ABU DHABI STATE OF ENVIRONMENT REPORT 2017

EXECUTIVE SUMMARY
Perhaps our biggest achievement over the past 20 years is the growth of our collective knowledge on the state of our environment and anthropogenic impacts.
Introduction

This report serves as the Executive Summary for Abu Dhabi State of Environment Report (AD-SoER) 2017, which is an up-to-date analysis of the current status of key areas of Abu Dhabi’s environment.

From air quality to fisheries, AD-SoER 2017 is a journey in understanding the various dynamic elements and relationships that form what we currently observe as the state of the environment in Abu Dhabi Emirate.

About Abu Dhabi Emirate

Abu Dhabi is the capital emirate of the United Arab Emirates (UAE), a young federation of seven emirates which was founded in 1971. It covers around 67,000 km², accounting for 87% of the total area of the UAE, making it the largest of the emirates.

Abu Dhabi is bordered by the Arabian Gulf and the Emirate of Dubai to the north, the Kingdom of Saudi Arabia to the west and south, and the Sultanate of Oman to the east. The emirate’s climate is ‘arid’ or even ‘hyper-arid’, with a sub-tropical climate that is hot in summers and mild to cool in winters with sporadic rainfall.

Abu Dhabi’s Commitment to the Environment

Abu Dhabi Government is committed to preserving its environment and natural resources, in order to maintain the health of its people and economy. To achieve this ambition, the emirate ensures the protection of the environment and the preservation of its natural resources through on-going and future initiatives. This commitment is reflected in the Abu Dhabi Plan, which is the emirate’s strategic blueprint designed to guide its development and sustainable growth. It has 25 key goals, one of which is to achieve ‘a sustainable environment and the optimal use of resources to preserve natural heritage’.

To achieve the stated goals of the Abu Dhabi Plan, a range of programmes across all vital sectors is to be implemented between 2016 and 2020. Five of these programmes relate to the environment and include: improving the quality of air and marine water; limiting the impacts of climate change; preserving biodiversity, fisheries and soil resources; managing waste; and managing water resources, including groundwater.

DPSIR Framework

The DPSIR framework used for AD-SoER 2017 provides an assessment of the different aspects of the environment such as air, water, land and biodiversity, as well as certain key issues such as climate change, fisheries, waste and forestry. It provides information on the scale and trend of any observed changes to the state of the environment, as well as the likely impacts of the state and the effectiveness of any responses. To gain this level of understanding, the Environment Agency – Abu Dhabi (EAD) has been monitoring various aspects of the environment over the last 20 years.

However, data without analysis is of limited value. Thus, the analytical framework of DPSIR (Driver-Pressures-State-Impact-Responses) has been employed to review the data gathered and draw conclusions as to causal relationships leading to the observed state of the environment in Abu Dhabi Emirate.

This allows the following to be assessed:

Drivers: The primary forces driving environmental change, namely social, demographic, legal, policy and economic developments and the corresponding changes in lifestyles, consumption and production patterns.

Pressures: The human and natural factors causing environmental change.

State: The physical, chemical or biological conditions and trends of the environment.

Impact: The implications of environmental change on society’s welfare, through the effects of those changes on ecosystems, human health and the economy.

Responses: The responses from organisations and individuals to address this change and their effectiveness.

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The development of AD-SoER 2017 was led by experienced Emirati staff within EAD, undergoing multiple layers of stakeholder participation and consultation. Stakeholders included Abu Dhabi Emirate entities, federal entities, NGOs and academia. During the compilation of AD-SoER 2017, a new generation of young Emiratis was trained in order to be able to continue the assessment of the state of Abu Dhabi Emirate’s environment in the future.

The AD-SoER 2017 comprises two main parts:

ENVIRONMENTAL ASPECT

| SOIL RESOURCES | FISHERIES |
| WATER | FORESTRY |
| MARINE WATER QUALITY | WASTE |
| BIODIVERSITY |

Further details and links to data for each of these areas can be found in the main AD-SoER 2017 as well as on EAD’s Enviro-portal (http://enviroportal.ead.ae/).
Driving Forces of Environmental Change

There are many natural drivers that put pressure on the environment. However, it is anthropogenic (human) influence that is the root cause of much of the observed negative environmental change in Abu Dhabi Emirate. Much of this change has been brought about by a few macro or common drivers. In addition, each of the main environmental components and priority issues has specific drivers that will be covered in their respective sections of the report.

To avoid undue repetition in AD-SoER 2017, these common drivers are described together in one section rather than repeated throughout.

The main drivers described below are an increasing population and economic growth. These drive the pressures exerted on the environment primarily through increasing the demand for natural resources. In addition, pressure from increasing pollution affects the state of the environment with potential adverse impacts.

The emirate aims to deal with such pressures by acting as a leader in the efficient use of resources through the Abu Dhabi Plan.

Demographic Drivers
The population of Abu Dhabi Emirate is 2,784,490 (2015 mid-year estimate), over 14 times greater than in 1976 and almost twice that in 2005. The main reason for this rapid growth has been the influx of expatriate workers required to meet the emirate’s development needs. Today only 19% of the country’s inhabitants are Emirati nationals, and more than 60% of the population is urban.

Any growth in population causes greater pressure to be put on the environment through increases in demands for resources and increases in waste and pollution. There is an urgent need to ensure greater efficiency in the utilisation of resources in order to minimise the additional pressures felt by the environment.

Economic Drivers
Economic growth is the result of higher production and consumption levels and is an important driving force behind the depletion of natural resources and the generation of pollution.

After oil exports from the UAE began in the 1960s, the Gross Domestic Product (GDP) of the Emirate of Abu Dhabi increased very rapidly and continues to grow. The emirate contributes about 60% to the country’s GDP, which is one of the highest per capita in the world.

Recently, Abu Dhabi has set a number of economic policy priorities to diversify its economy into non-oil sectors. Part of the future economic growth will be based on the development of heavy, export-oriented industries, such as metals, which require abundant energy to be competitive in international markets.

Such demands for energy mean that unless it comes from environmentally benign sources, extra pressure will be put on the environment in the form of additional emissions and discharges.

Scientific & Technological Drivers
The development of scientific knowledge can have a profound impact on the environment for good or bad. For example, advances in water extraction technologies contribute to the depletion of groundwater resources.

If technology facilitates resource uses, it can potentially also increase pressure on the environment by speeding up the rate of extraction.

The application of science to the development of cleaner technologies can contribute to reducing the carbon and energy intensity of economic activities. Advances in desalination technology (based on solar energy being tested by Masdar) or the deployment of more efficient cooling systems (as recommended by the Executive Affairs Authority) may also contribute to reducing the emirate’s carbon footprint, as indeed will the development of nuclear energy for peaceful purposes by the Emirates Nuclear Energy Corporation.

Public Policy Drivers
Like scientific and technical drivers, public policy drivers can have both a positive and negative impact. For example, policies such as subsidies for resource use can encourage inefficient usage, while those that encourage the uptake of renewable energy sources can help to reduce emissions and environmental impact.

Abu Dhabi Government is striving to ensure policies are in place to decouple economic growth from increasing resource consumption and emissions.

Studies indicate that carbon represents more than 80% of the UAE’s ecological footprint. Public policy therefore needs to focus on reducing the amount of energy required for cooling, desalination of seawater and transportation in order to decouple growth from environmental degradation.
Part 1: Environmental Themes

AIR QUALITY

Drivers
- Population growth
- Demand for resources
- Rapid economic development
- Subsidised energy
- Lack of options for low emissions transport

Pressures
- Industrial activity (including oil and gas)
- Construction activity
- Transportation
- Climate change
- Dust events

State
- High concentration of particulate matter (dust)
- Ground level ozone above limits
- Sulphur dioxide within limits but increasing
- Hydrogen sulphide concentrations causing odour nuisance

Impacts
- Poor health
- Infrastructure requiring constant cleaning
- Poor visibility
- Loss of working days

Responses
- Better regulation and enforcement
- Increased monitoring
- Science and research
- Awareness
- New technologies
- Public policy

State of Air Quality
Particulate matter (dust) and ozone are the pollutants which cause most concern in the emirate. Due to the arid nature of the region, background levels of particulate matter are naturally very high and concentrations increase dramatically during dust events.

Ground level ozone concentrations currently exceed UAE limits, with an observed gradual increase recorded over the past few years.

Sulphur dioxide (mainly emitted from fuel combustion in transportation; electricity production; water desalination; and oil and gas processing) is within UAE limits in most of the ambient air quality monitoring network. However, an increase in concentrations has been observed over the past few years in the Al Dhafra Region.

Hydrogen sulphide concentrations in the emirate are not at harmful levels to the public. However, frequent episodes of odour nuisance due to hydrogen sulphide have been recorded. Nitrogen dioxide and carbon monoxide remain below the limits set in the UAE ambient air quality standard.

The emirate’s neighbours, both within the UAE and internationally. However, there is currently insufficient information available to assess this.

Ground-level ozone is a challenge because it frequently exceeds national ambient limits. As a secondary pollutant, its precursors are emitted from oil and gas activities, some industrial processes, petrol stations, transport and biogenic sources, such as vegetation.

It is likely that climate change phenomena may also exert pressures that could, in the near future, exacerbate air quality degradation.

Studies indicate that outdoor air pollution can have serious impacts on human health, although more research must be done to understand the environmental impacts in the Gulf region. Poor air quality has significant socio-economic impacts, with associated costs for health care, loss of working days, poor visibility impacting transportation activities, and cleaning and maintenance of infrastructure during dust events.

Abu Dhabi Emirate is responding to instances of poor air quality by working on a cross-sector framework to improve air quality. It has developed an air quality monitoring station network within and between the emirates, and has funded awareness campaigns, plus a number of projects to generate new knowledge about air quality. Continuous efforts in monitoring, regulations, enforcement, environmental planning, research and awareness will lead to a better quality of life and enhanced air quality.

Provided that all of the planned strategies and programmes remain implemented and the advances in technology continue, then it is anticipated that the emirate can continue to grow its population and economy while minimising anthropogenic impacts on air quality.

Drivers & Pressures
The pressure on Abu Dhabi Emirate’s air quality primarily comes from industrial pollution, transport emissions, population increase and dust events.

A significant amount of emissions come from facilities involved in oil and gas production and processing; electricity production; water desalination; and industrial processes. Urban centres, motor vehicle traffic and marine vessels are also contributors to overall emissions. There may be further pressure from emissions from localised activities, such as construction and other industrial processes.
State of Soil

Soil provides ecosystem services for a large part of terrestrial life. Soil degradation reduces its ability to perform such services and is the main threat to soils in Abu Dhabi Emirate.

The total area of soil naturally degraded, to varying extents, in Abu Dhabi Emirate is equal to 57,200 km², which is about 85% of the emirate’s total area of 67,340 km².

Salinisation of soil due to groundwater abstraction and/or irrigation with saline groundwater is a significant situation on many Abu Dhabi farms. This is further complicated when associated with waterlogging problems and an increase of calcium carbonate. About 90% of agricultural farms in Al Ain are affected by salinity.

Drivers & Pressures

Given the emirate’s expanses of sandy soil, wind erosion is a major driver of natural irreversible land degradation in Abu Dhabi Emirate. This can be combated locally through forest plantation, however, this response should be balanced against any increase in the demand for water resources.

Currently, salinisation is the main degradation problem along coastal areas of Abu Dhabi Emirate. Natural causes are attributable to seawater intrusion and excess salt in marine sediments. Pressures on soil which are attributable to anthropogenic causes are mostly due to irrigation. Other anthropogenic pressures exerted on soil resources include compaction, excavation, landfilling and over-grazing.

It is likely that climate change phenomena will also exert pressures that could, in the near future, exacerbate soil degradation through storm erosion and drought.

Impacts

The impacts of soil degradation include soil erosion, salinisation and waterlogging. In economic terms, farm abandonment and rehabilitation, road maintenance and the repair of irrigation systems require investment and therefore economic loss.

Currently, there is no data on the possible social effects of soil degradation and contamination in Abu Dhabi Emirate. However, mining and agriculture can expose the population to heavy metals and pesticides which have leached into the soil.

Response

A number of responses have been initiated to mitigate soil degradation. These include policies to manage groundwater abstraction, more effective land-use planning, programmes protecting biodiversity, and the introduction of investigations and guidelines. EAD is currently developing a Soil Quality Monitoring Programme for industrial, residential, and agricultural land. The programme will determine areas of concern. The Soil Survey Project is an enabling factor: conducted in 2009, this emirate-wide survey led to the formation of the UAE Soil Information System and the Soil Archiving Facility, which stores soil samples under optimum controlled conditions, preserving their scientific value over time.

Outlook

Looking ahead, while there is data regarding soil in Abu Dhabi Emirate, there are many gaps to bridge in terms of regulating and protecting soil from contamination and degradation. However, this issue is marked as a priority and the aforementioned plans, such as soil monitoring programmes, are already underway.

FIGURE 3 Agriculture Suitability
WATER RESOURCES

KEY INDICATOR OF CURRENT STATE: 2,013 Mm³ GROUNDWATER ABSTRACTED IN 2015 (PROJECTED VALUE)

STATE
- Declining quantity and quality of groundwater reserves
- Loss of natural vegetation/ecosystems
- Heavy dependence on decreasing groundwater reserves
- Potential impacts to human health and marine environment from increased emissions/discharges
- Economic impact from inefficient use of water

IMPACTS

GROWTH

IMPACTS

• Population growth
• High demand for resources (particularly irrigation water – ground and desalinated)
• Rapid economic development
• Economic incentives such as subsidies for agriculture

DRIVERS
- Investment in innovative, renewable energy-based technologies for water use and production
- Better demand-side management
- Better integrated water management
- Improving consumer awareness
- Better regulation and enforcement

PRESURES
- Irrigation for agriculture and forestry
- Domestic consumption
- Industrial activity
- Inadequate infrastructure
- Climate change

RESPONSES

GROUNDWATER
- Water use and production
- Desalination and power facilities installed
- Marine environment

DESALINATED

TREATED WASTE

WATER RE-USED

TOTAL

60.31 %
34.57 %
5.12 %
100 %

Desalination has many impacts on biodiversity, including, entrainment of larvae during the seawater intake; emissions to air during processing; and discharges to the marine environment, such as concentrated brine and hot cooling water, as well as chlorine and copper.

Potential impacts have been fuelled by the growing demand and expansion of agriculture, with a view to making Abu Dhabi less dependent on imported food.

Inadequate infrastructure is also a pressure on water resources, with losses from the system contributing to the demand to produce more water. Inefficient irrigation practices are also an important factor in this over-consumption.

Over-consumption of groundwater is impacting groundwater quality and quantity, while desalination and waste water treatment practices can potentially impact human health through pollutant emissions and marine life through brine discharge.

Desalination is the regulator for groundwater in Abu Dhabi Emirate. Initiatives have been designed to relieve the pressure on groundwater from agriculture. These include: reductions in subsidies available for water, innovative irrigation and agricultural practices, including the use of TSE for agricultural purposes, and a ‘Crop Calculator’, which determines optimal water use by various crops.

Infrastructure improvement initiatives will help to minimise losses to the system, while projects such as the Strategic Reserve will ensure that there is a contingency volume of groundwater available in times of crisis.

As population and industrialisation levels rise in Abu Dhabi Emirate, the demand for water is also expected to continue to increase. It is anticipated that if the abstraction of groundwater continues at the current rate then there may be only a couple of decades of groundwater suitable for agriculture and forestry remaining in certain areas of the emirate.

However, a focus on resource efficiency and reducing the emirate’s water footprint will help to conserve what remains of this resource.
**MARINE WATER QUALITY**

**Drivers & Pressures**
- Population growth
- Demand for resources
- Coastal development
- Lack of infrastructure
- Discharges into marine waters
- Atmospheric deposition
- Dredging and filling
- Industrial facility waste
- Dredging, filling
- Ballast water discharge
- Desalinisation and treatment
- Economic development
- Insufficient infrastructure
- Climate change
- Urbanisation
- Increased population

**State of the Marine Waters of Abu Dhabi Emirate**
- Generally good, apart from certain confined areas
- Increasing eutrophication due to industrial and treated wastewater discharges
- Fish kills and beach closures
- Increase in harmful algal blooms
- Chlorophyll-a
- Nutrients (nitrate and phosphate)
- Algal blooms
- Microbial contamination
- Site-specific factors

**Impacts**
- Changes in pH, temperature, clarity and salinity can also cause impacts to coral communities, which, if destroyed, may have important implications for other marine life. Microbial contamination and site-specific eutrophication in confined areas such as channels and marinas can pose a risk to human health and may result in beach closures. This may also have socio-economic impacts on recreation and tourism.

**Expressions**
- A robust regulatory framework
- Need for better regulation of eutrophication
- A need for better regulation of microbial quality
- High water and sediments standards
- Coastal development
- Increase in harmful algal blooms
- Fish kills and beach closures
- Emergency preparedness plans
- A robust regulatory framework

**Response**
- The Government of Abu Dhabi aims to implement a robust marine water quality programme to protect human health and the environment, by developing and enforcing regulations and policies. Response plans and emergency preparedness solutions are in place for emergency situations, and infrastructure projects such as STEP (Strategic Tunnel Enhancement Programme) will help to minimise the chance of emergencies occurring. Finally, a crucial response is to increase both stakeholder and public awareness of potential threats and their solutions.

Existing responses include the launch of the Marine Water Quality Monitoring Programme (MWQMP) in 2006, designed to provide an early warning forecast for harmful algal bloom formation. A study, which recurs every five years, aims to investigate marine water and sediment quality across all of Abu Dhabi Emirate’s territorial waters, ambient quality limits for marine water and sediment, based on international standards and MWQMP research, and the regulation of industrial facilities.

**Drivers & Pressures**
- Drivers
- Recreational and tourism
- Economic development
- Coastal development
- Insufficient infrastructure
- Climate change
- Urbanisation
- Increased population

**Impacts**
- Changes in pH, temperature, clarity and salinity can also cause impacts to coral communities, which, if destroyed, may have important implications for other marine life. Microbial contamination and site-specific eutrophication in confined areas such as channels and marinas can pose a risk to human health and may result in beach closures. This may also have socio-economic impacts on recreation and tourism.

**Responses**
- A robust regulatory framework
- Need for better regulation of eutrophication
- A need for better regulation of microbial quality
- High water and sediments standards
- Coastal development
- Increase in harmful algal blooms
- Fish kills and beach closures
- Emergency preparedness plans

**Outlook**
Pressure on the marine environment in Abu Dhabi Emirate continues to rise, so it is important to maintain and enhance monitoring and preparedness programmes to tackle any emergencies.

It is expected that climate change will impact marine water quality in the emirate by increasing temperature, salinity and acidity. The implications of this for marine life are currently under investigation.
Biodiversity

Drivers
- Population growth
- Demand for resources
- Rapid economic development

Pressures
- Habitat loss, alteration, and fragmentation (on coast in particular)
- Construction activity
- Tourism activity
- Pollution
- Climate change
- Waste

State
- Over 3,700 known species
- Less than 2% of species are threatened (excluding invertebrates)
- 147 Invasive Alien Species (IAS) documented

Impacts
- Displacement of native species by IAS
- Potential loss of ecosystem services due to decline in key species
- Loss of cultural/intrinsic values

Responses
- Ex-situ conservation programmes
- Re-introduction programmes
- Protected area network

State of Biodiversity
Abu Dhabi Emirate has 3,787 terrestrial and marine species. While many face threats, less than 2% are listed as threatened under the International Union for Conservation of Nature (IUCN) Red List. Most species are considered stable, although a few have declined in both extent and population. Currently, there are 147 Invasive Alien Species (IAS) that exist in Abu Dhabi Emirate’s terrestrial and freshwater environments. IAS colonise quickly, competing with native species for resources, which exerts pressure on the native species.

Drivers & Pressures
Population growth and an increase in urbanisation and industrialisation cause habitat loss and fragmentation. Additional factors exerting pressure on biodiversity in Abu Dhabi Emirate include: pollutants; the exploitation of natural resources (such as fishing); illegal animal trade; the introduction of IAS; and growth of construction activity and the resultant waste. Pressure from climate change, in particular, may be acute, as a rise in sea levels could destroy coastal habitats for nesting birds and turtles, while increased sea temperatures can lead to coral bleaching and knock-on effects on other biota. Afforestation also exerts pressure on biodiversity, by drawing on groundwater resources that are no longer available to native fauna and flora.

Impacts
A loss of biodiversity may impact the culture, traditions and values of Abu Dhabi Emirate. This includes an impact on cultural activities, such as the hunting of traditional prey species like the houbara, or the degradation of critical habitat which impacts species including turtles, dugong and fish stocks.
Ecosystem services, such as pollination by insects, may also be affected if certain key species are lost.
The loss of apex predators, such as sharks, from ecosystems may have dramatic impacts on the rest of the system.

It is also possible that disease vectors and pest species may migrate into Abu Dhabi Emirate as a consequence of climate change.

Responses
Abu Dhabi Emirate has 19 protected areas (13 terrestrial, 6 marine), which cover nearly 29% of the terrestrial and marine biomes. Some sites are of international importance, including Manama Biosphere Reserve and Al Wathba Wetland, which was the first area in Abu Dhabi to be declared on the Ramsar List of Wetlands of International Importance. The emirate is making excellent progress towards helping the UAE reach the Aichi 2020 targets for protected areas under the Convention on Biological Diversity, to which the UAE is a signatory.
In addition, there are a suite of ex-situ conservation programmes which have the singular aim of conserving specific threatened species, such as captive breeding and release programmes for the Houbara Bustard and Arabian and Scimitar-horned Oryx.

Other responses include programmes on important and threatened species, such as long-term research and monitoring, as well as the use of modern technologies such as satellite tracking, geo-location, mobile data and drones. For future responses, frameworks and strategies to improve the status of biodiversity will be aligned with pre-existing programmes. It is vital to engage with stakeholders and local partners to enforce laws and regulations which protect and conserve Abu Dhabi Emirate’s biodiversity.

Outlook
The biodiversity of Abu Dhabi Emirate has become more vulnerable over the last few years than ever before. In terms of future solutions, it is time to coalesce research and transform it into tangible conservation efforts that actively tackle issues including human impact, climate change and the impact of IAS, and adequately resource protected area management.
On-going responses will focus on sustainable development and improving policies and regulatory frameworks, as well as improving the conservation status of threatened species.
Part 2: Priority Issues

Climate Change

**Drivers**
- Population growth
- Demand for resources
- Rapid economic development
- Further pressures from agriculture and waste

**Pressures**
- Anthropogenic GHG emissions from power plants, water desalination facilities, oil facilities, motor vehicles and industries
- Further pressures from agriculture and waste

**State**
- 17.6% increase in GHG emissions locally over two-year period (2010 to 2012)
- The total CO2 per GDP for 2012 is 0.19 kg CO2/GDP (AED, at 2005 constant prices)

**Impacts**
- Air and sea temperature increases, causing deterioration of natural ecosystems
- Rises in sea level leading to inundation of coastal habitats and infrastructure
- Increases in seawater acidity and salinity, leading to coral bleaching and die-off as well as associated impacts on other species

**Responses**
- UAE's 27% clean energy goal by 2021
- Mass transit infrastructure
- Tariff reform
- Knowledge and public awareness
- Green building regulations and efficiency standards
- Adaptation measures such as planting mangroves for coastal protection

**Key Indicator of Current State:** 40.55 TONNES/CAPITA CO2 (BASED ON MID-YEAR REVISED 2012 POPULATION ESTIMATES PROVIDED BY SCAD)

**State of Climate Change**
Climate change is already being felt globally. Effects include: higher air and water temperatures, lower precipitation levels; and a rise in sea level, seawater acidity and salinity.

Acidity levels in the Arabian Gulf are increasing at a faster rate than most other oceanic waters around the world. Abu Dhabi Emirate’s marine biodiversity is impacted by a variety of stressors, which include coastal development, over-exploitation, habitat fragmentation and pollution.

**Drivers & Pressures**
The main drivers for the increasing pressure exerted by greenhouse gas (GHG) emissions in Abu Dhabi Emirate are due to rapid growth in the population and economic development, coupled with an ever-increasing demand for water and energy. The main source of GHG emissions is the combustion of fossil fuels for water, electricity and transportation. In 2012, CO2 emissions from fuel combustion in the emirate reached 35.7 tonnes per capita (based on revised mid-year population estimate from SCAD).

**Impacts**
Abu Dhabi Emirate is particularly vulnerable to the impact of climate change due to its extreme arid climate and low-lying coastal areas. The emirate’s exposure to storm-induced erosion and flooding could be affected, with concomitant impacts on coastal infrastructure and habitats.

The Arabian Gulf is already one of the most stressed marine environments on earth. Changes in habitat quality and primary production may also affect productivity for fisheries. Increased salinity, temperature and acidity levels are all expected to take their toll on the marine environment as a result of climate change.

Increased aridity and recent climate-driven changes in vegetation are also likely to impact local agriculture, bird species and a wide range of desert animals. Climate change may also have significant impacts on public health, the specificities of which are the subject of ongoing research.

**Response**
The Government of the UAE is fully committed to the United Nations Framework Convention on Climate Change negotiating process. The UAE National Agenda has set a target for clean energy to contribute 27% of the country’s total energy mix by 2021. The UAE Energy Strategy aims to increase the contribution of clean energy to 50 percent by 2050.

In recent years, new policies have been introduced in the electricity and water sector in Abu Dhabi, which aim to cut consumption through a reduction of subsidies and the introduction of incentives to increase end-user efficiency. New policies have also been introduced in the transportation sector to reduce emissions through a comprehensive surface masterplan, low emission zones and vehicle efficiency standards.

**Outlook**
Existing plans and proposed strategies for sustainable development ensure that Abu Dhabi Emirate will achieve significant GHG reductions in the mid-term. The emirate has undertaken a number of measures to tackle this issue, including: tariff reform, green building regulations and efficiency standards; district cooling, a new fuel pricing economy, and a federal freight network.

By 2030, the largest potential for emission reduction is through combined electricity and water production. By the year 2020, nuclear and renewables will cover approximately 30% of the emirate’s energy demand, avoiding 22 million tonnes of CO2 eq.

All of these factors may go some way towards mitigating the impact of climate change. However, the potential for change should not be underestimated and adaptation to the impacts of climate change should be emphasised in the future development plans.
FISHERIES

DRIVERS
- Population growth
- Demand for resources
- Rigid economic development
- Tourism
- More efficient fishing technology
- Lack of previous fishing limits

PRESSURES
- Over-capacity in fishing fleet
- Coastal development
- Industrial activity
- Tourism activity
- Climate change

STATE
- There has been a decline in the status of fisheries resources by an estimated 90%.
- 14 species, accounting for 93% of the commercial catch, are caught unsustainably.
- Unexploited adult stock size.

IMPACTS
- Social impacts (jeopardising contribution to future food security, job opportunities, recreational value and tourism opportunities).
- Environmental impacts (potential reduction in ecosystem function, possible far-reaching effects on marine domain).

RESPONSES
- Arabian Gulf Fisheries Resource Assessment Survey
- Seasonal fishing bars
- Fishing gear regulations
- Licensing system
- Pioneering the UAE Sustainable Fisheries Programme

State of Fisheries

Fisheries are an integral part of Abu Dhabi Emirate’s heritage, and some traditional fishing methods are still used today. Currently, there are 147 licensed and active lansh (31% of the Abu Dhabi fleet) and 321 tarad (69% in the Emirate of Abu Dhabi with the recreational fishing sub-sector equating to just under one third of the commercial catch. Fishing is not a major contributor to the country’s GDP, and more than half of the UAE’s seafood is imported, but it has cultural significance to the Emirati population.

The state of fisheries is assessed against two indicators: The Spawning Biomass per Recruit (SBR) index, and the Sustainable Catch (SC) index. Both indicate a dramatic decline in the state of the emirate’s fish stock.

The SBR indicates that the stock level was lowest for hamour, a key species, recording only around 4% of the unexploited adult stock size.

The 2015 SC index indicates that over 90% of fish are unsustainably caught, the result of over 30 years of overfishing, with 14 species assessed as severely over-exploited.

Drivers & Pressures

The population in Abu Dhabi Emirate has doubled over the last ten years, creating an increased demand for fish. Coastal development has led to the loss of critical habitats, such as mangroves and seagrass that serve as nurseries for many fish species. Salinisation, acidification and climate change affect species’ reproduction and juvenile survival, as well as coral, another critical habitat. The illegal fishing of prohibited species, violation of size limits or fishing gear restrictions, plus exploitation superseding sustainable limits, all contribute to fishery decline.

Impacts

There are numerous impacts from the current over-exploited state of Abu Dhabi Emirate’s fisheries. These include: threats to a rich cultural history, which is now jeopardised for future generations; future fisheries’ contributions to food security, employment, recreational value and tourism. Depletion of the emirate’s fisheries also has an inevitable impact on ecosystem function.

Key Indicator of Current State: 7.6% of fish harvested sustainably in 2015

The UAE Sustainable Fisheries Programme (2015) set out a comprehensive four-year plan which incorporated international and national targets, aiming for 70% of resources to be harvested sustainably by 2021. In addition, there are moves to promote aquaculture as a means of economic diversification, as well as to relieve some of the pressure on natural fish stocks.

Outlook

Abu Dhabi Emirate’s fisheries are at a critical tipping point. The ecosystem cannot sustain current levels of fishing pressure, which is five times the sustainable level. If current exploitation levels remain as they are, this will likely result in further declines in the state of the emirate’s fisheries within the next five years, potentially leading to eventual collapse, with corresponding adverse social and economic effects. Even with the implementation of some management, collapse may occur within 10 years.

However, the implementation of a management plan that includes clear reduction targets (aimed at reducing fishing operations by at least the current amount of overexploitation), will likely result in the recovery of the emirate’s fisheries, and sustainability by 2030.
The forests of Abu Dhabi Emirate are a refuge for antelopes and ungulates, which use these forests to approximately 55,000 animals (from 12 different species). Abu Dhabi Emirate contains more than 540 afforested areas, which are distributed across different zones and habitats. Containing around 20 million trees, they cover 3.5% of the emirate. After agriculture, forests are the second largest consumer of groundwater in the UAE. The condition of forests is significantly influenced by the level of water salinity of groundwater, the properties of the soil in which the trees are grown and management practices at the site. Almost 79% of forests in Abu Dhabi Emirate, maintaining sustainable forests is dependent on human intervention. As such, considerable financial, energy and water resources are required to maintain them.

As part of the vision of the late Sheikh Zayed bin Sultan Al Nahyan to ‘Green the Desert’, forests were planted to cover several parts of the desert, to protect roads and urban areas from sand movement and to act as a refuge for wildlife. Abu Dhabi Emirate contains more than 540 afforested areas, which are distributed across different zones and habitats. Containing around 20 million trees, they cover 3.5% of the emirate. After agriculture, forests are the second largest consumer of groundwater in the UAE. The condition of forests is significantly influenced by the levels of water salinity of groundwater, the properties of the soil in which the trees are grown and management practices at the site. Almost 79% of forests in Abu Dhabi Emirate can be considered in good condition.

The forests of Abu Dhabi Emirate are a refuge for approximately 55,000 animals (from 12 different species of antelopes and ungulates), which use these forests to their advantage to tolerate harsh climatic conditions. Due to the anthropogenic nature of the presence of forests in Abu Dhabi Emirate, maintaining sustainable forests is dependent on human intervention. As such, considerable financial, energy and water resources are required to maintain them.

In order to keep the emirate’s forests alive, maintenance teams are required to operate various machinery, which has a CO₂ impact on the environment. The forests also require 214 million cubic metres of water per year, which are largely extracted from groundwater resources. This level of water extraction may exhaust groundwater resources within the next few decades. Wastewater can increase carbon storage in soils.

The outlook for artificial forests in the emirate of Abu Dhabi is uncertain. While they certainly have intrinsic value, this is at the expense of valuable water resources. With improved irrigation techniques and alternative sources of water such as TSE, it will be possible to reduce the demand for water, but how far remains to be seen.

In order to reduce the pressure on groundwater, 56 forests have been connected to treated sewage effluent (TSE) water alternatives. This response has resulted in increased vegetation cover, as treated wastewater can increase carbon storage in soils. There have also been pioneering efforts to manage wildlife population size in the emirate’s forests. There are future plans to deepen existing response solutions. The most crucial issues are the need to switch to clean energy, a reduction in water usage and a reduction in non-native trees. In order to increase the financial sustainability of Abu Dhabi Emirate’s forests, the government will encourage better management strategies, and develop agricultural activities and ecotourism projects.
There is currently a struggle to maintain pace with the sites. With an approximate increase of 32% in 2015, EAD is working towards remediation of illegal dumping which leads to gaps, conflicts and diversion of waste. There is a lack of standardisation across the UAE, and 2% to the sanitary landfill.

A total of 8.48 million tonnes of solid waste was generated: 99% non-hazardous waste and 1% hazardous waste. Generated 1.65 kg of municipal solid waste per day.

In 2015, the average person in Abu Dhabi Emirate terms of production, transformation or consumption. Drivers & Pressures

Population growth and economic development are the predominant causes of waste generation in Abu Dhabi Emirate. However, inadequate waste infrastructure is the key driver for the lack of proper waste management.

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Impacts

Dumping waste consumes energy, releases emissions and has potentially detrimental impacts on human health. Waste disposal is currently known to impact air quality and climate change, biodiversity, land (especially the soil quality) and groundwater.

Response

In response, EAD issued a set of waste management policies aimed at improving waste management practices and reducing the adverse impact on the environment.

Infrastructure investment includes the expansion of hazardous waste management facility, BeATT to manage hazardous materials from the oil and gas sector, and the construction of facilities to deal with naturally-occurring radioactive materials.

In alignment with the standards set by the International Atomic Energy Agency, the UAE is also designing a strategy for radioactive waste management.

Further responses to the problem of waste management include licensing, tariffs and customer services. For example, Tadweer has adopted a licensing system which is applied to commercial and industrial sectors.

Public engagement with sustainability and waste management has increased with the implementation of educational tools and activities to ensure outreach and communication with the community. This includes initiatives such as ‘paperless day’, an annual paper-free day which aims to reduce waste and raise awareness among the public.

Other initiatives include: Estidama, a sustainable development initiative which is promoted by the Department of Urban Planning and Municipalities (DUPM); and Saving Grace, a public awareness initiative to tackle surplus food waste.

The UAE and EAD have set targets to tackle waste generation sustainably by 2021 and 2020 respectively. The current regulatory framework will be expanded and implemented.

Development of an Integrated Waste Management Master Plan is underway, to achieve sustainable waste management and upgrade the infrastructure. Progress is being made in bio-solids management through regulation updates and improvement of license protocols, with tactics including regular quality monitoring.

Outlook

The outlook for waste in Abu Dhabi Emirate is promising if planned investment in waste infrastructure and maturing waste management systems with greater regulation and enforcement goes ahead.

The current average person in Abu Dhabi Emirate generated 1.65 kg of municipal solid waste per day. In 2015 there were 8.48 million tonnes of solid waste. The average person in the Emirate of Abu Dhabi generated 1.65 kg/day of solid waste in 2015.
Summary

Many positive steps are being taken in terms of policies to improve the environmental quality of Abu Dhabi Emirate. Significant achievements have also been made in the conservation of the emirate’s biodiversity. However, there are continued and growing pressures on the fragile environment of Abu Dhabi Emirate, largely as a result of rapid population increase and economic growth. While this growth may bring economic benefits to the emirate, unrestrained growth may put a strain on Abu Dhabi’s fragile environment, further deteriorating the precious natural capital and potentially causing adverse impacts on human and economic capital.

Examples of the pressures exerted on the environment include observable increases in pollutants such as sulphur dioxide (SO₂) and ozone (O₃). These are a result of emissions from sources such as transportation and from energy and water production. As such we can, and should, respond accordingly in order to limit the impacts of these pressures, particularly where they might have adverse impacts on human health.

However, we should not lose sight of the fact that Abu Dhabi Emirate can be naturally very dusty: while air quality in the form of high PM₁₀ (dust) levels might be poor, this is a natural state for the environment and one with which we must learn to live. Even so, we should endeavour not to add to the problem by controlling pressures that contribute to poor air quality, and focus on areas such as indoor air quality and its potential health impacts.

A decline in the state of the environment is demonstrated by groundwater resources in the emirate, which have decreased dramatically in both quantity and quality in many areas. Useable groundwater is limited. Only 3% is fresh and 18% brackish, with the remainder too saline to be able to use directly. Given the very low rate of aquifer recharge, it is expected that if current rates of extraction continue then this precious resource will be fully exhausted in due course. Therefore, there is an urgent need to develop appropriate responses that take into account societal needs as well as those of the environment.

Marine water quality is a prime example of the inextricable interconnectivity of which we need to be cognisant. If we increase the production of desalinated (marine) water in order to meet growing demands from population and economy, and to make up the shortfall from a depleted groundwater reserve, then we run the risk of exacerbating a decline in the quality of marine water. In turn, this also increases impacts on marine life, such as corals and fisheries. Furthermore, by burning fossil fuels to generate desalinated water, we also contribute further to climate change and all of its potential impacts.

Regarding fisheries, we have a very clear indication that this particular natural resource is in a critical state, with an observable collapse of fish stocks in the waters of Abu Dhabi Emirate. A great deal of work has been done to understand the reasons for this collapse and responses are currently being developed. Even so, it should be noted that it may take many years to see any improvements in the state of the emirate’s fisheries because these are natural systems and will take time to recover.

It is only by fully understanding the various Drivers, Pressures and Impacts, that we can develop appropriate Responses in order to maintain or improve the State of the environment in which we live.

The State of Environment Report for the Emirate of Abu Dhabi, of which this is the Executive Summary, provides much of the information and understanding required by decision makers to make informed choices and develop appropriate actions. There is always more to understand and greater insight to glean as we continue to monitor the environment in order to manage it as best as we can for this and future generations.
preserving our heritage · protecting our future