, providing incentives for recycling initiatives, and supporting the development of recycling industries. The Zero Waste project initiated by Türkiye can be a good example of such an initiative.

Strengthening Environmental Governance: The development and implementation of robust environmental policies, laws, and regulations is a key factor in addressing environmental challenges. These should encompass pollution control, natural resource management, and climate change mitigation and adaptation. Governments should ensure the establishment and empowerment of dedicated environmental institutions that oversee and enforce environmental regulations. This is important to ensure compliance with the policy.

Enhance Monitoring and Data Collection: Member countries are urged to invest in environmental monitoring and data collection, particularly related to climate change. This will be important as a backbone for modelling and analysis to understand local environmental and climate risks and vulnerabilities. The comprehensive environmental and climate risk assessments can then be used for the development of robust early warning systems and effective climate change mitigation and adaptation policies.

Finally, there is also an urgent need to improve cooperation between OIC member countries to provide effective and efficient benefits to society. Cooperation is crucial

for strengthening institutional capacity and knowledge sharing among OIC member countries to effectively address environmental and climate change challenges. Investing in education and training programmes for government officials and professionals, along with regional and international cooperation, enables the exchange of best practises, technology transfer, and financial support for environmental and climate resilience initiatives.

The OIC member countries are invited to also actively engage in environmental programmes and initiatives of relevant OIC institutions such as the Islamic Development Bank (IsDB), SESRIC, Standing Committee for Scientific and Technological Cooperation (COMSTECH), Standing Committee for Economic and Commercial Cooperation (COMCEC), Islamic World Educational, Scientific and Cultural Organization (ICESCO), and the Islamic Organisation for Food Security (IOFS).

References

Abbas, G., Ahmad, S., Ahmad, A., Nasim, W., Fatima, Z., Hussain, S., Rehman, M. H. ur, Khan, M. A., Hasanuzzaman, M., Fahad, S., Boote, K. J., & Hoogenboom, G. (2017). Quantification the impacts of climate change and crop management on phenology of maize-based cropping system in Punjab, Pakistan. Agricultural and Forest Meteorology, 247, 42–55. https://doi.org/10.1016/J.AGRFORMET.2017.07.012

Acevedo, M., Pixley, K., Zinyengere, N., Meng, S., Tufan, H., Cichy, K., Bizikova, L., Isaacs, K., Ghezzi-Kopel, K., & Porciello, J. (2020). A scoping review of adoption of climate-resilient crops by small-scale producers in low- and middle-income countries. Nature Plants 2020 6:10, 6(10), 1231–1241. https://doi.org/10.1038/s41477-020-00783-z

Adulugba, C. (2021). Sustainable Energy Transition in Sub-Saharan Africa. In M. Asif (Ed.), Energy and Environmental Security in Developing Countries. Springer. https://doi.org/https://doi.org/10.1007/978-3-030-63654-8

Amegah, A. K., & Agyei-Mensah, S. (2017). Urban air pollution in Sub-Saharan Africa: Time for action. Environmental Pollution, 220, 738–743. https://doi.org/10.1016/j.envpol.2016.09.042

Austin, K. G., Schwantes, A., Gu, Y., & Kasibhatla, P. S. (2019). What causes deforestation in Indonesia? Environmental Research Letters, 14(2), 024007. https://doi.org/10.1088/1748-9326/aaf6db

Bretschger, L., & Pittel, K. (2020). Twenty Key Challenges in Environmental and Resource Economics. Environmental and Resource Economics, 77(4), 725–750. https://doi.org/10.1007/s10640-020-00516-y

Chabejong, N. E. (2016). A Review on the Impact of Climate Change on Food Security and Malnutrition in the Sahel Region of Cameroon. Climate Change Management, 133–148. https://doi.org/10.1007/978-3-319-24660-4_9/COVER

Chen, C., Noble, I., Hellmann, J., Coffee, J., Murillo, M., & Chawla, N. (2015). University of Notre Dame Global Adaptation Index: Country Index. University of Notre Dame Global Adaptation Index Country:Country Index Technical Report, 46.

Climate Action Tracker. (2021). Climate summit momentum: Paris commitments improved warming estimate to 2.4°C. May 2021, 0–12.

Davidson, N. C. (2014). How much wetland has the world lost? Long-term and recent trends in global wetland area. Marine and

Freshwater Research, 65(10), 934–941. https://doi.org/10.1071/MF14173

Delincé, J., Ciaian, P., & Witzke, H.-P. (2015). Economic impacts of climate change on agriculture: the AgMIP approach. Journal of Applied Remote Sensing, 9(1), 97099.

EU. (n.d.). Air - Policies - Environment - European Commission. Retrieved June 8, 2021, from https://ec.europa.eu/environment/air/index_en.htm

Everett, T., Ishwaran, M., Ansaloni, G. P., & Rubin, A. (2010). Economic Growth and the Environment. Defra Evidence and Analysis Series, Paper 2(March 2010).

FAO. (2006). Food Security. Policy Brief, 2. https://doi.org/10.1016/j.jneb.2010.12.007

FAO. (2008). An Introduction to the Basic Concepts of Food Security.

FAO. (2016a). Impact of the Ebola virus disease outbreak on market chains and trade of agricultulral products in West Africa.

FAO. (2016b). Practice Of Conservation Agriculture In Azerbaijan, Kazakhstan And Uzbekistan (A. Nurbekov, A. Kassam, D. Sydyk, Z. Ziyadullaev, I. Jumshudov, H. Muminjanov, D. Feindel, & J. Turok (Eds.)).

FAO. (2017). The State of Food and Agriculture 2017: Leveraging Food Systems for Inclusive Rural Transformation.

FAO. (2021a). Agricultural trade and policy responses during the first wave of the pandemic in 2020. https://doi.org/10.4060/cb5406en

FAO. (2021b). FAO 2020 – 2021 La Niña advisory: Potential impacts on agriculture and food security in high-risk countries. http://www.fao.org/3/cb2954en/cb2954en.pdf

Acevedo, M., Pixley, K., Zinyengere, N., Meng, S., Tufan, H., Cichy, K., Bizikova, L., Isaacs, K., Ghezzi-Kopel, K., & Porciello, J. (2020). A scoping review of adoption of climate-resilient crops by small-scale producers in low- and middle-income countries. Nature Plants 2020 6:10, 6(10), 1231–1241. https://doi.org/10.1038/s41477-020-00783-z

FAO. (2016). Practice Of Conservation Agriculture In Azerbaijan, Kazakhstan And Uzbekistan (A. Nurbekov, A. Kassam, D. Sydyk, Z. Ziyadullaev, I. Jumshudov, H. Muminjanov, D. Feindel, & J. Turok (Eds.)).

FAO. (2021c). State And Outlook Of Agroforestry in Asean: Status, Trends and Outlook 2030 and beyond (T. Lin, D. Catacutan, M. van Noordwijk, R. Mulia, E. Simelton, Q. T. Nguyen, R. F. Finlayson, C. N. Rogel, & P. Orencio (Eds.)).

FAO, IFAD, UNICEF, WFP, & WHO. (2021). The State of Food Security and Nutrition in the World 2021. Transforming food systems for food security, improved nutrition and

affordable healthy diets for all. FAO.

FAO, & UNEP. (2020). The State of the World's Forests 2020. Forests, biodiversity and people. https://doi.org/https://doi.org/10.4060/ca8642en

Fathurrahman, F. (2019). Transformation Pathways Toward a Sustainable Energy System in Türkiye. In PhD Thesis. Middle East Technical University.

Fattorini, D., & Regoli, F. (2020). Role of the chronic air pollution levels in the Covid-19 outbreak risk in Italy. In Environmental Pollution (Vol. 264, p. 114732). Elsevier Ltd. https://doi.org/10.1016/j.envpol.2020.114732

Fenhann, J. (2017). Pledge Pipeline. UNEP/DTU. http://www.unep.org/climatechange/resources/pledge-pipeline

FSIN. (2021). Global Report on Food Crises 2021.

Goodwin, N. R. (2003). Five Kinds of Capital: Useful Concepts for Sustainable Development (Working Paper No. 03–07). Tufts University, Global Development and Environment Institute.

Group of Multilateral Development Banks. (2021). Joint report on multilateral development banks' climate finance 2020. 56 pp. http://documents.worldbank.org/curated/en/247461561449155666/Joint-Report-on-Multilateral-Development-Banks-Climate-Finance-2018

Hamed, Y., Hadji, R., Redhaounia, B., Zighmi, K., Bâali, F., & El Gayar, A. (2018). Climate impact on surface and groundwater in North Africa: a global synthesis of findings and recommendations. Euro-Mediterranean Journal for Environmental Integration, 3(1), 25. https://doi.org/10.1007/s41207-018-0067-8

Health Effects Institute. (2020). State of Global Air 2020. IHME.

IEA. (2020). World Energy Outlook 2020. Paris: IEA. https://www.iea.org/reports/world-energy-outlook-2020

IEA. (2021). Net Zero by 2050—A Roadmap for the Global Energy Sector. Paris: International Energy Agency. https://iea.blob.core.windows.net/assets/ad0d4830-bd7e-47b6-838c-40d115733c13/NetZeroby2050-ARoadmapfortheGlobalEnergySector.pdf

IPCC. (2013). Climate Change 2013. https://www.researchgate.net/profile/Abha_Chhabra2/publication/271702872_Carbon_and_Other_Biogeochemical_Cycles/links/54cf9ce80cf24601c094a45e/Carbon-and-Other-Biogeochemical-Cycles.pdf

IPCC. (2014a). Climate Change 2014 Part A: Global and Sectoral Aspects. In Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.

https://doi.org/10.1017/CBO9781107415379

IPCC. (2014b). Climate change 2014 Part B: Regional Aspects. In Climate Change 2014: Impacts, Adaptation and Vulnerability: Part B: Regional Aspects: Working Group II Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. https://doi.org/10.1017/CBO9781107415386

IPCC. (2015). Drivers, Trends and Mitigation. Climate Change 2014 Mitigation of Climate Change, 351–412. https://doi.org/10.1017/cbo9781107415416.011

IPCC. (2019). Food Security. Food Security. In: Climate Change and Land: An IPCC Special Report on Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security, and Greenhouse Gas Fluxes in Terrestrial Ecosystems, 437–550. https://burundi-food-securityhealthywealthywise.weebly.com/food-security.html

IPCC. (2021). Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. In Cambridge University Press. https://doi.org/10.1017/9781009157896.001

IPCC. (2023). AR6 Synthesis Report: Climate Change 2023. Sixth Assessment Report of the Intergovernmental Panel on Climate Change.

IsDB. (2020). 2020-2025 Climate Action Plan. https://www.isdb.org/climate-change/publications/climate-action-plan-2020-2025

IUCN. (n.d.). IUCN Red List of Threatened Species. Retrieved June 7, 2021, from https://www.iucnredlist.org/about/background-history

Jeffrey, P., & Gearey, M. (2006). Integrated water resources management: Lost on the road from ambition to realisation? Water Science and Technology, 53(1), 1–8. https://doi.org/10.2166/wst.2006.001

Ketiem, P., Makeni, P. M., Maranga, E. K., & Omondi, P. A. (2017). Integration of climate change information into drylands crop production practices for enhanced food security: A case study of Lower Tana Basin in Kenya. African Journal of Agricultural Research, 12(20), 1763–1771. https://doi.org/10.5897/ajar2016.11506

Lange, G.-M., Wodon, Q., & Carey, K. (2018). The Changing Wealth of Nations 2018: Building a Sustainable Future. Washington, DC: World Bank. https://doi.org/10.1596/978-1-4648-1046-6

MacCarthy, J., Tyukavina, S., Weisse, M., & Harris, N. (2022). New Data Confirms: Forest Fires Are Getting Worse. Forests. https://www.wri.org/insights/global-trends-forest-fires?utm_campaign=treecoverlossfires2022&utm_medium=bitly&utm_source=GFWBlog

Maggio, G., & Sitko, N. (2019). Knowing is half the battle: Seasonal forecasts, adaptive cropping systems, and the mediating role of private markets in Zambia. Food Policy, 89(August 2018), 101781. https://doi.org/10.1016/j.foodpol.2019.101781

Mahmood, R., Jia, S., & Zhu, W. (2019). Analysis of climate variability, trends, and prediction in the most active parts of the Lake Chad basin, Africa. Scientific Reports, 9(1), 1–18. https://doi.org/10.1038/s41598-019-42811-9

McKinsey & Company. (2020). Agriculture and climate change: Reducing emissions through improved farming practices. Agriculture and Climate Change, April. https://doi.org/10.4060/cb1593en

OECD. (2016). The economic consequences of air pollution. In Policy highlights. https://doi.org/10.1016/0013-9327(78)90018-6

OECD. (2020a). Building back better - A sustainable, resilient recovery after COVID-19. June, 2–16. https://read.oecd-ilibrary.org/view/?ref=133_133639-s08q2ridhf&title=Building-back-better-_A-sustainable-resilient-recovery-after-Covid-19

OECD. (2020b). Climate Finance Provided and Mobilised by Developed Countries in 2013-18. In Climate Finance Provided and Mobilised by Developed Countries in 2013-18.

OECD. (2021). Climate-Related Development Finance Data. https://www.oecd.org/dac/financing-sustainable-development/development-finance-topics/climate-change.htm

Oliva, P., Alexianu, M., & Nasir, R. (2019). Suffocating prosperity : Air pollution and economic growth in developing countries. International Growth Centre, December, 1–9. https://www.theigc.org/wp-content/uploads/2019/12/IGCJ7753-IGC-Pollution-WEB_.pdf

Onyeneke, R. U., Igberi, C. O., Uwadoka, C. O., & Aligbe, J. O. (2018). Status of climate-smart agriculture in southeast Nigeria. GeoJournal, 82(2). https://www.jstor.org/stable/45117499

Ordway, E. M., Asner, G. P., & Lambin, E. F. (2017). Deforestation risk due to commodity crop expansion in sub-Saharan Africa. Environmental Research Letters, 12(4), 044015. https://doi.org/10.1088/1748-9326/aa6509

Rudel, T. K. (2013). The national determinants of deforestation in sub-Saharan Africa. Philosophical Transactions of the Royal Society

B: Biological Sciences, 368(1625). https://doi.org/10.1098/rstb.2012.0405

Rume, T., & Islam, S. M. D.-U. (2020). Environmental effects of COVID-19 pandemic and potential strategies of sustainability. Heliyon, 6(9). https://doi.org/10.1016/j.heliyon.2020.e04965

Schoeman, J., Allan, C., & Finlayson, C. M. (2014). A new paradigm for water? A comparative review of integrated, adaptive and ecosystem-based water management in the Anthropocene. International Journal of Water Resources Development, 30(3), 377–390. https://doi.org/10.1080/07900627.2014.907087

SESRIC. (2018). OIC Water Report 2018: Transforming Risk into Dialog and Cooperation.

SESRIC. (2019). Urban Development in OIC Countries: Towards Sustainable Urbanization (Infrastructure Development Studies). Ankara: Statistical, Economic and Social Research and Training Centre for Islamic Countries. https://www.sesric.org/files/article/713.pdf

SESRIC. (2020). Socio-Economic Impacts of COVID-19 Pandemic in OIC Member Countries: Prospects and Challenges. Ankara: Statistical, Economic and Social Research and Training Centre for Islamic Countries. https://www.sesric.org/files/article/724.pdf

SESRIC. (2021). OIC Water Report 2021: Towards Sustainable Water Management.

SESRIC. (2022). Socio-Economic Impacts of the COVID-19 Pandemic in OIC Countries: Pathways for Sustainable and Resilient Recovery.

Sherbinin, A. de, Carr, D., Cassels, S., & Jiang, L. (2007). Population and Environment. Annual Review of Environment and Resources, 32(1), 345–373. https://doi.org/10.1146/annurev.energy.32.041306.100243

Smith P., Bustamante, M., Ahammad, H., Clark, H., Dong, H., Elsiddig, E. A., Haberl, H., Harper, R., House, J., Jafari, M., Masera, O., & C. Mbow, N. H. Ravindranath, C. W. Rice, C. Robledo Abad, A. Romanovskaya, F. Sperling, and F. T. (2014). Agriculture, Forestry and Other Land Use (AFOLU). In R. Edenhofer, O., J. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, & T. Z. and J. C. M. (eds. . Savolainen, S. Schlömer, C. von Stechow (Eds.), Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (pp. 811–922). Cambridge University Press. https://doi.org/10.1017/cbo9781107415416.017

Stolton, S., Dudley, N., Avcıoğlu Çokçalışkan, B., Hunter, D., Ivanić,

K.-Z., Kanga, E., Kettunen, M., Kumagai, Y., Maxted, N., Senior, J., Wong, M., Keenleyside, K., Mulrooney, D., & Waithaka, J. (2015). Values and Benefits of Protected Areas. Protected Area Governance and Management, 145–168. https://press.anu.edu.au/publications/protected-area-governance-and-management#tabanchor

Suberu, M. Y., Mustafa, M. W., Bashir, N., Muhamad, N. A., & Mokhtar, A. S. (2013). Power sector renewable energy integration for expanding access to electricity in sub-Saharan Africa. In Renewable and Sustainable Energy Reviews (Vol. 25, pp. 630–642). Pergamon. https://doi.org/10.1016/j.rser.2013.04.033

Travaglio, M., Yu, Y., Popovic, R., Selley, L., Leal, N. S., & Martins, L. M. (2021). Links between air pollution and COVID-19 in England. Environmental Pollution, 268, 115859. https://doi.org/10.1016/j.envpol.2020.115859

UN. (2017). Resolution adopted by the General Assembly on 6 July 2017. Work of the Statistical Commission Pertaining to the 2030 Agenda for Sustainable Development, A/RES/71/3(July), 1–25. https://undocs.org/A/RES/71/313

UN. (2018). World Urbanization Prospects: The 2018 Revision, Online Edition. https://population.un.org/wup/

UN. (2019a). World Population Prospects 2019, Online Edition. Rev.1. https://population.un.org/wpp/

UN. (2019b). World Urbanization Prospects 2018: Highlights (ST/ESA/SER.A/421). https://population.un.org/wup/Publications/Files/WUP2018-Highlights.pdf

UN. (2020). The Sustainable Development Goals Report 2020. https://doi.org/10.4324/9781003099680-3

UN Secretary-General. (2016). Report of the open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction. 21184(December), 1–41.

UN, & UNESCO. (2018). Progress on Transboundary Water Cooperation 2018. https://doi.org/10.18356/f6afa45b-en

UNCCD. (2015). Integration of the Sustainable Development Goals and targets into the implementation of the United Nations Convention to Combat Desertification and the Intergovernmental Working Group report on land degradation neutrality. 11235(July), 4. https://www.unccd.int/sites/default/files/inline-files/dec3-COP.12eng.pdf

UNDP-UNEP. (2012). The Economics of Land Degradation for the Agriculture Sector in Tajikistan.

UNEP. (2012). UN-Water Status Report on The Application of Integrated Approaches to Water

Resources Management. In United Nations Environment Programme.

UNEP. (2016). Transboundary River Basins Status and Trends.

UNEP. (2019a). Global Environmental Outlook 6: Healthy Planet, Healthy People. Cambridge University Press. https://doi.org/10.1017/9781108627146

UNEP. (2019b). Measuring Progress Towards Achieving the Environmental Dimension of the SDGs. https://doi.org/10.7748/ns.3.52.55.s59

UNEP. (2021). Emissions Gap Report 2021: The Heat Is On – A World of Climate Promises Not Yet Delivered. https://www.unep.org/resources/emissions-gap-report-2021

Vandeweerd, V., Glemarec, Y., & Billett, S. (2012). Readiness for Climate Finance. 1–32. http://www.undp.org/content/dam/undp/library/Environment and Energy/Climate Strategies/Readiness for Climate Finance_12April2012.pdf

Venter, Z. S., Aunan, K., Chowdhury, S., & Lelieveld, J. (2020). COVID-19 lockdowns cause global air pollution declines. Proceedings of the National Academy of Sciences of the United States of America, 117(32), 18984–18990. https://doi.org/10.1073/pnas.2006853117

Watson, J. E. M., Dudley, N., Segan, D. B., & Hockings, M. (2014). The performance and potential of protected areas. In Nature (Vol. 515, Issue 7525, pp. 67–73). Nature Publishing Group. https://doi.org/10.1038/nature13947

WHO. (2006). WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide. In Global Update 2005. https://doi.org/10.1007/s12011-019-01864-7

Wolf, M. J., Emerson, J. W., Esty, D. C., de Sherbinin, A., & Wendling, Z. A. (2022). 2022 Environmental Performance Index.

World Bank. (2021). The Changing Wealth of Nations 2021: Managing Assets for the Future. In The Changing Wealth of Nations 2021: Managing Assets for the Future. https://doi.org/10.1596/978-1-4648-1590-4

World Bank. (1992). World Development Report 1992: Development and the Environment. New York: Oxford University Press. https://openknowledge.worldbank.org/handle/10986/5975

World Bank. (2006). Where is the Wealth of Nations? Measuring Capital for the 21st Century. Washington, DC: World Bank.

World Bank. (2011). The Changing Wealth of Nations: Measuring Sustainable Development in the New Millennium. Washington, DC: World Bank.

World Bank. (2018). Building Back Better, Achieving Resilience through Stronger, Faster, and more Inclusive Post-disaster Reconstruction.

World Commission on Environment and Development. (1987). Our Common Future. Oxford; New York: Oxford University Press. https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf

Yenigün, K., Turan, A., & Çamaş, T. (Eds.). (2023). Zero Waste. Republic of Türkiye Ministry of Environment, Urbanization and Climate Change.

Zou, S. Y., & Ockenden, S. (2016). What Enables Effective International Climate Finance in the Context of Development Co-operation? June, 25. http://www.oecd-ilibrary.org/development/what-enables-effective-international-climate-finance-in-the-context-of-development-co-operation_5jlwjg92n48x-en

Annexes

ANNEX A. Country Classifications

OIC Member Countries (57):

AFG	Afghanistan	GAB	Gabon	MDV	Maldives	SDN	Sudan
ALB	Albania	GMB	Gambia	MLI	Mali	SUR	Suriname
DZA	Algeria	GIN	Guinea	MRT	Mauritania	SYR	Syria*
AZE	Azerbaijan	GNB	Guinea-Bissau	MAR	Morocco	TJK	Tajikistan
BHR	Bahrain	GUY	Guyana	MOZ	Mozambique	TGO	Togo
BGD	Bangladesh	IDN	Indonesia	NER	Niger	TUN	Tunisia
BEN	Benin	IRN	Iran	NGA	Nigeria	TUR	Türkiye
BRN	Brunei Darussalam	IRQ	Iraq	OMN	Oman	TKM	Turkmenistan
BFA	Burkina Faso	JOR	Jordan	PAK	Pakistan	UGA	Uganda
CMR	Cameroon	KAZ	Kazakhstan	PSE	Palestine	ARE	United Arab Emirates
TCD	Chad	KWT	Kuwait	QAT	Qatar	UZB	Uzbekistan
COM	Comoros	KGZ	Kyrgyzstan	SAU	Saudi Arabia	YEM	Yemen
CIV	Cote d'Ivoire	LBN	Lebanon	SEN	Senegal		
DJI	Djibouti	LBY	Libya	SLE	Sierra Leone		
EGY	Egypt	MYS	Malaysia	SOM	Somalia		

* Syria is currently suspended from OIC membership.
Note: Country codes are based on ISO 3166-1 alpha-3 codes.

Non-OIC Developing Countries (98):

Angola	Dominica	Madagascar	São Tomé and Príncipe
Antigua and Barbuda	Dominican Republic	Malawi	Serbia
Argentina	Ecuador	Marshall Islands	Seychelles
Armenia	El Salvador	Mauritius	Solomon Islands
The Bahamas	Equatorial Guinea	Mexico	South Africa
Barbados	Eritrea	Micronesia	South Sudan
Belarus	Ethiopia	Moldova	Sri Lanka
Belize	Fiji	Mongolia	St. Kitts and Nevis
Bhutan	Georgia	Montenegro	St. Lucia
Bolivia	Ghana	Myanmar	St. Vincent and the Grenadines
Bosnia and Herzegovina	Grenada	Namibia	Swaziland
Botswana	Guatemala	Nauru	Tanzania
Brazil	Haiti	Nepal	Thailand
Bulgaria	Honduras	Nicaragua	Timor-Leste
Burundi	Hungary	Palau	Tonga
Cabo Verde	India	Papua New Guinea	Trinidad and Tobago
Cambodia	Jamaica	Paraguay	Tuvalu
Central African Republic	Kenya	Peru	Ukraine
Chile	Kiribati	Philippines	Uruguay
China	Kosovo	Poland	Vanuatu
Colombia	Lao P.D.R.	Romania	Venezuela
Democratic Republic of the Congo	Lesotho	Russia	Vietnam
Republic of Congo	Liberia	Rwanda	Zambia
Costa Rica	North Macedonia	Samoa	Zimbabwe
Croatia	Panama		

Developed Countries (39):**

Australia	Germany	Lithuania	Singapore
Austria	Greece	Luxembourg	Slovak Republic
Belgium	Hong Kong	Macao SAR	Slovenia
Canada	Iceland	Malta	Spain
Cyprus	Ireland	Netherlands	Sweden
Czech Republic	Israel	New Zealand	Switzerland
Denmark	Italy	Norway	Taiwan
Estonia	Japan	Portugal	United Kingdom
Finland	Korea, Rep.	Puerto Rico	United States
France	Latvia	San Marino	

** Based on the list of advanced countries classified by the IMF.

Geographical Classification of OIC Member Countries

Sub-Saharan Africa (21): OIC-SSA

Benin	Gambia	Nigeria
Burkina Faso	Guinea	Senegal
Cameroon	Guinea-Bissau	Sierra Leone
Chad	Mali	Somalia
Comoros	Mauritania	Sudan
Côte d'Ivoire	Mozambique	Togo
Gabon	Niger	Uganda

Middle East and North Africa (19): OIC-MENA

Algeria	Kuwait	Saudi Arabia
Bahrain	Lebanon	Syria*
Djibouti	Libya	Tunisia
Egypt	Morocco	United Arab Emirates
Iraq	Oman	Yemen
Iran	Palestine	
Jordan	Qatar	

*Syria is currently suspended from its OIC membership.

East and South Asia and Latin America (9): OIC-ESALA

Afghanistan	Guyana	Maldives
Bangladesh	Indonesia	Pakistan
Brunei Darussalam	Malaysia	Suriname

Europe and Central Asia (8): OIC-ECA

Albania	Kyrgyzstan	Turkmenistan
Azerbaijan	Tajikistan	Uzbekistan
Kazakhstan	Türkiye	

ANNEX B. Climate Change Vulnerability and Readiness Indices

Country	Vulnerability (Lower = Better)	Rank	Readiness (Higher = Better)	Rank	Status
Afghanistan	0.58	49	0.24	53	Highly vulnerable, less ready to adapt
Albania	0.41	19	0.41	15	Less vulnerable, less ready to adapt
Algeria	0.39	12	0.33	29	Less vulnerable, less ready to adapt
Azerbaijan	0.44	24	0.44	12	Less vulnerable, ready to adapt
Bahrain	0.45	28	0.51	7	Highly vulnerable, ready to adapt
Bangladesh	0.54	42	0.28	45	Highly vulnerable, less ready to adapt
Benin	0.57	48	0.34	26	Highly vulnerable, less ready to adapt
Brunei	0.37	5	0.53	4	Less vulnerable, ready to adapt
Burkina Faso	0.55	44	0.29	42	Highly vulnerable, less ready to adapt
Cameroon	0.48	31	0.26	50	Highly vulnerable, less ready to adapt
Chad	0.66	53	0.19	56	Highly vulnerable, less ready to adapt
Comoros	0.53	39	0.28	44	Highly vulnerable, less ready to adapt
Cote d'Ivoire	0.51	34	0.31	37	Highly vulnerable, less ready to adapt
Djibouti	0.48	32	0.33	30	Highly vulnerable, less ready to adapt
Egypt	0.44	26	0.34	25	Highly vulnerable, less ready to adapt
Gabon	0.42	22	0.30	39	Less vulnerable, less ready to adapt
Gambia	0.55	43	0.33	32	Highly vulnerable, less ready to adapt
Guinea	0.53	41	0.31	34	Highly vulnerable, less ready to adapt
Guinea-Bissau	0.66	54	0.27	47	Highly vulnerable, less ready to adapt
Guyana	0.46	29	0.31	35	Highly vulnerable, less ready to adapt
Indonesia	0.45	27	0.39	19	Highly vulnerable, less ready to adapt
Iran	0.39	11	0.39	18	Less vulnerable, less ready to adapt
Iraq	0.44	25	0.30	38	Less vulnerable, less ready to adapt
Jordan	0.38	8	0.41	16	Less vulnerable, less ready to adapt
Kazakhstan	0.36	3	0.52	5	Less vulnerable, ready to adapt
Kuwait	0.38	10	0.47	10	Less vulnerable, ready to adapt
Kyrgyzstan	0.35	1	0.39	17	Less vulnerable, less ready to adapt
Lebanon	0.42	21	0.29	41	Less vulnerable, less ready to adapt
Libya	0.43	23	0.27	46	Less vulnerable, less ready to adapt
Malaysia	0.38	7	0.51	6	Less vulnerable, ready to adapt
Maldives	0.52	37	0.44	13	Highly vulnerable, ready to adapt
Mali	0.60	51	0.29	40	Highly vulnerable, less ready to adapt
Mauritania	0.57	47	0.36	21	Highly vulnerable, less ready to adapt
Morocco	0.38	9	0.43	14	Less vulnerable, ready to adapt
Mozambique	0.52	35	0.27	48	Highly vulnerable, less ready to adapt

Country	Vulnerability (Lower = Better)	Rank	Readiness (Higher = Better)	Rank	Status
Niger	0.67	56	0.33	27	Highly vulnerable, less ready to adapt
Nigeria	0.50	33	0.25	51	Highly vulnerable, less ready to adapt
Oman	0.48	20	0.51	8	Less vulnerable, ready to adapt
Pakistan	0.41	38	0.31	36	Highly vulnerable, less ready to adapt
Qatar	0.53	6	0.53	3	Less vulnerable, ready to adapt
Saudi Arabia	0.38	17	0.54	2	Less vulnerable, ready to adapt
Senegal	0.41	40	0.35	23	Highly vulnerable, less ready to adapt
Sierra Leone	0.53	46	0.32	33	Highly vulnerable, less ready to adapt
Somalia	0.56	55	0.36	22	Highly vulnerable, less ready to adapt
Sudan	0.67	52	0.26	49	Highly vulnerable, less ready to adapt
Suriname	0.62	15	0.33	28	Less vulnerable, less ready to adapt
Syria	0.41	30	0.23	55	Highly vulnerable, less ready to adapt
Tajikistan	0.47	16	0.33	31	Less vulnerable, less ready to adapt
Togo	0.41	36	0.35	24	Highly vulnerable, less ready to adapt
Tunisia	0.52	13	0.44	11	Less vulnerable, ready to adapt
Türkiye	0.39	2	0.48	9	Less vulnerable, ready to adapt
Turkmenistan	0.35	18	0.24	54	Less vulnerable, less ready to adapt
Uganda	0.41	50	0.29	43	Highly vulnerable, less ready to adapt
UAE	0.58	4	0.58	1	Less vulnerable, ready to adapt
Uzbekistan	0.37	14	0.39	20	Less vulnerable, less ready to adapt
Yemen	0.40	45	0.25	52	Highly vulnerable, less ready to adapt
OIC	0.48		0.36		Highly vulnerable, less ready to adapt
World	0.44		0.43		