

AGEDI | THE ABU DHABI GLOBAL ENVIRONMENTAL DATA INITIATIVE

CLIMATE CHANGE PROGRAMME



Introduction



Climate Change, one of the world's most daunting environmental challenges, can be better understood by developing an integrated and expanding pool of environmental data to facilitate informed decision-making.

To help drive a process towards improved climate change mitigation, in 2008, Environment Agency – Abu Dhabi (EAD) completed the first climate change vulnerability assessment for the Emirate of Abu Dhabi. While several systems and sectors were screened as potentially highly vulnerable to climate change, the focus of this original assessment was on coastal zones, water resources, and dryland ecosystems.

AGEDI's follow-up to this initial study was in 2011 with the aim of establishing a climate change work programme that could build upon, expand and deepen the understanding of vulnerability to the impacts of climate change, as well as identify practical adaptive responses at the local, national and regional levels. This work is driven by AGEDI's vision to enhance accessibility to environmental data and information to support effective decision-making. During this period, AGEDI engaged and collaborated with over 100 key stakeholders in a five-stage consultative process, identifying 12 highly integrated-subprojects across the Emirate of Abu Dhabi, the UAE and the Arabian Gulf. The process also helped establish the types of outputs considered to be the most useful for future policy-making at each level.

The outcome of this is AGEDI's four-year Climate Change Programme, known as the Climate Change Impacts, Vulnerability and Adaptation Assessment for Abu Dhabi, UAE, and the Arabian Peninsula. This commenced in 2013 and will continue through to 2016.

Ultimately, the Programme will develop and provide access to useable, high quality environmental data within the context of local and/or regional partnerships and effective stakeholder engagement. As such, this offers potential as an important basis upon which to develop high-level, coordinated decision-making about the critical adaptation to climate change.

4 years
12 sub-projects
More than 500 stakeholders



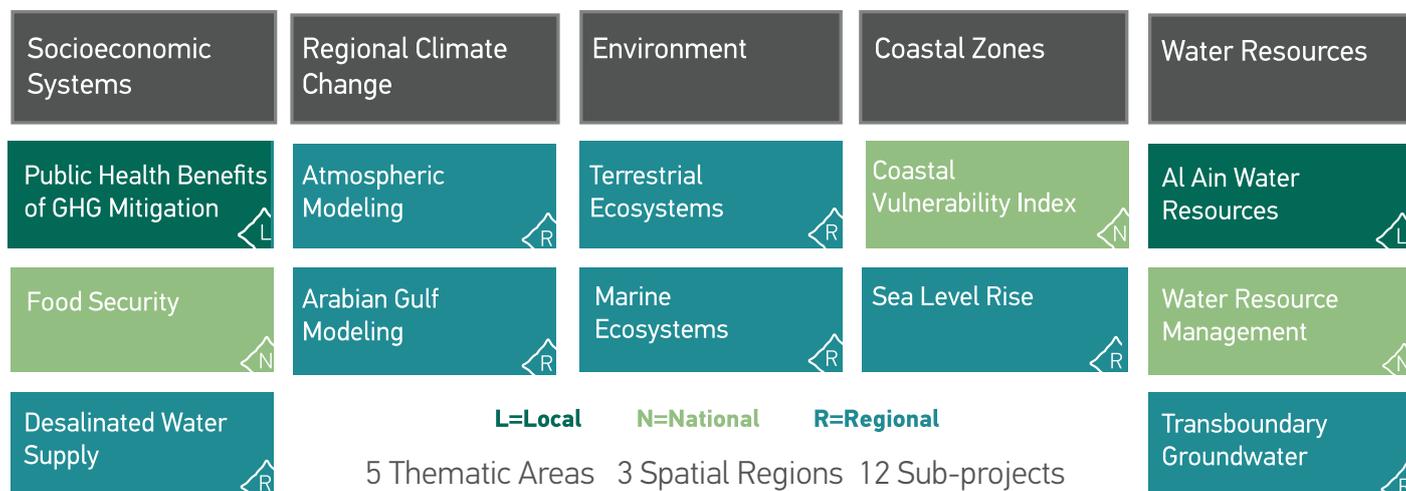
More than 40 outcomes

	Atmospheric Modelling	Arabian Gulf Modelling	Terrestrial Ecosystems	Marine Ecosystems	Transboundary Groundwater	Water Resource Groundwater	AI Ain Water Management	Coastal Vulnerability Index	Desalinated Water Supply	Food Security	Public Health Benefits of GHG Mitigation	Sea Level Rise
High-resolution maps for policy-makers	○	○										
User-friendly datasets for follow-up research by the regional scientific community	○	○	○	○	○	○	○	○	○	○	○	○
Comprehensive technical report	○	○	○	○	○	○	○	○	○	○	○	○
High-resolution maps depicting current and future habitat suitability for key species					○							
Adaptation options		○		○	○	○	○					
High-resolution maps depicting species invasion/extinction and fish catch potential			○									
High-resolution maps depicting future groundwater levels				○								
High-resolution maps depicting future water resource requirements					○							
Model outputs for follow-up scientific research	○	○	○	○	○	○	○	○	○	○	○	○
High-resolution maps depicting future water recharge scenarios						○						
High-resolution maps depicting inundation extent												○
Tabular outputs of land use types affected							○					
Tabular outputs of data used	○	○	○	○	○	○	○	○	○	○	○	○
High-resolution maps depicting Arabian Gulf impacts	○	○	○	○				○				○
Model datasets for follow-up research by the regional scientific community	○	○	○	○	○	○	○	○	○	○	○	○
Costs and benefits of data options								○	○			
High-resolution maps depicting air quality improvements										○		
Adapted models for Abu Dhabi conditions										○		

Programme of Work



LNR Climate Change Assessment Project 2013-2016



The climate change work programme is driven by the growing awareness that the UAE and other Arabian Gulf countries – Oman, Saudi Arabia, Qatar, Bahrain, Yemen and Kuwait – are particularly vulnerable to climate change.

The region has already experienced numerous changes that have been linked to climate change, including increasing temperatures, rising sea levels that exceed global average rates, increasingly acidic coastal waters that harm marine life, and altered dust storm. These trends will only intensify in the future, which will adversely impact marine and terrestrial biodiversity, groundwater supply, air quality, public health, coastal zone infrastructure, and other valuable systems and sectors. In response, the UAE and other Gulf countries have mobilised resources to confront this critical environmental challenge.

The Programme's thematic areas and associated sub-projects were designed to develop an integrated and expanding pool of environmental data on this issue. As the first-of-its-kind effort in the Arabian Gulf, it

represents a timely and strategic initiative that can help regional leaders, innovators and decision-makers better understand the stakes, and the range of options available to them. The 12 sub-projects also represent an organising framework to engage partners from across the region on issues that are widely considered to be high priority, while also involving several international organisations to facilitate replication in other regions of the world.

Regional Climate Change

The Regional Climate Change sub-projects of the Phase II Climate Change Programme provide essential input into the other sub-projects. AGEDI first explores regional climatic **Atmospheric Modelling**, which helps explain how climate change is expected to unfold on the Arabian Peninsula, while the **Arabian Gulf Modelling** then looks at the same for the Arabian Gulf. The results of the modelling sub-projects represent climate conditions on a regional scale, which has not yet been assessed at such a high resolution – in the Atmospheric Modelling, by accounting for local topography, changes in temperature,





precipitation, humidity, and wind patterns for the unique Arabian Peninsula will be projected. Similarly, in the Arabian Gulf Modelling, the ocean model will account for parameters like tidal characteristics, and help anticipate changes in sea surface temperature, salinity, currents, and other marine parameters for the Arabian Gulf.

Environment

Programme experts will then determine the impacts of climate change on the biodiversity of both **Terrestrial and Marine Ecosystems** and species at the regional scale, measuring their vulnerability to long-term changes with climate change. The research will inform adaptation strategies for climate change and will set the stage for more detailed future analyses, such as identifying key migration pathways. A similar quantitative assessment will determine the vulnerability of marine species and fisheries to long-term physical, chemical and biological modifications due to climate change, which the Arabian Gulf's marine ecosystems and fishers are known to be particularly sensitive to. This will also develop input towards strategic plans to ensure that adaptation and protection measures are identified and taken.

Water Resources

Meanwhile, within the theme of Water Resources, a quantitative assessment will provide clarity on the vulnerability of the Arabian Peninsula's shared, **Transboundary Groundwater** resource when impacted by a sea level raise that is typically associated with long-term climate change. Currently, the Dammam aquifer – the main groundwater resource that is shared by all countries bordering the Arabian Gulf – is already characterised by unsustainable groundwater use, which over the past decades has contributed to increasing salt-water intrusion and water quality challenges. With a projected rise in sea level, the potential for

saltwater intrusion into the aquifer will be further exacerbated. Additionally, groundwater recharge levels will be affected by declining rainfall, and economic and population growth may lead to increased groundwater demand, further threatening sustainable use of the aquifer. A vulnerability assessment will produce a better understanding of how the regional Dammam aquifer will respond to this combination of stresses and will also inform potential adaptation strategies that could be implemented within a regional cooperation framework.

Similarly, a UAE national-level assessment, the **Water Resource Management** sub-project, will provide greater understanding of the vulnerability of the nation's water resources to long-term regional climate change and socio-economic growth. Thus far, a quantitative assessment of climate change impacts on water resources has focused exclusively on the Abu Dhabi Emirate, however the other six emirates have a varying share in the overall mix of water resources and management arrangement, and will also be impacted in their agriculture, human health, coastal zones and infrastructure. The sub-project results will therefore help identify specific management strategies that can increase the resilience of the UAE's water resources against climate change and economic development.

Furthermore, rainfall patterns in the Hajar Mountains, which annually recharge groundwater levels in the Al Ain region, could be adversely affected by climate change. This may lead to a gradual decline in aquifer productivity and raises concerns about the long-term sustainability of the region.

By using the findings from the regional climate modeling sub-project, the **Al Ain Water Resources** sub-project will explore sustainable water resource management strategies in Al Ain relative to a set of regional climate





change and socioeconomic development scenarios. Once completed, the proposed research will identify specific management strategies that can enhance long-term sustainability and resilience to climate change in the area.

Coastal Zones

Looking to the Arabian Peninsula's coasts, much of the region's population, infrastructure and economic activity is located in coastal zones and is vulnerable to climate change-induced sea level rise and potential storm surges that would accompany more frequent extreme weather events. Climate change could be a primary cause for the increasing degradation of such coastal areas, which leads to an increase in coastal erosion and the inundation of productive lands and infrastructure. A vulnerability assessment of the inundation extent associated with plausible **Sea Level Rise** scenarios will produce a better understanding of the specific coastal zones in the region which are most at risk. Once completed, the proposed research will inform potential adaptation strategies that could be implemented within a regional cooperation framework.

Similarly, past studies of climate change impacts along coastal zones in the UAE have been undertaken from a long-term planning perspective. However, planners in the UAE are in need of actionable information amenable to their near-term planning horizons. One vulnerability assessment approach that can meet this need is the **Coastal Vulnerability Index**, an approach that has been applied in numerous other settings to good practical effect. Such an index can provide insights on issues of near-term concern to planners such as the relative risk to existing infrastructure, recommendations for coastal

protection priorities, strategic land development offset zones, and potential set-aside areas for future protection. Development of a coastal vulnerability index incorporates a range of factors that affect near-term coastal zones risks, including but not limited to current and projected levels of sea level rise. Once completed, the proposed research will inform potential coastal adaptation strategies that could be implemented within either an existing or enhanced coastal planning framework.

Socio-economic Systems

The production of potable water from seawater is highly energy intensive – and this is particularly true in the Arabian Gulf with its high salinity levels. Most desalination takes place at dual-purpose power stations that are able to co-produce electricity and desalinated water, however, there are significant environmental impacts associated with these 'business-as-usual' practices – highly saline brine and treatment chemicals are discharged directly into the Gulf, causing harm to marine biodiversity. With climate change, the Gulf may become even more saline due to increased evaporation from higher temperatures, reduced vertical circulation due to reduced shamal winds, and increased near-shore salinity due to permanently flooded salt-crusting sabkha areas from sea level rise. These potential impacts, combined with that of desalination plants in the small, shallow and slow-circulating Gulf, could lead to an environmental tipping point in which the salinity properties of Gulf waters exceed the coping thresholds of corals, fish species, and other marine life. **The Desalinated Water Supply** sub-project can be used to develop alternative plans that can lessen negative impacts to Gulf waters.





Following the same Socio-economic Systems theme, the global food crisis of 2008, with its price spikes and subsequent unrest in several countries, represents an important challenge to the development of food security plans capable of contributing to human well-being and social harmony. Even without the additional threat posed by climate change, the global food crisis exposed vulnerabilities associated with agricultural productivity, international trade markets, and food commodity prices. With climate change, current challenges of soil destruction, inadequate water supply, and stagnant monocultured crop yields will likely be seriously exacerbated, leading to reduced crop productivity in food-exporting countries, steady increases in food prices, and increased food insecurity around the world. The UAE, a country that is heavily dependent on food imports, is particularly vulnerable. The combination of declining agricultural productivity in food-exporting countries, tightening world food markets, and price speculation pressures could lead to recurrent food price spikes in the future, with resulting social disquietude, particularly among the UAE's large expatriate laborer workforce who would need to spend a growing share of limited income after remittances for food. An integrated adaptation assessment that accounts for climate change impacts on imported agriculture, international food trade, and economic livelihoods will help identify the country's options for increasing long-term **Food Security** under climate change.

Finally, within the same theme, several notable initiatives have been undertaken to reduce the carbon footprint of energy consuming activities in Abu Dhabi. While many of these have attempted to quantify the reduction in greenhouse gas (GHG) emissions, there has not yet been a comprehensive assessment of the positive impacts that such measures can have on public health. An improvement in public health is considered a co-benefit of GHG mitigation, which is not typically accounted for in the cost of saved carbon. Other co-benefits associated with the implementation of policies and measures that reduce GHG emissions include improvements to macroeconomic, environmental and aesthetic conditions. Public health co-benefits are particularly important and include reductions in the incidence of, for example, respiratory illnesses, cardiovascular disease, and allergies from the reductions in air emissions. With continued progress in the Abu Dhabi emirate to expand and intensify GHG-reducing activities, these public health co-benefits will likewise increase. An improved understanding of the **Public Health Benefits of GHG Mitigation** can help to leverage policymaker support for continued investments, while also promoting public awareness of the benefits of sustainable development practices.



About AGEDI:

AGEDI facilitates access to quality environmental data that equips policy-makers with actionable, timely information to inform and guide critical decisions towards a sustainable future, with a focus on the Arab region, and based on systemic problems that exist around the world.

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All resources are available for download at

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