AGEDI
مبادرة أبوظبي العالمية للبيانات البيئية
Abu Dhabi Global Environmental Data Initiative

Abu Dhabi Global Environmental Data Initiative (AGEDI)

Abu Dhabi Blue Carbon Demonstration Project

Abu Dhabi's Blue Carbon Policy (Climate Policy Assessment Report)

GRID ARENDAL

هيئة البيئة - ابوظبي
Environment Agency - ABU DHABI

The Abu Dhabi Blue Carbon Demonstration Project

The Abu Dhabi Blue Carbon Demonstration Project was commissioned by the Abu Dhabi Global Environmental Data Initiative (AGEDI) on behalf of the Environment Agency – Abu Dhabi (EAD) to help improve our understanding of the services the Emirate's coastal and marine ecosystems, provide, with a focus on carbon sequestration and storage. In addition, the outcomes endeavor to contribute to the improved understanding of this relatively new concept on both a regional and international level.

The project ultimately aims to inform a science-based approach to making decisions through policies and appropriate management, in particular in relation to sustainable ecosystem use and the preservation of their services for the current and future generations.

The project outcomes are highlighted in a series of project reports (see below). To achieve a comprehensive understanding of the project it is recommended that all project reports be read in their entirety. To gain an over view of the project the *Blue Carbon Ecosystems in Abu Dhabi* report is suggested. The project reports (each with its own Executive Summary) include:

- **Baseline Assessment Report: Coastal Ecosystem Carbon Stocks**
  This includes the details of how baseline Blue Carbon stock was quantified in Abu Dhabi, as well as results, analysis and recommendations for the future management and protection of these ecosystems.

- **Spatial Data Assessment Report**
  This includes details and results of an assessment of spatial coverage of Blue Carbon ecosystems in Abu Dhabi, and how these can be viewed, assessed and updated through the Abu Dhabi Blue Carbon Mapping Toolkit.

- **Ecosystem Services Assessment Report**
  This includes a description of the further Blue Carbon ecosystems' services, and how this relates to their condition, their potential values, the importance of ecosystems integrity as well as present threats which could be addressed by focused management.

- **Abu Dhabi's Blue Carbon Policy (This Report)**
  This describes the outcome of a process to develop an integrated policy framework to sustain and enhance the productivity of blue carbon ecosystems in the Abu Dhabi Emirate, while contributing and supporting national/global blue carbon ecosystem management efforts. The resulting policy framework consists of 5 key components and 10 specific policy actions that build off other Blue Carbon Demonstration project outcomes and incorporate stakeholder perspectives.

- **Financial Feasibility Assessment Report**
  This includes a brief rapid financial feasibility assessments for carbon and ecosystem services credits, and a description of the financial perspective to the 3 recommended specific Options including a specialized compensation fund.

These are supported by:

- **Abu Dhabi Blue Carbon Mapping Tool**
  Includes: An online assessment tool which illustrates the latest ecosystem information and associated carbon stock data at http: bluecarbon.unep-wcmc.org

- **Building Blue Carbon Projects: An Introductory Guide**
  This outlines the components and approaches of existing Blue Carbon Projects of recommendations and basic principles of how to undertake a Blue Carbon Project, based on project experience.

The overall project findings are described in the Project Publication, which also has a separate Executive Summary:

Blue Carbon Ecosystems in Abu Dhabi

This is an overview of the BlueCarbon ecosystems in Abu Dhabi, their relevance in terms of carbon sequestration and other ecosystem services; and recommendations for their future management.

Additional project publications include:

- **Infographic:** Illustration of the relative sequestration and storage of carbon in Blue Carbon ecosystems, and their overall value in monetary terms;
- **Edible Postcard:** A summary of the valuable services provided by Blue Carbon ecosystems;
- **Monthly Newsletter:** Project updates and video footage;
- **Project Website:** Please visit: abudhabi.**bluecarbonportal.org**

Executive Summary

In recent years, increasing international attention has focused on the potential of coastal and marine vegetative systems as a new opportunity to sequester and store the greenhouse gas carbon dioxide (CO_2). Recent research around the world has highlighted the valuable role that coastal and marine ecosystems play in sequestering and storing CO_2. This has subsequently sparked international interest in the protection of these ecosystems as a tool for climate change mitigation.

"Blue Carbon" describes the carbon stored, above and below ground, within these coastal ecosystems. In recognition of Blue Carbon's potential for contributing to Abu Dhabi's efforts to confront climatic change, Environment Agency - Abu Dhabi (EAD) supported a Blue Carbon Rapid Pre-Feasibility Study, Blue Carbon: First level exploration of natural coastal carbon in the Arabian Peninsula (with special focus on the AUE and Abu Dhabi) – A Rapid Feasibility Study (AGEDI, 2011). The Project, facilitated by Abu Dhabi Global Environmental Data Initiative (AGEDI), included over 40 meetings with local, national, and regional authorities and with organisations from three countries in the Arabian Peninsula. The outcome confirmed that the region's Blue Carbon resources may indeed be significant, while also underscoring the role of Blue Carbon ecosystems in providing valuable environmental services as well as Abu Dhabi's natural and cultural heritage.

The Abu Dhabi's Blue Carbon Demonstration Project was designed to build upon these findings and has subsequently quantified the carbon stored in these ecosystems as well as the overall extent of Blue Carbon resources in the Emirate. In addition, the condition and value of the associated ecosystem services have been determined, both in isolation and combination with the carbon values.

Abu Dhabi's Blue Carbon Policy Document (this document) was inspired by these developments. To ensure that a broad range of views was taken into account in the development of this Policy, an Emirate-wide stakeholder consultative process took place from April to September 2013. The result of these consultations, in combination with the scientific findings from the Carbon Baseline Assessment as well as the Ecosystem Services, Geographic and Finance Assessments undertaken, was clear direction regarding the dominant themes that should characterise the Policy. At the broadest level, the purpose of the Policy is to build conservation of Blue Carbon ecosystems into the daily business of the Emirate, within the broader framework of environmental management. It seeks to provide those responsible for administering relevant activities with clear guidelines and policy direction to ensure that Blue Carbon ecosystems in Abu Dhabi including mangroves, seagrasses, salt marshes and algal mats as well as associated Blue Carbon ecosystems including coastal sabkha, are managed in a way that accounts for their local and global environmental benefits.

Furthermore, the Policy aims to set a standard of excellence in this area, from which other Emirates may benefit, and to act as a catalyst that can stimulate and facilitate private sector participation.

Abu Dhabi's Blue Carbon Policy report (this report), and the actions it describes, represents a compilation of the various actions needed to deliver the key strategic aims and objectives of the project:

- **Key aim:** to increase and sustain the productivity and integrity of Blue Carbon ecosystems within the Emirate of Abu Dhabi and beyond.

- **Key objectives:** to support the management of Blue Carbon ecosystems in Abu Dhabi through activities that improve management practices, develop enhanced knowledge networks, promote coordinated action across emirate-level instiutions, build local capacity, and support global actions;

- **Spatial scope:** At the Abu Dhabi level, to conserve, restore, and sustainably manage Blue Carbon ecosystems; at the a national (United Arab Emirates, UAE) level, to share data and information, promote coordinated management approaches; at the global level to invest in Blue Carbon conservation projects, support Blue Carbon accounting methodological development, promote best practices.

Stakeholder consensus emerged on five (5) key components that for the Abu Dhabi Blue Carbon Policy, including:

- **Improve information management systems***:* This refers to the development of a system for Blue Carbon ecosystem information management in order to facilitate better planning, analysis, and capacity-building. A foundation for this has been developed through the Geographic component of the Abu Dhabi Blue Carbon Mapping Toolkit. Achieving the policy goals in this category will help to ensure a sound scientific basis for subsequent management planning and Blue Carbon ecosystem policy updates;

- **Sustainably manage Blue Carbon ecosystems:** This refers to the development of a protocol for sustainable Blue Carbon ecosystem management. Such a protocol seeks to recognise that Blue Carbon ecosystems, and in particular the connectivity been these ecosystems, are a vital component of Abu Dhabi's natural environment and has a special role in relation to the Emirate's development agenda. Achieving the policy goals in this category will help to address and overcome the range of potentially competing perspectives on access to and development of Blue Carbon ecosystem areas through an ecosystem based management approach;

- **Enhance institutional coordination:** This refers to the enhancement of coordination arrangements across relevant Emirate-level and national governmental institutions. At present, there exist multiple entities with overlapping regulatory, policy, and/or decision-making roles that may pose future challenges for effective and efficient institutional

action affecting Blue Carbon ecosystems. Achieving the policy goals in this category will help to ensure that stable and collaborative institution arrangements are shaped;

- **Engage in and support international actions on Blue Carbon:** This refers to actions in support of the international community as it seeks to integrate Blue Carbon into the climate change negotiations and develop methodological approaches to quantify carbon fluxes and environmental services within Blue Carbon ecosystems. Achieving the policy goals in this category will help to enhance Abu Dhabi's role and reputation as an international leader in the area of Blue Carbon resource development and ecosystem management;

- **Promote public awareness of Blue Carbon ecosystem benefits:** This refers to the development of programmes that are aimed at increasing the awareness of the benefits of Blue Carbon ecosystems among the private sector and the public at large. Achieving policy goals under this category will lead to a better informed general public about the importance of Blue Carbon ecosystems, as well as strengthened capacity in key institutions to undertake the needed analyses and studies that contribute to better policymaking.

The operative elements of *Abu Dhabi's Blue Carbon Ecosystems Policy* Document are described in the form of the following ten (10) specific recommended Policy Actions:

- **Policy Action #1: Blue Carbon Ecosystem Observation Systems**
  This aims to strengthen existing Emirate-based observation systems to better understand the scope and function of Blue Carbon ecosystems, together with the nature and magnitude of past and current threats. This involves comprehensive surveillance, monitoring, mapping, analysis, documentation, and dissemination of collected information building upon the foundation laid as part of this project;

- **Policy Action #2: Greenhouse Gas Inventory Development**
  This aims to augment existing Emirate-based greenhouse gas (GHG) emission tracking systems to estimate and document carbon pools/fluxes in a spatially-dependent manner consistent with international methodological guidance. This will involve data sharing across institutions, database development, information management, documentation, and dissemination of the levels and rates of carbon pool storage in Blue Carbon ecosystems;

- **Policy Action #3: Blue Carbon Ecosystem Services Valuation**
  The objective here is to introduce economic valuation as a basis to account for the value of the non-market services that Blue Carbon ecosystems provide. It will leverage from the information developed in the Policy Action on Blue Carbon Observation Systems in conjunction with state-of-the art methods to determine the economic value of the many Blue Carbon ecosystem services that currently have an implied economic value of zero within Emirate-level financial planning frameworks;

- **Policy Action #4: Blue Carbon Ecosystem Management Objectives**
  This aims to establish Blue Carbon ecosystem management objectives that represent a consensus among Emirate-level/national government agencies, the private sector, and non-governmental organisations. The process of consensus-building will embed Blue Carbon ecosystem management within other marine, land, soil, water, air, biodiversity, climate change, and wildlife conservation policies, as well as economic and coastal development policies. It will also help to ensure that Blue Carbon ecosystem management is harmonised with overall national land use and maritime planning objectives and jurisdictional and legal responsibilities concerning Blue Carbon ecosystems clarification;

- **Policy Action #5: Blue Carbon Ecosystem Priority Areas**
  The objective is to identify priority Blue Carbon ecosystems for near-term management planning. Blue Carbon ecosystems, being attractive sites for development activities since the 1960s, have witnessed intensive coastal development activities, leading to habitat loss, fragmentation, and degradation. Given the recent emergence of Blue Carbon ecosystems' services in the international climate change policy debate, along with the growing body of knowledge on their values, there is currently no systematic way to account for this information as indicators that can help define priority areas;

- **Policy Action #6: Blue Carbon Ecosystem Management Plans**
  This aims to develop special management plans for the priority Blue Carbon ecosystems identified through the previous Policy Action (i.e., Policy 'Action #5). A management plan represents a way to introduce increased specificity in protecting significant Blue Carbon resources and resolving development and protection conflicts where Blue Carbon ecosystems affect the interests of multiple stakeholder communities. Such plans encompass the identification, study, and evaluation of functions to be protected, stakeholder values and interests, and development/investment requirements regarding protection and regulation;

- **Policy Action #7: Integration of Blue Carbon ecosystems within Plan Maritime 2030:**
  The aim here is to integrate Blue Carbon ecosystem institutional coordination needs within the Plan Maritime 2030 process. The integration of specific Blue Carbon-related perspectives offers an opportunity to propose specific institutional arrangements that can promote cooperation and harmonisation of institutional and regulatory boundaries regarding the management, protection and rehabilitation of Blue Carbon ecosystems. This integration is important because one of the final outputs of Plan Maritime 2030 will be a holistic, institutional coordination framework that enjoys broad support within key entities in the Emirate;

- **Policy Action #8: Bilateral Blue Carbon investment**
  This aims to expand existing donor assistance frameworks within Abu Dhabi and the UAE to account for the importance of Blue Carbon in national sustainable development strategies of countries with high-productivity Blue Carbon ecosystems. The integration of Blue Carbon related perspectives within the donor assistance agenda offers high profile

opportunities to engage in actions that are moving to the forefront of the international climate change negotiations;

- **Policy Action #9: International Secretariat for Blue Carbon**
  The objective is to establish an international Secretariat for Blue Carbon activities in the City of Abu Dhabi, with EAD as the host institution. As present, technical, policy, research and other activities are being undertaken within a context of a consortium of non-governmental organisations without a centralised coordinated structure. This Policy Action is driven by a range of factors including the recognition of the global management benefits that a centralised Secretariat would offer, the potential of such a Secretariat to accelerate and coordinate actions within the climate change negotiations, and the belief that AGEDI may be is uniquely positioned to lead such a unit given its ongoing collaboration with UNEP on Blue Carbon activities;

- **Policy Action #10: Promote awareness**
  It is essential that civil society groups and individuals operate from a common understanding about the role of Blue Carbon in meeting the challenge of climate change. This will help to mobilise public support for new policies. In particular, it will be important to reach out to young people. Children, youth and teachers represent the potential for a future citizenry be sensitised to the valuable role of these ecosystems. Raising awareness among this group will likely involve targeted awareness-raising events rather than updates to school curriculum.

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Abbreviations

ADNOC	Abu Dhabi National Oil Company
AGEDI	Abu Dhabi Environmental Data Initiative
CBD	Convention on Biologic Diversity
CfRN	Coalition for Rainforest Nations
CI	Conservation International
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
COP	Conference of the Parties (UNFCCC)
EAD	Environment Agency - Abu Dhabi
EEA	European Environmental Agency
ENEC	Emirates Nuclear Energy Corporation
EPA	Effectively Protected Area
FAO	Food and Agriculture Organisation of the United Nations
GDP	Gross Domestic Product
GHG	greenhouse gas
IOC	Intergovernmental Oceanographic Commission
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for the Conservation of Nature
km	kilometer
km^2	square kilometer
MoEW	Ministry of Environment and Water (federal)
NOAA	National Oceanographic and Atmospheric Administration (US)
ODSC/MSEC	Office of the Deputy Supreme Commander/Maritime Security Executive Committee
SBSTA	Subsidiary Body for Scientific and Technical Advice
SEEA	System of Environmental and Economic Accounting

SNA	System of National Accounts
SOE	State of Environment
tC	tonnes of carbon
UAE	United Arab Emirates
UNESCO	United Nations Educational, Scientific, and Cultural Organisation
UNFCCC	United Nations Framework for Climate Change Convention
UPC	Abu Dhabi Urban Planning Council

Stakeholder Organisations Consulted

Abu Dhabi Department of Economic Development

Abu Dhabi Department of Transportation

Abu Dhabi Marine Operating Company

Abu Dhabi Municipality

Abu Dhabi National Oil Company

Abu Dhabi Urban Planning Council

Critical Infrastructure and Coastal Protection Agency

Environment Agency - Abu Dhabi

Emirates Wildlife Society – World Wide Fund for Nature

Masdar

Mubadala Petroleum

Tourism Development Investment Corporation

UAE Ministry of Environment and Water

UAE Ministry of Foreign Affairs - Department of Energy and Climate Change

UAE Ministry of International Cooperation and Development

1 Introduction

1.1 Project Context

Today, growing emissions of carbon dioxide (CO_2) from a wide range of human activities is causing unprecedented changes to the global climate. Already in many parts of the world, coastal waters have warmed, temperatures have risen, ocean pH has decreased and rainfall patterns have noticeably been altered. Globally, sea levels and temperatures are predicted to rise further, the oceans to become more acidic/less alkaline and extreme weather is expected to become more common (IPCC, 2007). Identifying effective, efficient and politically acceptable approaches to reduce CO_2 emissions is one of humanity's most pressing challenges.

In recent years, increasing international attention has focused on the potential of coastal and marine vegetative systems as a new opportunity to store and sequester CO_2. Recent research around the world has highlighted the valuable role that coastal and marine ecosystems play in sequestering and storing the greenhouse gas (CO_2) and this has sparked international interest in the protection of these ecosystems as a tool for climate change mitigation (Duarte et al, 2005; Crooks et al, 2011; Broadhead 2011; O'Sullivan et al, 2011; Sifleet et al 2011; Gordon et al 2011).

"Blue Carbon" is shorthand for the carbon found in these ecosystems. In Abu Dhabi, Blue Carbon ecosystems, including mangrove forests, salt marshes, seagrass beds and cyanobacterial "blue-green algal" mats, sequester and store atmospheric carbon in biomass and sediments. Coastal sabkha is also considered an associated ecosystem storing, albeit not sequestering Blue Carbon. These coastal ecosystems are particularly efficient at sequestering carbon because they not only photosynthesise and deposit carbon in the soils beneath them but they also trap matter suspended in the water column (thus trapping organic carbon during tidal cycles) and they trap sediments and particulate matter being deposited from land-based sources. Furthermore, coastal ecosystems accrete with sea-level rise and thus continue to deposit carbon in their soils for centuries and millennia, whereas terrestrial forests tend to reach carbon 'equilibrium' in their soils after decades. Because of these attributes, coastal 'Blue Carbon' ecosystems are amongst the most 'intense' natural carbon stores in the world. Most Blue Carbon is stored in the sediments below the ground, rather than in the biomass above the ground, with from 50 to 99% of carbon in sediments rather than biomass. This is why ecosystems with relatively little biomass above the ground such as seagrasses or salt marshes can still store significant amounts of carbon (McLeod et al 2011). When these ecosystems are destroyed, buried carbon can be released into the atmosphere as carbon dioxide, contributing to global warming. Understanding the Blue Carbon resource can therefore help determine the extent to which these ecosystems can help contribute to mitigate this.

In short, Blue Carbon is now widely recognised as a globally significant reserve of carbon meriting policymaker attention. In addition, the ecosystems where Blue Carbon is found are well known as nursery habitats for fish, crustaceans, migratory birds, and marine mammals like the endangered dugong. Such ecosystems can also provide other environmental services. They protect shorelines,

support coastal tourism, and provide nursery grounds for fish and habitats for a wide range of species. They also have significant cultural and social value.

The Abu Dhabi Blue Carbon Demonstration Project aims to improve our understanding of carbon sequestration and the other services that coastal and marine Blue Carbon ecosystems provide. It is also focused on enhancing local capacity to measure and monitor carbon in coastal ecosystems, and to manage associated data. In addition, it aims to identify options for the incorporation of these values into policy and management and lead to sustainable ecosystem use and the preservation of their services for future generations. It is the latter that is the focus of this report.

1.2 The Development of Abu Dhabi Blue Carbon Policy

As a way of ensuring that a broad range of views was taken into account in the development of this Policy, an Emirate-wide stakeholder consultative process was undertaken from April to September 2013. These stakeholder organisations, identified in the section entitled: "Stakeholder organisations consulted", were instrumental with advising on the overall scope and components of the initial draft of the Policy. On 20 August 2013, local technical experts and key mid-level stakeholders participated in a workshop in Abu Dhabi convened by AGEDI to provide feedback on an Executive Summary of this initial draft of the Policy. The input received has contributed significantly to the development of the final version of the *Blue Carbon Ecosystems Policy of Abu Dhabi*. At the broadest level, the purpose of the Policy is to build conservation of Blue Carbon ecosystems into the daily business of the Emirate, within the broader framework of environmental management. It seeks to provide those responsible for administering relevant activities with clear guidelines and policy direction to ensure that Blue Carbon ecosystems in Abu Dhabi including mangroves, seagrasses, salt marshes and potentially algal mats as well as associated Blue Carbon ecosystems including coastal sabkha, are managed in a way that accounts for their local and global environmental benefits.

The Policy has also been developed within the framework of the UAE's responsibilities under the United Nations Framework Convention on Climate Change (UNFCCC) and the Regional Organisation for the Protection of the Marine Environment (ROPME). It should also be read in the context of the goals, objectives and guiding principles of Abu Dhabi's existing strategies for coastal zone and environmental management, namely the Abu Dhabi Environment Strategy (2008-2012), Interim Coastal Development Guidelines, Urban Planning Vision 2030, Environment Vision 2030, and the recently-launched process for the development of the Maritime 2030 Plan.

1.3 This Report

Abu Dhabi's Blue Carbon Policy report (this report), and the actions it describes, represents a compilation of the various actions needed to support the establishment and operation of a specialized fund to which Abu Dhabi property developers, private companies, and other entities benefiting from Blue Carbon ecosystems could contribute. The goal of this fund is to support a range of activities associated with Blue Carbon ecosystems and associated ecosystem services, such as mangrove restoration, improved protection of seagrass, support for public-awareness etc. Fundamental to the effective operation of the Fund is a better understanding of a range of

data and information associated with Blue Carbon ecosystems, much of which is currently not available, and which this policy document identifies for ongoing efforts.

Moreover, *Abu Dhabi's Blue Carbon Policy* represents the consensus outcome of a stakeholder consultative process to develop a proactive alignment of local and global benefits. Complementary to and building on Abu Dhabi's Environment Vision 2030 and other key documents, the Policy seeks to promote the conservation, sustainable use and enhancement of coastal environments to facilitate Blue Carbon functions at local, national, and international scales. The Policy demonstrates that Abu Dhabi recogniszes the special role Blue Carbon resources play in the well-being of its citizens, and is committed to the sustainable management of these resources for the benefit of current and future generations.

The resulting Blue Carbon Policy framework includes five (5) recommended key components and ten (10) recommended priority policy actions. Together, they seek to outline key policy directions in the short to mid-term. The bullets below indicate the five major components of the Policy:

- Improve Information Management Systems;
- Sustainably Manage Blue Carbon Ecosystems;
- Enhance Institutional Coordination;
- Engage in and Support International Actions on Blue Carbon;
- Promote Public Awareness of Blue Carbon Benefits.

These are discussed in details within Sections 4 to 8 of this report.

1.4 The Policy Team

The Policy Assessment was led by Bill Dougherty, an expert in Climate Change Policy and Gabriel Grimsditch, Programme Officer for Oceans and Climate Change for the United Nations Environment Programme (UNEP) Marine and Coastal Ecosystems Branch in Nairobi, Kenya, an expert in Blue Carbon.

Bill Dougherty is the President of the Climate Change Research Group. He is a professional engineer with broad experience in engineering analysis and regional planning and in recent years, he has worked on projects in Morocco, Sudan, Pakistan, Thailand, and South Africa, focusing on energy system modeling, institutional capacity appraisal, statistical analysis of traditional energy markets, and development of environmental externality values. In the U.S., his research has included an analysis of the social costs and benefits of switching to alternative fuel vehicles, modeling of national policies in the electric and transport sectors for reducing greenhouse gas emissions, and assessing transportation demand management options. Dr. Dougherty has also been a key contributor to the development of analytical tools to assess air quality, health, and environmental impacts of electric resource supply options and alternative regional transportation strategies. Bill received a Ph.D. in Regional Planning from the University of Pennsylvania in 1991.

With a BSc in Environmental Science and an MSc in Conservation from the University College London, Gabriel worked for the IUCN Global Marine Programme where he helped to coordinate the IUCN Climate Change and Coral Reefs Working Group and collaborated with the NGO Coastal and Oceans Research and Development in the Indian Ocean (CORDIO) in Mombasa to carry out coral reef resilience and climate change research. Gabriel now works as a Programme Officer in the Freshwater and Marine Ecosystem Branch in UNEP, based in Nairobi, and manages a range of projects around the world focusing on blue carbon as well as Marine Protected Areas.

1.5 Acknowledgements

Bill Dougherty and Gabriel Grimsditch have prepared this Blue Carbon Policy document under the overall guidance of Dr. Fred Launay, Acting Director of the Abu Dhabi Global Environmental Data Initiative at the Environment Agency of Abu Dhabi. Ms. Huda Petra Shamayleh and Ms. Jane Glavan of AGEDI and Ms. Emma Corbett from GRID-Arendal provided excellent logistical support for the stakeholder consultative meetings, as well as ongoing facilitation to ensure that stakeholder views are fully accounted for in Abu Dhabi's Blue Carbon policy. A word of thanks is also extended to the many stakeholders whose comments and insights have been instrumental in providing direction and shape to the Policy.

2 Abu Dhabi's Blue Carbon Ecosystems

2.1 Overview of Blue Carbon ecosystems

During the field surveys of the *Abu Dhabi Blue Carbon Demonstration Project*, algal mats (scientifically known as cyanobacterial mats and microbial mats) were also assessed, along with coastal sabkha, as potential Blue Carbon ecosystems as well as traditional mangroves, salt marsh and seagrass (Figure 1). Each of these areas represents productive ecosystems in shallow seawater and intertidal environments and offer important advantages for long-term carbon sequestration. Because Blue Carbon has not previously been accounted for in the UAE's national greenhouse gas inventories, including the carbon stored in managed coastal ecosystems in future inventories could reduce net CO_2 per capita estimates, currently one of the highest in the world, if ecosystems are managed sustainably and not destroyed. Conversely, mismanagement and destruction of coastal ecosystems can release CO_2 and increase per capita emissions.

2.2 Spatial extent of Blue Carbon ecosystems in Abu Dhabi

The Emirate of Abu Dhabi is home to nearly 1,900 square kilometers of Blue Carbon ecosystems (Spatial Data Assessment Report, Abu Dhabi Blue Carbon Demonstration Project 2013). As illustrated in Figure 2, seagrass meadows account for the largest share, about 84% or almost 1,600 km^2. It is likely that seagrass areas are currently underestimated, as this extent is currently based upon the amalgamation of remote sensing imagery to 3.5 m and local expert knowledge, and was found to be present to a depth of 10m during the field surveys.

Mangrove forests in Abu Dhabi cover about 141 km^2, or about 8% of Blue Carbon ecosystems. Natural mangroves are generally small-sized when compared to mangroves in non-arid regions of their distribution, with an average height below 5 meters. Most are found in areas that have reduced wave energy and are protected from strong winds, generally between Ras Ghanada in the northeast to Marawah Island further to the west. There have been significant mangrove plantations over the past 20-30 years, with the mangrove plantation on Sammaliah Island accounting for about 8 km^2, or about 6% of the total mangrove area.

Cyano-bacterial algal mats cover about 109 km^2 or about 6% of Blue Carbon ecosystems in Abu Dhabi. Algal mats consist of simple, plant-like organisms that occur naturally and contain relatively high carbon stocks and are found throughout Abu Dhabi's roughly 2,340 km^2 of coastal sabkha areas. Around the world, they can be found as individual cells, clumps, filaments, or large mats. In Abu Dhabi's hot, hyper-arid environment, they become desiccated in inter-tidal coastal sabkha areas and are deposited in the form of large mats several centimeters thick.

Salt marshes account for the remaining 48 km^2, or about 3% of Blue Carbon ecosystems. These are intertidal areas that are often gently sloping and provide important foraging habitats for many important migratory birds. These areas are characterized by organic-rich soft mud from

decomposing seagrass and algae. Below the top centimeter, salt marshes exist in an anoxic state (i.e., no dissolved oxygen available) that is capable of securing long-term carbon storage in large and ever-increasing quantities. Many salt marshes have been lost in the areas around Abu Dhabi City due to ongoing development and land reclamation activities.

2.3 Carbon Storage potential of Blue Carbon ecosystems in Abu Dhabi

Combining these spatial results with those obtained from the carbon baseline assessment, provides an indication of the total carbon stored in Abu Dhabi's Blue Carbon ecosystems. This is illustrated in Table 1. Using the Abu Dhabi Emirate data from Table 1, these ecosystems today hold between 52 and 181 million tonnes of CO_2e. To illustrate the potential significance of these results, they can be contrasted with Abu Dhabi's recently completed GHG emissions inventory associated with a single year, 2010 (EAD, 2012).

Table 1: Range in carbon dioxide equivalent (CO_2e) storage in Abu Dhabi compared with tropical regions

Major Blue Carbon ecosystem	Abu Dhabi Emirate			Tropical regions (Sifleet *et.al.* 2011)		
	Below ground *	Above ground	Total	Below ground *	Above ground	Total
Seagrass	7 – 396	0 - 4	7 - 401	880-6,000	0-13	880-6,013
Mangrove	178-655	0 - 333	199-728	800-3,000	300-1,000	1,100-4000
Coastal Sabkha	187 - 442	N/A	187 - 442	N/A	N/A	N/A
Algal Mat	68 - 562	N/A	68 - 562	N/A	N/A	N/A
Salt marsh	108 - 600	3 - 14	111 - 606	900-1,700	5-18	905-1,718

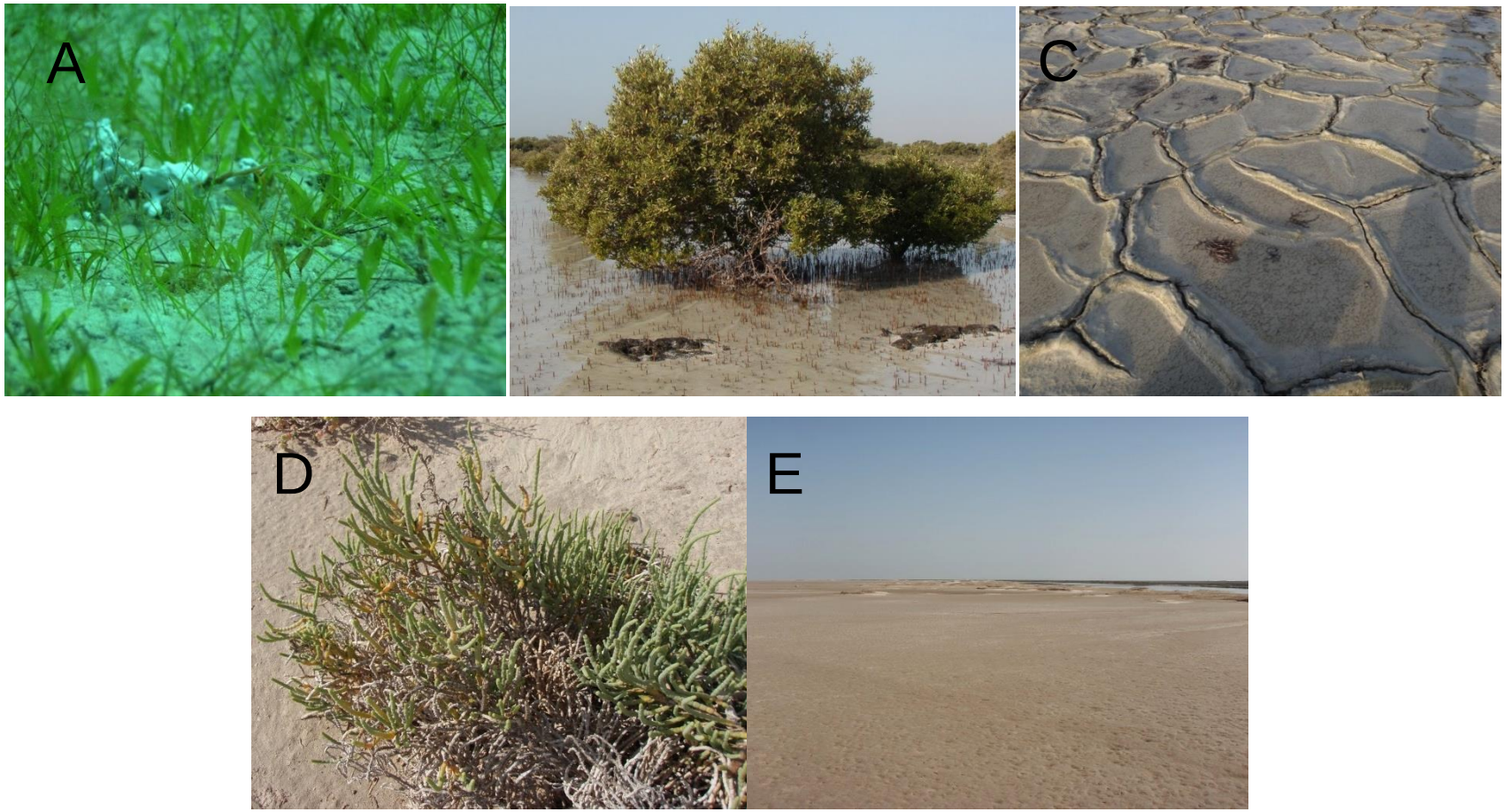
** Refers to the top 1 metre of sediments*

Note: CO_2e figures have been calculated based on a conversion factor of 3.667 from the Carbon Stock figures

Box 2 provides a number of conclusions that highlight the significance of the carbon benefits associated with Blue Carbon ecosystems when compared to GHG emission inventory results for the Emirate.

Box 2: Illustrative comparisons between annual GHG emissions and Blue carbon in Abu Dhabi using the upper estimate of carbon storage potential.

- The total amount of carbon stored in Abu Dhabi's Blue Carbon ecosystems and its coastal sabkhas is equivalent to up to 2.5 years of emissions from energy production and consumption activities in the Emirate;
- The amount of carbon released from a destruction of 11% of seagrass meadows is equivalent to the annual GHG emissions associated with Abu Dhabi's total waste management activities;
- The annual carbon sequestration benefit from the entire afforested and green park area in Abu Dhabi would be lost if only approximately 6% of mangroves, salt marshes and seagrass meadows were destroyed; and
- The Freshwater demand costs to sustain afforested areas in Abu Dhabi's hyper-arid environment are enormous compared to protection/management cost of Blue Carbon ecosystems that are sustained by freely available seawater.

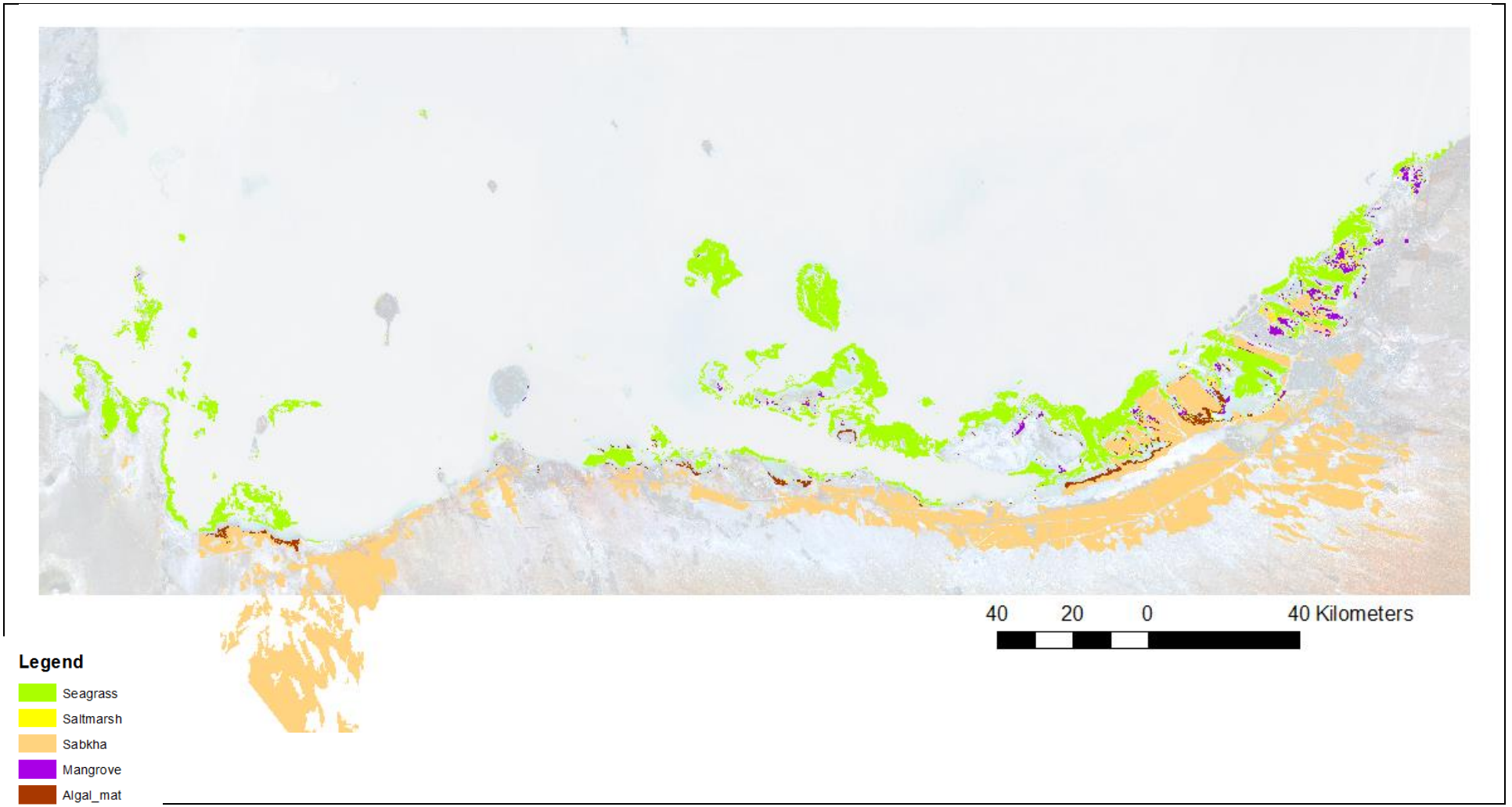


SOURCE: Abu Dhabi Blue Carbon Project

Abu Dhabi Blue Carbon Project

Figure 1

Photos of a) Seagrass b) Mangrove c) Algal mat d) Salt marsh and e) Coastal sabkha.

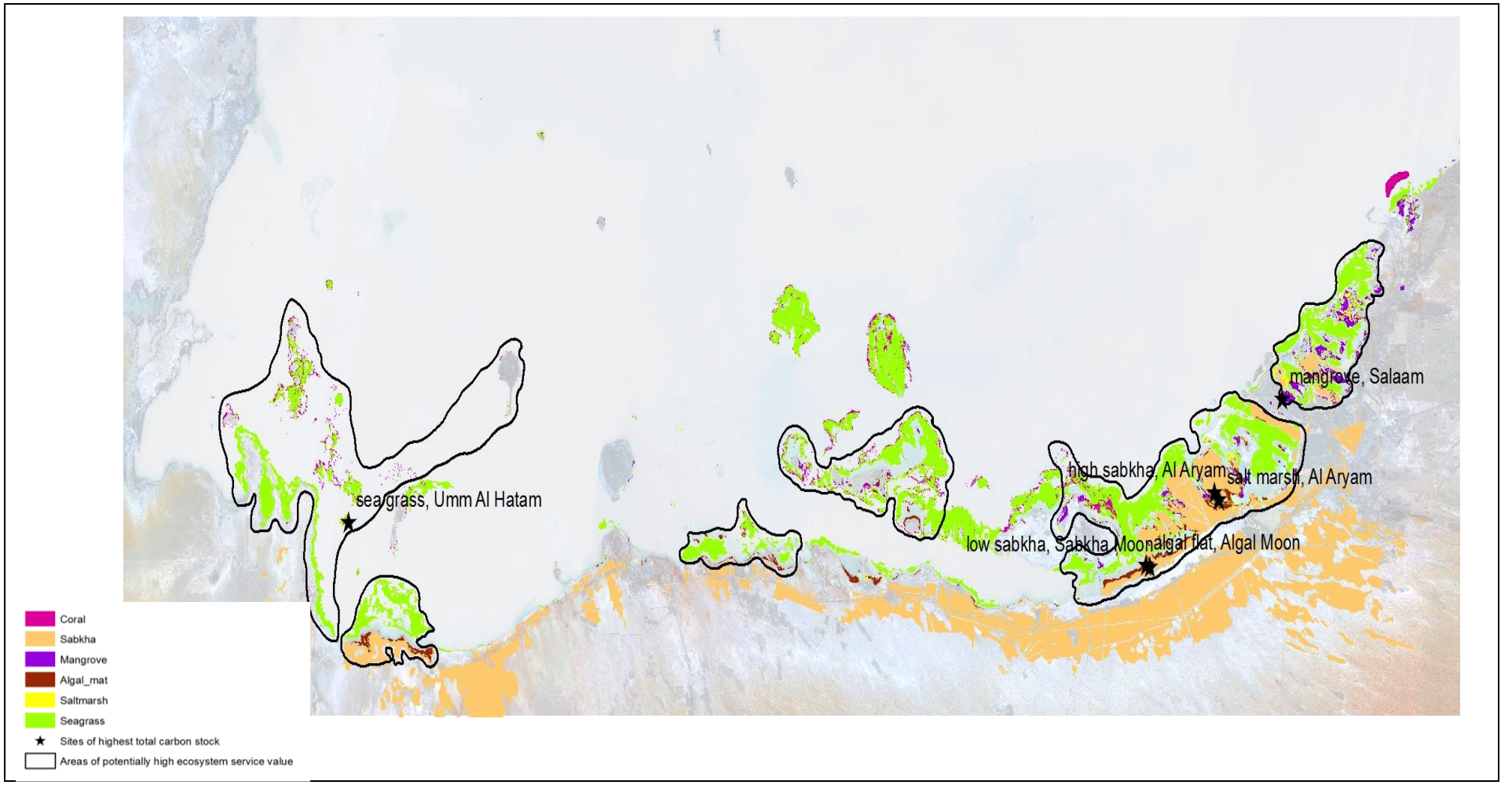


SOURCE: Abu Dhabi Blue Carbon Project

Abu Dhabi Blue Carbon Project

Figure 2

Spatial extent of Blue Carbon ecosystems in Abu Dhabi.



SOURCE: Abu Dhabi Blue Carbon Project

Abu Dhabi Blue Carbon Project

Figure 3

Estimated areas of highest concentration of Blue Carbon co-benefits arising from Blue Carbon Ecosystems.

It is important to note that these are initial results and conclusions from a Demonstration project and subject to further analysis by entities to be determined for confirmation. For example, the sample size for coastal sabkhas was small and cannot be considered representative of the entire coastal area. The same applies to seagrass meadows. Moreover, Abu Dhabi's inventory of greenhouse gas is a work in progress with a numbers of follow-on stages in the planning stages.

Going forward, there are several key questions that will need to be explored to develop a better understanding of the carbon fluxes associated with Blue Carbon ecosystems in Abu Dhabi. In addition, the other aspects of Blue Carbon ecosystems, namely the economic value of the environmental and other services they provided may warrant as much or more policy attention as the actual carbon stored.

2.4 Blue Carbon ecosystems services in Abu Dhabi

Blue Carbon ecosystems also provide a range of important ecosystem services. These services are typically not valued in the same terms as, for example, oil production, which is priced in terms of dollars per barrel. However, the lack of a clear market value for ecosystem services does not imply that their value is zero or not measurable. For example, the outcome of the United National Conference on Sustainable Development 2012 ("Rio+20") recognized that oceans, seas and coastal areas form an integrated and essential component of the Earth's ecosystem. Under the United Nations Framework for Climate Change Convention (UNFCCC), there is an explicit recognition of the role and importance of marine ecosystems as carbon sinks and reservoirs. Furthermore, the Convention on Biologic Diversity (CBD) encourages parties to take measures to manage and protect ecosystems, among them coastal, so as to maintain their resilience to extreme climate events and to help mitigate and adapt to climate change. This is reflected in the CBD's Aichi Targets, particularly Target 14.

The Ecosystem Services Assessment component of the Abu Dhabi Blue Carbon Demonstration Project provides information about co-benefits being delivered from Abu Dhabi's Blue Carbon ecosystems. These benefits, comprising both provisioning and regulating ecosystem services, make the mangrove, seagrass, salt marsh, sabkha, and algal mat ecosystems that can be found along the coast, around the islands, and offshore in the Emirate particularly valuable. These services are only beginning to be understood and quantified; some values are already recognized as significant, but all can be considered potentially important, to be further defined in future studies. These will prove to be noteworthy considerations when weighing trade-offs and in development of future policies.

The Blue Carbon ecosystems that were assessed in this study contribute to the splendour of the Abu Dhabi environment, and enhance human well-being at the local, regional, and global scale. Locally, Blue Carbon ecosystems contribute to maintaining livelihoods, providing food and materials, promoting economic growth, and reducing vulnerabilities to sea level rise, storm events, and spread of disease. At the regional level, Abu Dhabi's Blue Carbon areas maintain the web of life in both the Gulf and the coastal areas in countries bordering it – an increasingly critical contribution given the rapid acceleration of loss of these ecosystems in other locales. On a global

scale, understanding these ecosystems in terms of the benefits they offer and the ways they are threatened provides valuable knowledge and groundtruthing for the rest of the world. This is especially true since the environmental conditions in the Gulf region are a harbinger of things to come across the globe in a climate-changed future, given that seawater temperatures and salinity are among the highest in the world. How these mangroves, seagrasses, salt marshes, sabkhas, and algal mats fare, and what can be done to make them as resilient as possible in the face of global change, allows a glimpse into the future, and prepares the world to safeguard these important ecosystem services as best it can.

It is well understood that, together, these services annually translate into significant benefits for Abu Dhabi. What is less clear is the actual value of these services in economic terms. Such information would make possible the direct comparison of the value of these environmental services with the value of other goods and services on the basis of a common monetary metric. There are several studies that have considered the economic value of coastal ecosystem services (e.g., Barbier, et al., 2011; Conservation International, 2008; Costanza, 1997, de Groot, et al., 2012).

Using proxy values from other parts of the world where economic studies have been conducted and using those to frame the range of possible values in Abu Dhabi masks the fact that, due to the extreme environmental conditions in the Gulf region, both biodiversity and production is relatively low in these ecosystems compared to others elsewhere in the world. Market values are not comparable to other parts of the world where fisheries are more productive, where eco-tourism is a greater factor in economic development, or where coastal communities and properties are at greatest risk from flood-related inundation, storm surges caused by cyclones or hurricanes, and/or tsunamis. On the other hand however, property values potentially protected by Blue Carbon ecosystems, are relatively high in Abu Dhabi. Subsequently, it is recommended that these ecosystems need to be further assessed in order to determine if the ecosystem services they are hypothesized as delivering are in fact being delivered. Since value fundamentally relates to perception, it will be important to undertake social science research to ascertain how these services are viewed and whether there is interest (in government, among the private sector, and in the general populace) in maintaining or enhancing them.

Having said that, taking the highest figures for Blue Carbon ecosystem value and multiplying it by coverage (i.e. extent of ecosystem), the high end of the value range can, in very approximate terms, be estimated. Based on economic studies undertaken on these ecosystems in other parts of the world, the existing Blue Carbon ecosystems likely provide hundreds of millions of US dollars of value, in shoreline stabilization, support to fisheries, direct recreational use, and water quality maintenance. Other non-market values such as support to a wide array of biodiversity, regulating services that maintain planetary and regional balances, and cultural, spiritual, and aesthetic values must also be considered. Collectively it is clear that these Blue Carbon ecosystems are of immense value. The opportunity costs of losing these ecosystems to degradation or development are significant, especially since most Blue Carbon ecosystems are difficult if not impossible to restore, and restoration always commands high costs over long time frames.

Given that each Blue Carbon ecosystem and the ecological community it supports provide different ecosystem services, the most valuable areas will be those that have a combination or mosaic of these ecosystems, especially those in relatively close proximity to assets of value. Five areas within Abu Dhabi stand out in this regard. These are illustrated in Figure 3.

One additional but critically important consideration is that these ecosystems and the services they generate cannot be viewed in isolation. For mangrove forests to continue to provide nursery grounds for commercially and recreationally important fish populations, the two-way linkages between mangrove and offshore ecosystem such as seagrass beds, coral reefs, and offshore landform features must be maintained. Similarly, offshore systems like coral reefs create the conditions necessary for inshore systems like seagrasses to thrive; while mangroves and salt marsh act to trap sediments and nutrients that might smother or degrade seagrasses. The delivery of goods and services from natural systems is dependent not only on the condition of the ecosystem but also its functional linkages to associated ecosystems. Therefore during the marine and coastal spatial planning process (including updates) in Abu Dhabi, it will be important to consider the full suite of services, their values, and the impacts that human activities in any sector will have on continued delivery of these services. This is especially true as climate change adds to the spectre of cumulative impacts, and threatens to undermine the resilience of all marine and coastal ecosystems, in the Emirate and in the Arabian Gulf region.

2.5 Outline of the Policy Report

Whilst the outcomes of the Abu Dhabi Blue Carbon Demonstration Project have been significant, they are recognised as a first step in overall ecosystem based management in Abu Dhabi. It is hoped that the success of this demonstration project subsequent be replicated in other ecosystems throughout the emirate and a holistic approach to ecosystem management be pursued to the benefit of all.

3 Framework for Action

The importance of Blue Carbon ecosystems in storing carbon, providing environmental services, and possessing intrinsic cultural value represents the point of departure for a policy response that aims to conserve, restore and manage these ecosystems wisely for future generations. A framework for action builds upon these findings and is further shaped by Abu Dhabi's ongoing efforts to turn environmental vision into action, its institutional context for action, and its proactive stance on Blue Carbon ecosystems for the benefit of Abu Dhabi, the region, and the world.

3.1 Vision into action

The Emirate's commitment to environmental sustainability is reflected in its vision to protect and conserve the environment for people's well-being and a better life for all. The commitment to environmental protection by His Highness the late Sheikh Zayed bin Sultan Al Nayhan is one of his enduring legacies in the UAE and the Gulf region.

The translation of this vision into action has strong links with a Blue Carbon policy. Many of the priority areas of the Abu Dhabi Environmental Strategy (2008-2012) such as environmental sustainability, biodiversity management, environmental awareness, and environmental information have clear intersections in one way or another with priorities that would be at the centre of any Blue Carbon policy for the Emirate. This is an important point of departure in that it suggests that a basic framework is already in place for effective action to protect and sustainably manage Blue Carbon ecosystems. What is needed is to work collaboratively across Abu Dhabi institutions to effectively build upon this framework and ensure that Blue Carbon issues are integrated with current actions, and vice versa.

There are several actions already initiated or supported by EAD that translate vision into action, and which can be viewed as strategic Blue Carbon-related initiatives. For example, the EAD is currently rehabilitating, conserving and protecting mangrove forests in seven main sites across the Emirate of Abu Dhabi: Saadiyat Island, Jubail Island, the Marawah Marine Biosphere Reserve, Bu Syayeef Protected Area, Ras Gharab, the Eastern Mangroves and Ras Ghanada.

Moreover, in 2011 EAD provided the support required to establish the *Dugong, Seagrass and Coastal Communities Initiative*, an innovative sustainable management project designed to secure the ongoing survival of the dugong by, among other things, protecting the seagrass meadows on which it relies. Cross-cutting these and other initiatives was the publication in 2011 of the 200-page *Environmental Atlas of Abu Dhabi Emirate* which has done much to raise public awareness and appreciation of the enormous environmental and cultural heritage embodied in Abu Dhabi's marine and coastal environments.

In addition, a number of research programmes are either planned or underway that have direct relevance to Blue Carbon ecosystems. For example, an investigation on the invasion of alien species has been launched to develop an inventory of non-native species, identify major transport vectors for invasive species and to study the effect of such invasions on coastal ecosystems such as fisheries, sea grass meadows, and coral reefs. The project also aims to determine and develop mitigation measures, many of which may be found to overlap sustainable management initiatives applicable to Blue Carbon ecosystems.

Finally, work has recently been completed on the first assessment in the Arabian Gulf region of the potential of Blue Carbon ecosystems for not only storing carbon but also for supporting vital environmental functions. Blue Carbon: First level exploration of natural coastal carbon in the Arabian Peninsula (with special focus on the AUE and Abu Dhabi) – A Rapid Feasibility Study (AGEDI, 2011) was part of an AGEDI initiative exploring Blue Carbon in a local, national and regional setting (Figure 4). The range of information collected and synthesised in this assessment served to highlight the potentially significant role Blue Carbon can play throughout in the region and identified several opportunities in advancing coordinated environmental and climate change policy.

Combined, these initiatives suggest that a substantial amount of relevant initiatives that a Blue Carbon policy can take stock of and constructively build upon. Prominent among these efforts are the themes of protection, sustainable management, conservation, information management, and public awareness-raising.

3.2 Institutional context for action

More than 10 federal laws and 20 emir decrees relating to the marine and coastal environment have been produced since 1971 (AGEDI, 2008). At the Emirate level, the Abu Dhabi Environment Strategy (2008-2012), Interim Coastal Development Guidelines, Urban Planning Vision 2030, Environment Vision 2030, and the 2009 Maritime Strategy contain policy directions that affect Blue Carbon resources.

At the Emirate level, there are three key institutions with overlapping and complementary responsibilities regarding Blue Carbon ecosystems, namely the Environmental Agency - Abu Dhabi, the Abu Dhabi Urban Planning Council (UPC), and the Office of the Deputy Supreme Commander/Maritime Security Executive Committee (ODSC/MSEC). Each is briefly described relative to their potential role in Blue Carbon.

EAD's mission is to protect and conserve the environment. Key responsibilities include investigation, protection, sustainable management, and conservation of the Emirate's natural resources. Notably, it is the lead agency for the future development of an integrated coastal zone management policy, under which Blue Carbon ecosystem issues could eventually be prominently

incorporated. In the near-term future, the EAD is expected to assume an increasing role in regulation and control.

UPC's mission is to fulfil the vision of transforming Abu Dhabi into a global capital city, as inspired by the late Sheikh Zayed Bin Sultan Al Nahyan and nurtured today by His Highness Sheikh Khalifa Bin Zayed Al Nahyan. The UPC oversees all development in the Emirate and ensures that factors such as sustainability, infrastructure capacity, community planning and quality of life - as well as the Vision 2030 Plans - are incorporated into all policies, processes, and plans. The UPC is expected to play a role in resolving potential competition between infrastructure and environmental sustainability priorities as they may relate to Blue Carbon.

Figure 4: Cover page of the Blue Carbon Feasibility Study (Source: AGEDI)

The ODSC/MSEC's mission has been to coordinate management of the Abu Dhabi maritime domain. It is the lead agency for development of Abu Dhabi's Maritime Strategy and has established a governance structure comprised of five Interagency Planning and Policy Groups,

which engage ten agencies/departments within the Emirate. Through its role as manager of the stakeholder engagement process for maritime policy, the ODSC/MSEC can play a pivotal role in ensuring that the value of Blue Carbon ecosystems are well reflected in the planning process. The ODSC is currently in the process of assuming the responsibilities of the MSEC as per the Executive Council Resolution No. 15 of 2011.

Complicating this institutional context are activities and responsibilities of other Emirate and Federal level institutions. At the Emirate level, a key institution is the Abu Dhabi National Oil Company (ADNOC) and its group companies. ADNOC conducts offshore oil and gas production activities in areas where Blue Carbon ecosystems are found. At the federal level, the Ministry of Environment and Water (MoEW) has a jurisdictional role over matters related to wildlife conservation, fisheries management, and the marine environment. The Critical Infrastructure and Coastal Protection Agency is responsible for the enforcement of regulations regarding offshore operations. The Emirates Nuclear Energy Corporation (ENEC) oversees the development of nuclear power in the UAE and is charged with establishing regulatory standards concerning seawater intake for cooling as well as thermal discharges into the Gulf. Finally, the Ministry of Defence undertakes activities regarding bathymetric chart and map development.

Collectively, the range of institutions and their potentially overlapping activities, roles, and responsibilities for implementing laws, decrees, and vision documents suggest that effective institutional coordination will be central to the success of any Blue Carbon policy. While this collective institutional framework offers guidance for preserving marine biodiversity, conservation of endangered species, protection of marine water quality, and sustainable management of fisheries, it does not account for the full range of ecosystem services provided by Blue Carbon resources, nor the global environmental benefits they offer. Stable institutional coordination arrangements that can accommodate an expanded focus on Blue Carbon will help to resolve potentially competing priorities that may affect the future health of Blue Carbon ecosystems.

3.3 Proactive action and Blue Carbon

One of the underlying perspectives of Abu Dhabi's Blue Carbon Policy is the desire for proactive engagement around recent international initiatives regarding Blue Carbon. Many such initiatives are underway and form an essential backdrop to the development of Abu Dhabi Blue Carbon Policy. The United Nations Environment Programme (UNEP) Blue Carbon Initiative is an important international initiative with which EAD is collaborating closely. Through the Global Environment Facility (GEF), UNEP is expected to manage the largest investment in Blue Carbon to date and Abu Dhabi is a major partner on the programme. In fact, Abu Dhabi is one of the 'pilot projects' under the GEF 'Blue Forest' project and many of the tools, science and policies developed for Abu Dhabi will be used to guide other projects around the world, specifically in Madagascar, Mozambique, Indonesia and Ecuador.

Also, the Blue Carbon Initiative was launched in 2010 at UNFCCC COP-16 with a focus on maintaining the capacity of coastal ecosystems to sequester carbon from the atmosphere and ocean while avoiding emissions from their destruction and degradation. The Initiative is a collaborative effort led by Conservation International (CI), the International Union for the Conservation of Nature (IUCN), and the Intergovernmental Oceanographic Commission (IOC) of the United Nations Educational, Scientific, and Cultural Organisation (UNESCO). EAD has maintained an ongoing engagement with this initiative.

Moreover, one of the outcomes of the Blue Carbon Initiative directly relevant to the Abu Dhabi Blue Carbon Policy was the publication in 2012 by IUCN of a policy framework for countries to consider in their future wetland management plans (IUCN, 2012). Specifically, IUCN recommends the development of Blue Carbon national action plans that ensure the maintenance and provision of coastal carbon benefits as well as the full range of ecosystem services.

There have also been a number of other prominent initiatives that have begun to urge action regarding the accounting of Blue Carbon within formal policy processes. At the international level, the Coalition for Rainforest Nations (CfRN) at the May 2012 meeting of the UNFCCC's Subsidiary Body for Scientific and Technical Advice (SBSTA) urged that sufficient time be dedicated to discussing "emissions and removals from coastal and marine ecosystems such as mangroves, tidal salt marshes, and seagrass meadows," and that it should be considered a formal research theme in the future. They also requested that SBSTA invite the Intergovernmental Panel on Climate Change (IPCC) to start a work program "aimed at quantifying the role of coastal marine ecosystems on global atmospheric fluxes of greenhouse gases."

As a national level example, the National Oceanographic and Atmospheric Administration (NOAA) in the US has been active in recent years in building momentum for action of coastal Blue Carbon through national policy development/integration, scientific research, and assessing its role carbon markets. These actions are intended to support two complementary pathways for using the carbon service value of coastal habitats to advance habitat conservation, namely incorporating carbon services into federal policies and programs governing coastal habitats; and supporting the development of voluntary markets for coastal carbon.

While Abu Dhabi is under no obligation to engage and collaborate with the above Blue Carbon initiatives, there is a strong sense among decision-makers that, given the importance of its coastal ecosystems, a proactive approach that embraces the momentum and direction of Blue Carbon initiatives is in the long-term best interests of the Emirate. The formulation of a Blue Carbon policy, with its new opportunities for information management, sustainable management, international collaboration, and local awareness-raising provides an ideal framework to move the Blue Carbon agenda forward.

3.4 Strategic approach - Supporting the operation of the Specialised Fund

The above discussion makes clear that through its efforts to turn environmental vision into action, establishment of a robust institutional context for action, and a proactive perspective in accounting for Blue Carbon's potential, Abu Dhabi has already taken important steps in recognising and promoting the importance of Blue Carbon ecosystems locally and internationally. With the development of a Blue Carbon policy, Abu Dhabi is poised to build on these efforts and assuming a leading role in the international Blue Carbon-related efforts.

The overall purpose of *Abu Dhabi's Blue Carbon Policy* is to build conservation of Blue Carbon resources into the daily business of the Emirate, within the broader framework of environmental management. At the heart of the strategic approach for the development of the policy is the future establishment of a *Specialised Fund* to support local Blue Carbon management, conservation and protection. Supported by entities that either benefit from or adversely affect Blue Carbon ecosystems services, such a fund could be instrumental in sending appropriate signals to Abu Dhabi property developers, private companies, and other entities. Fundamental to the effective operation of the *Specialised Fund* is a better understanding of Blue Carbon ecosystems, for which this policy document seeks to provide an overall strategic framework. As discussed in detail in the Financial Assessment report, the Specialized Fund is needed to overcome deficiencies in the current approach to managing and protecting blue carbon ecosystems, while introducing a new mechanism that emphasizes flexibility, economic linkages, and stakeholder engagement.

Five policy recommendations seem more immediately relevant for the Specialised Fund to focus on:

- Policy Action #3: Blue Carbon Ecosystem Services Valuation
- Policy Action #4: Blue Carbon Management Objectives
- Policy Action #5: Blue Carbon Ecosystem Priority Areas
- Policy Action #6: Blue Carbon Management Plans
- Policy Action #10: Promote Awareness

Going forward probably the most important consideration is that the key stakeholders regarding the proposed analysis, and then hopefully the design, establishment and management of the Specialised Fund itself, are fully engaged in the process and develop an effective collaborative approach and working group to move the process forward.

A central issue is to determine how best to move from the current compensation model, which is not based on a clear principle of "proportionality" to the loss of combined ecosystem services involved, to a new system that does this in order to both to avoid the loss of critical ecosystem services and also to achieve more cost-effective results. The Financial Feasibility Assessment

provides detailed steps and strategies that should be explored in order to practically implement the Specialised Fund.

In recognition of the evolving understanding of the importance of Blue Carbon ecosystems, *Abu Dhabi's Blue Carbon Policy* aims to provide those responsible for administering relevant activities with clear guidelines and processes to ensure that mangroves, salt marshes, seagrasses, and algal mats in coastal sabkha areas are managed in a way that also accounts for their global and local environmental benefits within the context of the Specialised Fund. Further, the Policy aims to set a standard of excellence in this area, from which other Emirates and countries may benefit, and to act as a catalyst that can stimulate and enable private sector participation.

In terms of the overall strategic framework of the Abu Dhabi Blue Carbon Policy, the following statements synthesise the essential approach in the development of the policy:

- **Key aim:** to increase and sustain the productivity and integrity of Blue Carbon ecosystems within the Emirate of Abu Dhabi and beyond.

- **Key objectives:** to support the management of Blue Carbon ecosystems in Abu Dhabi through activities that improve management practices, develop enhanced knowledge networks, promote coordinated action across emirate-level instiutions, build local capacity, and support global actions;

- **Spatial scope:** At the Abu Dhabi level, to conserve, restore, and sustainably manage Blue Carbon ecosystems; at the a national (United Arab Emirates, UAE) level, to share data and information, promote coordinated management approaches; at the global level to invest in Blue Carbon conservation projects, support Blue Carbon accounting methodological development, promote best practices.

Regarding the specific components of the policy, stakeholder consultations undertaken during April 2013 revealed that the most strategic action on Blue Carbon for Abu Dhabi should focus on a subset of possible actions. As a point of departure, stakeholder consensus emerged on five key components that should feed into the development of a Blue Carbon policy for Abu Dhabi, as outlined below. The policy components are highly linked and build upon one another in an iterative cycle (Figure 5). This in turn will lead to the eventual incorporation and modification of current planning/vision frameworks such as Environment Vision 2030.

- **Improve information management systems:** This refers to the development of a system for Blue Carbon information management in order to facilitate better planning, analysis, and capacity-building. Achieving the policy goals in this category will help to ensure a sound scientific basis for subsequent management planning and Blue Carbon policy updates;

- **Sustainably manage Blue Carbon ecosystems:** This refers to the development of a protocol for sustainable Blue Carbon ecosystem management. Such a protocol seeks to recognise that Blue Carbon is a vital component of Abu Dhabi's natural environment and has a special role in relation to the Emirate's development agenda. Achieving the policy goals in this category will help to address and overcome the range of potentially competing perspectives on access to and development of Blue Carbon ecosystem areas;
- **Enhance institutional coordination:** This refers to the enhancement of coordination arrangements across relevant Emirate-level and national governmental institutions. At present, there exist multiple entities with overlapping regulatory, policy, and/or decision-making roles that may pose future challenges for effective and efficient institutional action affecting Blue Carbon ecosystems. Achieving the policy goals in this category will help to ensure that stable and collaborative institution arrangements are shaped;
- **Engage in and support international actions on Blue Carbon:** This refers to actions in support of the international community as it seeks to integrate Blue Carbon into the climate change negotiations and develop methodological approaches to quantify carbon fluxes and environmental services within Blue Carbon ecosystems. Achieving the policy goals in this category will help to enhance Abu Dhabi's role as an international leader in the area of Blue Carbon resource development;
- **Promote public awareness of Blue Carbon benefits:** This refers to the development of programmes that are aimed at increasing the awareness of the benefits of Blue Carbon among the private sector and the public at large. Achieving policy goals under this category will lead to a better informed general public about the importance of Blue Carbon ecosystems, as well as strengthened capacity in key institutions to undertake the needed analyses and studies that contribute to better policymaking.

Figure 5: Interactions and linkages among the five Blue Carbon policy components

In the remainder of this document, a number of specific Policy Actions are framed within these major component categories.

Finally, the operative elements of the *Abu Dhabi Blue Carbon Policy* are described in detail in the sections that follow. They have been developed with full recognition of the need to harmonise it with these existing policy instruments and, as appropriate, to amplify the goals, objectives and strategies of these policies. Working primarily through existing programs and decision-making mechanisms, the *Abu Dhabi Blue Carbon Policy* is designed to advance conservation of Blue Carbon resources as a new and integral part of efficient and responsible delivery of environmental services in the Emirate, and ultimately to support the well-being of the Emirate's and the planet's people.

4 Improve Information Management Systems

The first component in the Abu Dhabi Blue Carbon policy is the development of a system for information management in order to facilitate better planning, analysis, and capacity-building throughout the Emirate, and within the context of the existing legal framework afforded by national and Abu Dhabi laws and regulations. This will help to ensure a sound scientific basis for subsequent management planning and policy updates, and can build on the achievements of the Abu Dhabi Blue Carbon Demonstration Project, the geographic assessment and the Blue Carbon Mapping Toolkit in particular.

4.1 Aims

An Abu Dhabi information management system for Blue Carbon has three key aims. It will:

1. Build upon current baseline information on Blue Carbon ecosystems as developed by the project, including carbon sequestration potential and the range of other services that these ecosystems provide.
2. Systematically document changes in Blue Carbon resources, including the impact of those changes on carbon emission levels and ecosystem functions, and
3. Allow comparisons of current trends in change to historical trends in changes in the extent of Blue Carbon resources.

Implementing such a system will help to develop and monitor essential baseline data, improve understanding of key changes, and enhance the capacity to respond to those changes.

Some Blue Carbon-related information management systems are already taking place within formal information gathering networks in Abu Dhabi and the UAE. Most notable among these is the EAD Wetland Mapping Project, which aims to classify and characterise coastal wetlands, map coastal wetlands including mangroves, salt marshes and seagrass meadows, and to develop conservation and management plans for the coastal wetlands of the Emirate. Other efforts include the Dugong Research Program, which involves long-term monitoring and research to protect them and vital seagrass habitats, and the Sea Turtle research program, which involves long-term monitoring and research regarding nesting and seagrass foraging using satellite tagging and conservation techniques.

Data from new Blue Carbon information management systems, combined and building upon the more traditional and on-going wetland mapping and dugong/Sea Turtle monitoring efforts, will help to contribute towards a long-term, high-quality, and comprehensive information base needed for improved decision-making. They will also help to establish trends in Blue Carbon storage levels, as well as clearly document the range of key ecosystem services, paving the way for greater integration of their value within on-going coastal zone planning efforts in the Emirate.

4.2 Objectives

At the broadest level there are several objectives for enhancing Blue Carbon information management in Abu Dhabi, as described in the points below:

- Continue to collect and manage physical data on the range of Blue Carbon resources and services in the Emirate, making use of the information and infrastructure provided through the project;
- Provide an information clearing house function that shares data with other Emirate-level coastal planning organisations and enable public access to information via the internet;
- Develop information products suitable for subsequent scientific research and coastal zone planning, and the development of Blue Carbon ecosystem management plans;
- Maintain and regularly update all Blue Carbon-related data, information, remote sensing datasets, and maps by means of integrated data management systems with other ongoing data management efforts to assess the rate of change in Blue Carbon ecosystems.
- Investigate historical data on changes in the extent of Blue Carbon resources;

While the potential scope for observation networks in Abu Dhabi is quite large, there are three specific Blue Carbon policy initiatives that are recommended as an initial effort. These initiatives correspond to:

1. Observation and monitoring of Blue Carbon ecosystems;
2. Inventory of carbon benefits associated with Blue Carbon ecosystems; and
3. Quantification of the economic value of Blue Carbon ecosystems.

4.3 Policy Action #1: Blue Carbon Observation Systems

This Policy Action aims to strengthen existing Emirate-based observation systems to better understand the scope and function of Blue Carbon ecosystems, together with the nature and magnitude of past and current threats. It will involve comprehensive on-going surveillance, monitoring, mapping, documentation, and dissemination of collected information. Enhanced observation systems can build upon the available baseline information on the spatial, biological, and physical characteristics of Blue Carbon ecosystems in the Emirate. An enhanced ability to observe and collect information on Abu Dhabi's Blue Carbon ecosystems is directly linked to growing international momentum under the climate change negotiations to determine the carbon storage and sequestration potential of coastal vegetation ecosystems, such as mangroves, sea grass meadows, and salt marshes. A rapid assessment protocol has already been developed by the Abu Dhabi Blue Carbon Demonstration Project and could be used as a basis for the development of future monitoring plans. Similarly, baseline geographic information has been collected on Blue Carbon ecosystems, and can be accessed ad continuously updated through the Blue Carbon Mapping Toolkit developed by the project.

Building upon historical and baseline information is important for Blue Carbon because it can help to shape a better understanding of current status and trends, while providing a means to detect and predict future changes. It can also be used to measure the success of ecosystem management and whether management targets have been achieved. The term "baseline" refers to the collection of a broad range of information regarding Blue Carbon ecosystem characteristics. Such information can lead to improved mapping capabilities, increased accuracy of GHG releases associated with coastal development, development of standardised emission factors, and a better understanding of the linkages between Blue Carbon resources and broader ecosystem function. Moreover, systematic and reliable information on the scope, scale, and function of Blue Carbon ecosystems will be valuable to a wide range of Emirate-level groups engaged in coastal development activities.

Specifically, this Policy Action aims to enhance existing monitoring programs in natural settings to characterise the biological, ecological, physical, and chemical characteristics of all Blue Carbon ecosystems. It will achieve this through the observation, sampling, analysis, and interpretation of trends regarding carbon pool size, ecosystems services provision, biotic community characteristics, biological diversity, habitat coverage, survival/mortality characteristics of mangrove seedlings, sea grass cover biomass, water quality, and sediment characteristics and variability. A Blue Carbon observation system should enable Abu Dhabi planners to better assess the potential responses of Blue Carbon ecosystems to environmental changes resulting from coastal development, dredging activities, reduced water clarity, increased sedimentation, mounting fishery pressures, as well as climate change impacts in the Arabian Gulf such as rising sea levels, increasing sea surface temperatures, and ocean acidification. The specific components of the Policy Action include:

- **Assessment:** Undertake a comprehensive assessment of the Emirate's current marine observation systems to identify information gaps regarding Blue Carbon ecosystems and use this assessment to design a long-term Blue Carbon observation system that employs remote sensing, surveys, and direct measurements to meet the needs of national planning and international cooperation under the UNFCCC;
- **Guidance:** Develop/adapt technical guidelines for Blue Carbon measurement to inform subsequent information development activities regarding carbon pools and/or fluxes. These guidelines should include protocols for ascertaining historical loss and gain rates over past decades, as well as observation protocols for ongoing change. They should also provide a proposed definition of forests suitable for use in the Abu Dhabi context;
- **Integration:** Enhance inter-ministry coordination within the Emirate through the integration of Blue Carbon observation systems within other existing systems that detect trends in coastal water levels, shoreline change, wetland loss, and marine biological systems;
- **Appraisal:** Develop a set of leading indicators of specific impacts on Blue Carbon ecosystems within a collaborative multi-institution process and observe/record changes for those indicators. Indicators should be representative of key characteristics that affect marine flora and fauna in Blue Carbon ecosystems, while being accessible and useful to coastal/maritime management institutions.

- **Synthesis:** Regularly synthesise information from observation systems into databases, maps, studies, briefing notes, and interactive displays that can be used by government planners and the private sector to identify potential areas for future expansion/protection of Blue Carbon ecosystems, as well as useful for raising public awareness regarding the value of these systems.

4.4 Policy Action #2: Blue Carbon Greenhouse Gas Inventory Development

This Policy Action aims to augment existing Emirate-based GHG emission tracking systems to estimate and document carbon pools/fluxes in a spatially-dependent manner consistent with international methodological guidance. It will involve data sharing across institutions, database development, information management, documentation, and dissemination of the levels and rates of carbon pool storage in Blue Carbon ecosystems. Moreover, since reporting GHG emissions is part of the UAE's international commitment under the UNFCCC, an Abu Dhabi Blue Carbon inventory system will eventually need to be incorporated into efforts by the other Emirates.

Blue Carbon inventory development is important because it represents the starting point for any subsequent quantification of the carbon benefits associated with potential mitigation actions. These actions may include, for example, reducing emissions from Blue Carbon habitat loss/degradation, protection/conservation of Blue Carbon biomass stocks, sustainable management of Blue Carbon ecosystems, and enhancement of carbon stocks. While the current *Reducing Emissions from Deforestation and Forest Degradation* (REDD+) mechanism under the UNFCCC is limited to terrestrial systems, REDD+ offers a potential framework to address the carbon mitigation potential inherent in mangroves (although not other Blue Carbon ecosystems).

Today, there is currently no standardised methodology to quantify the carbon emission impact of changes in Blue Carbon ecosystems. The 2006 IPCC Guidelines for National GHG Inventories do not provide specific guidance for the estimation and reporting of anthropogenic GHG emissions from land use change in mangrove forests, salt marshes, seagrasses, or other Blue Carbon ecosystems. However, action is well underway by the IPCC to produce the "2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands". As of this writing, governmental and expert review of the second draft of this Supplement has been completed, with the expectation that the final Supplement will be adopted and accepted at the 37th Session of the IPCC in October of 2013.

Specifically, this strategic Policy Action aims to develop a user-friendly GHG emission tool that can be applied to Blue Carbon ecosystems for periodic GHG emission estimation and reporting for Abu Dhabi. A key feature of the tool is for its design to be compatible with potential follow-on Nationally Appropriate Mitigation Actions (NAMA) activities under the UNFCCC, such as baseline establishment, demonstration of additionality, leakage, and permanence of emissions reductions. The tool will codify the emerging methodological guidance in the IPCC's 2013 Supplement and should be linked to the information products of the Policy Action on Blue Carbon observation system. The use of this tool should position Abu Dhabi to better understand the GHG emission

implications associated with past and current coastal development activities affecting Blue Carbon ecosystems. The specific components of the Policy Action include:

- **Codification:** Design/develop a software tool that codifies IPCC methodological guidance and which can be used by both the UNFCCC focal point in the UAE and the EAD to track carbon storage and emissions from disturbed and/or rehabilitated Blue Carbon ecosystems;
- **Integration***:* Integrate the coastal wetlands inventory development tool into the ongoing efforts in the Abu Dhabi Emirate to develop a systematic and detailed Emirate-level GHG inventory system;
- **Exchange:** Promote national, regional, and international cooperation in gathering/exchange of Blue Carbon GHG inventory information, research, best practices, and experience.

4.5 Policy Action #3: Blue Carbon Ecosystem Services Valuation

This Policy Action aims to introduce economic valuation as a basis to account for the value of market and non-market based services that Blue Carbon ecosystems provide. It will build on the information developed in Blue Carbon observation network Policy Action in conjunction with state-of-the art methods to determine the economic value of the many Blue Carbon ecosystem services: **these currently have an implied economic value of zero** within Emirate-level financial planning frameworks. Blue Carbon ecosystem services include, but are not limited to, nutrient recycling, maintenance of hydrologic balance, pollutant processing, habitat provision, erosion control, biological regulatory services, as well as food for dugongs, coral reef fish, and invertebrates.

The valuation of Blue Carbon ecosystem services is important because the economic value of ecosystem services is currently not incorporated into Abu Dhabi's System of National Accounts (SNA). This is a well-known shortcoming common to many countries and is due to the fact that the value of ecosystem services is less amenable to monetisation than market goods such as oil and manufactured capital, which have clear price signals. Since the SNA constitutes the primary source of information about the Emirate's economy and is widely used for assessing economic performance, policy analysis and decision-making, it is crucial that ecosystem services be represented on the same footing as other goods and services. This will help to engage policymakers outside line ministries, notably in ministries of finance or national planning agencies, by presenting the impact associated with the destruction/degradation of Blue Carbon systems within an economic accounting framework familiar to them.

Standard methodologies are available and can be applied to the valuation of Blue Carbon ecosystem services. The System of Environmental and Economic Accounting (SEEA) was developed as an extension, or satellite account, to the SNA. The SEEA Handbook, compiled by the UN and other international agencies, was completed in 2003 (UN et al., 2003), and further revisions are underway. Several specialised manuals have subsequently been compiled, including one for fisheries (UN and FAO, 2004), which applies an ecosystem-based approach noting that one cannot view fisheries in isolation from the ecosystems on which they depend. The European Environment

Agency has produced a case study of accounting for coastal wetlands in the Mediterranean (EEA, 2010), which is relevant to marine ecosystems. Furthermore, the Abu Dhabi Blue Carbon Demonstration project has developed a methodology for assessing the value of Blue Carbon ecosystems for their provision of ecosystem services that involves field assessments and a simple scoring method for relevant ecological attributes (the Ecosystem Services Assessment Protocol by Agardy, Abdulla and Irving). This methodology has already provided the basis for identifying areas of high ecosystem services value. Together, this international guidance provides a methodological foundation for the economic valuation of Blue Carbon ecosystem services in Abu Dhabi.

Specifically, this strategic Policy Action aims to establish a framework by which to account for Blue Carbon ecosystem services within the national accounting system of Abu Dhabi. The use of this tool should position Abu Dhabi to better understand the economic implications associated with past and current coastal development activities affecting Blue Carbon ecosystems. The specific components of the Policy Action include:

- **Physical accounting***:* Construct a comprehensive ecosystem services account system that will serve as an inventory, in physical terms, of the nature, quantity and quality of Blue Carbon ecosystem assets and services;
- **Economic valuation***:* Apply ecosystem service valuation techniques to the inventory of ecosystem services to ascribe economic value to Blue Carbon ecosystem services within the framework of System of Environmental and Economic Accounting;
- **National accounts integration***:* Establish a System of Environmental and Economic Accounting for the resulting Blue Carbon ecosystem service values and promote the adoption of this satellite accounting system within financial planning/reporting activities in Abu Dhabi.

Furthermore, it is recommended that Abu Dhabi undertake three important lines of more detailed research:

1) More fully determine the condition of Blue Carbon ecosystems, using widespread application of the Ecosystem Services Assessment protocol under a statistically robust sampling regime. The purpose of this would be to better understand which Blue Carbon ecosystems are delivering maximum services, and for those Blue Carbon ecosystems that are degraded, allow identification of the root causes or drivers behind threats.
2) Enhance the understanding of the hydrology and oceanography of Abu Dhabi's nearshore waters and coastal systems, including flows through mangrove channels, sea level changes, and patterns of inundation. This is necessary to be able to model responses to climate change, as well as predicted outcomes resulting from restoration, protection, or – alternatively – habitat loss. It is suggested that such applied research be focused first and foremost on the areas estimated to support the greatest concentration of services (as identified in this assessment).
3) Survey stakeholders and the populace of Abu Dhabi to appraise the perceived value of marine

goods and services, including recreational and cultural values attached to coastal landscapes/seascapes, the value of hazard risk minimisation for developers, insurers, and investors, and the public health values associated with maintaining ecosystem health and minimising disease. The purpose of this is to allow a wider base of investors to participate in the protection or restoration of Blue Carbon ecosystems, and allow provide a more robust basis for determining compensation fees for damage to these ecosystems.

For a more extensive discussion of the role of Blue Carbon ecosystem services, please refer to the Ecosystem Service Assessment of the Abu Dhabi Blue Carbon Demonstration Project.

5 Sustainably Manage Blue Carbon Ecosystems

The second component in the Abu Dhabi Blue Carbon policy is the development of a protocol for the sustainable management of Blue Carbon ecosystems within a broader framework of ecosystem-based management. Such a protocol seeks to recognise that Blue Carbon is a vital component of Abu Dhabi's natural environment and has a special role in relation to the Emirate's development agenda. It also seeks to explicitly address the range of potentially competing perspectives on access to and development of Blue Carbon ecosystem areas.

5.1 Aims

An Abu Dhabi protocol for sustainable Blue Carbon management has two key aims. First, it will promote conservation of Abu Dhabi's Blue Carbon ecosystems through the development of shared management objectives that account for their ecological, social, cultural, and economic value to the Emirate. Second, it will manage Blue Carbon ecosystems in an ecologically sustainable way and within the framework of integrated management principles. Implementing such a protocol will provide clear signals to planners, private sector developers, and other parties regarding the overall framework allowing future disturbance as well as requirements for rehabilitation.

Some notable management and conservation of Blue Carbon ecosystems are already taking place in Abu Dhabi within the framework of international commitments. The 500-hectare Al Wathba Wetland Reserve, established in 1998 approximately 40 km southeast of Abu Dhabi city, is the UAE's fourth site (and first in Abu Dhabi) under the Ramsar Convention on the Conservation of Wetlands. The Emirate has also agreed to include sustainable management of wetlands in national land use planning. This has led to a series of management plans for critical habitats that serve as a proxy for "Effectively Protected Area" (EPA) status. As of 2009, of the 3.7 thousand square kilometers of Blue Carbon ecosystems (i.e., seagrass meadows, mangroves, sabkhas, and coral reefs), about 332 square kilometers, or 9%, enjoy EPA status (AGEDI, 2009).

The development of a management protocol for Blue Carbon ecosystems combined and building upon on-going wetland protection efforts, will help to contribute towards long-term ecological sustainability of these areas. A Blue Carbon management protocol will ensure that concrete steps are taken to stop the degradation and destruction of these ecosystems while recognising the need to sustainably manage on-going human uses of these areas. It will also help to make repair and rehabilitation activities in Blue Carbon ecosystems an integral part of managing the long-term interests the environment, economy, and cultural heritage of the Emirate.

5.2 Objectives

At the broadest level there are several objectives for a Blue Carbon ecosystem management protocol for Abu Dhabi including:

- Account for cultural heritage and other non-price values in developing a consensus set of Blue Carbon ecosystem management objectives among key stakeholders;

- Identify priority Blue Carbon ecosystems, together with their spatial extent and potential vulnerability hotspots, on the basis of a set of indicators;
- Adopt an ecosystem approach to Blue Carbon ecosystem management that reviews the current mangrove afforestation and reforestation practices and incorporates integrated marine spatial planning and adaptation to climate change;

There are three specific Blue Carbon policy actions that are recommended as an initial effort.

These initiatives correspond to:

1. Development of Blue Carbon ecosystem conservation objectives;
2. Establishment of priority Blue Carbon ecosystem areas; and
3. Preparation of formal management plans for priority Blue Carbon ecosystems.

5.3 Policy Action #4: Blue Carbon Management Objectives

This Policy Action aims to establish a set of Blue Carbon ecosystem management objectives that represent a consensus among Emirate-level/national government agencies, the private sector, and non-governmental organisations. The process of consensus-building will embed Blue Carbon ecosystem management within other marine, land, soil, water, air, biodiversity, climate change, and wildlife conservation policies, as well as economic and coastal development policies. It will also help to ensure that Blue Carbon is harmonised with overall national land use and maritime planning objectives and clarify jurisdictional and legal responsibilities concerning Blue Carbon ecosystems.

The establishment of a set of consensus Blue Carbon management objectives is important because it represents a crucial basis for subsequent decisions that may restrict access, require investment, oblige rehabilitation, or redefine protected status. There are likely multiple stakeholder perspectives within the Abu Dhabi Emirate regarding the merits of Blue Carbon ecosystem conservation. Finding common ground may be a straightforward process, or it may involve the discovery and balancing of important competing priorities among coastal land development, oil exploration operations, industrial expansion, and other activities.

Specifically, this Policy Action aims to conduct a collaborative process that invites constructive dialogue around the interests of stakeholders vis-à-vis Blue Carbon ecosystem management. This represents an important step aimed at promoting on-going cooperation and communication among key groups and institutions.

The specific elements of the Policy Action include:

- **Awareness-raising:** This involves making sure people know what Blue Carbon is. It will build upon previous awareness-raising effort and incorporate emerging findings from Blue Carbon research efforts in the Emirate;

- **Engagement:** Design/launch a stakeholder engagement process the outcome of which is a set of objectives for Blue Carbon ecosystem conservation that are amenable to integrating in planning protocols;
- **Dissemination:** Distribute the results of the outcome of the process in various media such as television and the press.

5.4 Policy Action #5: Blue Carbon Ecosystem Priority Areas

This Policy Action aims to identify priority Blue Carbon ecosystems for near-term management planning. Blue Carbon ecosystems, being attractive sites for development activities since the 1960s, have witnessed intensive coastal development activities, leading to habitat loss, fragmentation, and degradation. Given the recent emergence of Blue Carbon in the international climate change policy debate, there is, at present, no comprehensive inventory of the spatial extent of Blue Carbon ecosystem areas in Abu Dhabi. Nor have there been systematic efforts to develop a common set of environmental threat and other relevant indicators that could serve as a basis for establishing priorities for intervention or protection.

Establishing priorities for the development of management plans is important because some Blue Carbon vulnerability and ecosystem service value hotspots merit more urgent attention than other areas where current and near-term future threat levels or ecosystem service values may be lower. Priority rankings can help to identify areas where the development of management plans for rehabilitation, repair, and/or protection are simultaneously ecologically advantageous, economically feasible, and temporally imperative. The ranking of Blue Carbon ecosystems relative to their vulnerability and ecosystem service value is an information-based assessment that draws upon spatial, biological, economic, ecological, and other data collected as part of the observation system component of the Abu Dhabi Blue Carbon Policy. It represents an important step in an ongoing process of sustainable management of these areas and provides an opportunity for a systematic harmonisation of Blue Carbon priorities across institutions and sectors.

Specifically, this strategic Policy Action aims to integrate two key activities of the Abu Dhabi Blue Carbon Policy, namely information management and stakeholder engagement, in the establishment of priority Blue Carbon ecosystem areas for subsequent management plan development. Achieving consensus on priority areas should be based on previous efforts in biodiversity conservation planning as well as on some sort of multi-criteria assessment process in which there is a transparent accounting and weighting of the perspectives of key stakeholders.

The specific elements of the Policy Action include:

- **Objectives***:* Build upon the consensus management objectives established in the previous Policy Action to inform and guide the development/refinement of indicators most pertinent to the evaluation and prioritisation of Blue Carbon ecosystems;
- **Synthesis:** Apply the emerging outputs of Strategy on Blue Carbon observation networks to define the spatial extent and key characteristics of all Blue Carbon ecosystems in Abu Dhabi;

- **Prioritisation:** Assess the set of indicators of Blue Carbon ecosystems within a multi-criteria assessment framework to establish the spatial extent of priority Blue Carbon ecosystem sites.

5.5 Policy Action #6: Blue Carbon Management Plans

This Policy Action aims to develop special management plans for the priority Blue Carbon ecosystems identified through the previous Policy Action. A management plan represents a way to introduce increased specificity in protecting significant Blue Carbon resources and resolving development and protection conflicts where Blue Carbon ecosystems affect the interests of multiple stakeholder communities. Such plans encompass the identification, study, and evaluation of functions to be protected, stakeholder values and interests, and development/investment requirements regarding protection and regulation.

The development of detailed management plans for priority Blue Carbon ecosystem areas is important for two key reasons. First, without a clear management plan, regulatory and permitting authorities at the Emirate level can find themselves caught between competing interests with little opportunity to use a collaborative process to resolve issues to the mutual benefit of the environment, the community, and private interests. Second, a management plan offers an alternative and advantageous approach when compared to an individual permitting process, which can sometimes lead to piecemeal and unpredictable results.

There are several approaches available for the development of management plans. In light of the multiple benefits associated with Blue Carbon, it is essential that an Ecosystem Approach be adopted. An Ecosystem Approach is a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way. It is the primary framework for action under the Convention on Biological Diversity and has been operationalised into a set of practical steps by the IUCN (IUCN, 2004). UNEP has published an introductory guide on Ecosystem-based Management (UNEP, 2011). The Ecosystem Approach is particularly relevant to Blue Carbon management plans because it can incorporate integrated marine spatial planning and promotes the consideration of, and response to, long-term threats such as climate change. According to UNESCO, marine spatial planning refers to the public process of analysing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic, and social objectives. Marine Spatial Planning is based on good data that can lead to good planning and good decision-making, including good data on Blue Carbon resources. Marine Spatial Planning should also take into account the dynamic nature of coastal ecosystems and the fact that climate change will likely alter their distribution.

Within the overall Ecosystem Approach, there are several components that should guide the development of Blue Carbon ecosystem management plans. These include the incorporation of compensatory mitigation schemes to address adverse environmental impacts on Blue Carbon ecosystems caused by development activities; rehabilitation of areas of destroyed/degraded Blue Carbon ecosystems, particularly mangroves; encouragement of non-destructive uses of Blue Carbon ecosystems over activities that involve destruction or alteration of coastal/maritime

conditions; and introduction of enforcement mechanisms to ensure compliance with protection/zoning restrictions. Together, these components provide a framework for the design of management plans that can balance the range of competing interests. In particular, the current policies and practices surrounding reforestation and afforestation of mangroves in Abu Dhabi could be revised and improved to increase the value of the ecological services the rehabilitated ecosystems provide. Key elements of the management plans produced under this Policy Action are summarised in the bullets below.

- **Objectives:** Develop a set of goals linked with the State of Environment (SOE) initiative that are stated relative to each ecosystem type, target species, or function that has been identified a vulnerable to current or future threats;
- **Actions:** Identify specific management actions to be taken with respect to each of the stated objectives, including maintenance, restoration, improvement, remediation, conservation, adaptive management, spatial planning, ecotourism activities, and monitoring actions, and identify the respective actors' roles and responsibilities;
- **Reporting:** Establish and apply a checklist to periodically review progress relative to each of the management actions incorporated into the plan, provide for public/news releases, and review management plans.

6 Enhance Institutional Coordination

The third component in the Abu Dhabi Blue Carbon policy is the enhancement of coordination arrangements across relevant Emirate-level and national governmental institutions. At present, there exist multiple entities with overlapping regulatory, policy, and/or decision-making roles that may pose future challenges for effective and efficient institutional action affecting Blue Carbon ecosystems. It will be essential to clearly define roles and responsibilities regarding Blue Carbon ecosystems across relevant institutions.

6.1 Aims

Enhanced institutional coordination for Blue Carbon ecosystem management has one key aim. That is, it seeks to establish a stable collaboration and coordination framework within which technical and administrative issues can be resolved and decisive actions taken to promote and protect Blue Carbon ecosystems within the overall context of Ecosystem-based Management. Implementing such a framework reflects recognition of the importance of agencies working together for common objectives, and the need for transparency and the exchange of information.

Abu Dhabi's Maritime Strategy was enacted in 2009 and provides the overall vision, goals, and priorities for a government-wide, integrated approach to maritime planning and policy. It underscores the importance of enhanced institutional coordination among public agencies as well as with private sector entities. At present, a major initiative is underway in Abu Dhabi to operationalise its strategic vision into an actionable framework for a consolidated, simplified and updated regulatory system to govern future planning within coastal and marine areas. Known as Abu Dhabi's *Plan Maritime 2030*, it seeks to develop an integrated approach for overall planning and management in the very areas where Blue Carbon resources are located. When completed sometime in 2014 or 2015, the *Plan Maritime 2030* will constitute the unifying action plan for coordinated institutional governance in marine and coastal areas.

It is essential that recommendations regarding enhanced institutional coordination around Blue Carbon ecosystems take advantage of the stakeholder process currently underway to develop Abu Dhabi's *Plan Maritime 2030*. Not only can the other strategic components of the *Blue Carbon Policy* help to inform and augment the focus of *Plan Maritime 2030* to consider Blue Carbon issues, but the institutional strategic component of the *Blue Carbon Policy* can benefit from the mandate of *Plan Maritime 2030* for improved governance around issues common to both Blue Carbon and the larger maritime development vision, including environmental and resource conservation, sustainable use and development, and sustainably managed waterways.

6.2 Objectives

At the broadest level, there are several key objectives that should be advanced within the context of participation in the Plan Maritime 2030 governance and coordination process including:

- Identify potential institutional governance overlaps, gaps and conflicting mandates for Blue Carbon ecosystem management;
- Suggest agency-specific delineated responsibilities for Blue Carbon resource management that minimise duplication and overlapping of efforts;
- Introduce and promote the notion of an Abu Dhabi coordinating body for Blue Carbon resource management that coordinates cross-sectoral planning and implementation; and
- Ensure that institutional coordination arrangements address the need for effective enforcement of penalties against violations in Blue Carbon ecosystems.

There is one specific Blue Carbon policy action that is recommended. This action corresponds to the integration of Blue Carbon issues within the institutional governance aspects of the Plan Maritime 2030 planning process.

6.3 Policy Action #7: Integration of Blue Carbon within Plan Maritime 2030

This Policy Action aims to integrate Blue Carbon institutional coordination needs within the Plan Maritime 2030 process. The integration of specific Blue Carbon-related perspectives offers an opportunity to propose specific institutional arrangements that can promote cooperation and harmonisation of regulatory boundaries regarding the management, protection and rehabilitation of Blue Carbon ecosystems. This integration is important because one of the final outputs of Plan Maritime 2030 will be a holistic, institutional coordination framework that enjoys broad support within key entities in the Emirate. There is no better institutional coordination basis on which to launch the various Blue Carbon policy actions considered. The specific elements of the Policy Action include:

- **Awareness-raising:** This involves making sure people know what Blue Carbon is. It will build upon previous awareness-raising effort and incorporate emerging findings from Blue Carbon research efforts in the Emirate;
- **Engagement:** Design and launch a stakeholder engagement process the outcome of which is a set of objectives for Blue Carbon ecosystem conservation that are amenable to integrating in planning protocols;
- **Dissemination:** Distribute the results of the outcome of the process in various media such as television and the press.

7 Engage in international actions

The fourth component in the Abu Dhabi Blue Carbon Policy is an active engagement in ongoing international actions regarding Blue Carbon. Underlying this policy component is the desire to situate Abu Dhabi as a disseminator of information and promoter of actions that can demonstrate the potential of coastal Blue Carbon ecosystems for meeting the global challenge of climate change.

7.1 Aims

An Abu Dhabi programme for engagement in international actions in support of Blue Carbon management has two key aims. First, it will promote conservation of global Blue Carbon ecosystems around the world through pilot projects and investments. Second, it will disseminate lessons learned from its own experiences in the implementation of its Blue Carbon policy. The development of such a programme will help to increase global recognition of the importance of global Blue Carbon ecosystems and contribute to improvements in the way they are managed and conserved.

There are at least two mechanisms by which these aims could be pursued. At the Emirate level, The Abu Dhabi Fund for Economic Development (ADFD), an autonomous institutions owned by the Emirate, has as its overall mission to help developing countries achieve sustainable economic growth and reduce poverty by providing financial resources, forging partnerships in the public and private sectors, and adopting international best practices to insure aid effectiveness. One of the Fund's objectives is to support development efforts in developing nations by intensifying cooperation with regional and international donors. The use of government grant instruments within the ADFD to support Blue Carbon management projects around the world is consistent with the Fund's aims of poverty alleviation, international cooperation, and cooperate social responsibility. In 2012, the distribution of funds included many countries in tropical climates where Blue Carbon ecosystems show the highest productivity while being under the greatest threat.

At the national level, the development of public policy for foreign assistance is, as of 2013, under the Ministry of International Cooperation and Development. Within this ministry, the Office for the Coordination of Foreign Aid (OCFA) is the lead department for tracking foreign assistance, which in 2011 totalled Dh7.7 billion from 34 UAE donor organisations in grants and loans to development, humanitarian, and charity programmes in 128 countries. About 77% of the total amount came from the UAE government with the next 10% coming from the ADFD. UAE donor assistance encompasses development assistance to improve the quality of life. Given their cultural and heritage value, investing in the protection of Blue Carbon ecosystems is consistent with near-term enhancement of quality of life while also promoting its longer-term enhancement by preserving the existence of these systems for future generations.

In addition, cooperation with the private sector operations abroad is also a potential avenue for

enhancing Blue Carbon resources globally. Abu Dhabi corporations, for example Mubadala, carry out extractive operations all around the world including in many tropical countries with rich Blue Carbon resources. As part of their Corporate Social Responsibility, or from a "licence to operate" perspective, of these Abu Dhabi-based companies, and in order to improve the welfare and livelihoods of the populations in the countries where these companies operate, investments could be made in the protection and maintenance of coastal ecosystem services or in the 'greening' of overseas operations.

The incorporation of Blue Carbon considerations within the selection criteria for one or both of the above donor assistance mechanisms will help to contribute towards sustainable development while ensuring that Abu Dhabi retains a leading role in the Blue Carbon international initiatives. Expanding these funds to incorporate Blue Carbon considerations will ensure that concrete steps are taken to promote the value of these ecosystems for local quality of life as well as for the global benefits they generate.

7.2 Objectives

At the broadest level there are several objectives for promoting international action around Blue Carbon issues:

- Identify priority Blue Carbon ecosystems in various regions throughout the world for potential grant assistance or other forms of support to preserve Blue Carbon ecosystems for current and future generations;
- Develop selection criteria within existing foreign donor assistance mechanisms upon which to prioritise grant assistance for potential Blue Carbon pilot projects or sustainable management initiatives; and
- Promote Abu Dhabi as a host city, and the EAD as a host institution, for the coordination of international technical, policy, and support efforts associated with the Blue Carbon initiative.

There are two specific Blue Carbon policy actions that are recommended. These initiatives correspond to:

1. Providing bilateral donor assistance to sustainable manage priority global Blue Carbon ecosystem areas; and
2. Establishing an international Secretariat for Blue Carbon activities within the Emirate of Abu Dhabi.

7.3 Policy Action #8: Bilateral Blue Carbon investment

This Policy Action aims to expand existing donor assistance frameworks within Abu Dhabi and the UAE to account for the importance of Blue Carbon in national sustainable development strategies of countries with high-productivity Blue Carbon ecosystems. The integration of Blue Carbon-

related perspectives within the donor assistance agenda offers high profile opportunities to engage in actions that are moving to the forefront of the international climate change negotiations. This Policy Action is driven by a range of factors including the recognition of the enormous global benefits that accrue from investing in protecting high-value Blue Carbon ecosystems worldwide, the potential of Blue Carbon ecosystems to support local quality of life, and the capacity for leveraging other international donor assistance through a lead-by-example approach.

The specific elements of the Policy Action include:

- **Criteria development:** This involves the development of internal guidelines within appropriate foreign assistance mechanisms to ensure a systematic and reliable approach to the consideration of Blue Carbon investment/support opportunities;
- **Target setting:** This involves the establishment of annual donor assistance targets in monetary terms for supporting Blue Carbon pilot and other projects;
- **Monitoring and evaluation:** This involves the establishment of internal protocols to monitor and conduct periodic evaluations to assess the impact of the assistance and update selection/support guidelines as needed.

7.4 Policy Action #9: International Secretariat for Blue Carbon

This Policy Action aims to build on the Eye-on-the-Earth process and establish an international Secretariat for Blue Carbon activities in the City of Abu Dhabi, with AGEDI within the EAD as the host entity. At present, technical, policy, research and other activities are being undertaken within a context of a consortium of non-governmental organisations without a centralised coordinated structure. The promotion of Abu Dhabi as a host city for such a centralised Secretariat is consistent with both the recognised value that such a Secretariat would offer, as well as Abu Dhabi's reputation as one of the world's most influential cities, currently ranked 22nd according to the latest edition of Cities of Opportunity report (PWC/PNYC, 2012). This Policy Action is driven by a range of factors including the recognition of the global management benefits that a centralised Secretariat would offer, the potential of such a Secretariat to accelerate and coordinate actions within the climate change negotiations, and the belief that the EAD is uniquely positioned to lead such a unit given its ongoing collaboration with UNEP on Blue Carbon activities. The specific elements of the Policy Action include:

- **Mobilisation:** This involves working with international organisations, NGOs, and other prominent entities engaged in Blue Carbon activities regarding the usefulness, desirability, and modalities of an international Secretariat for Blue Carbon based in Abu Dhabi;
- **Establishment:** This involves the establishment of the Blue Carbon Secretariat at AGEDI within the EAD, with a formal mission statement that describes its functions, responsibilities, and lines of accountability;
- **Coordination:** This involves the development of annual work programmes that promote and

support the methodological, project-based, and policy-related activities of the communities engaged in Blue Carbon-related activities.

8 Promote Public Awareness of Blue Carbon Benefits

The fifth and final component in the Abu Dhabi Blue Carbon policy is the development of a public awareness-raising strategy to support the implementation of the Blue Carbon policy. This outreach to decision-makers, the business community and the public at large is an essential element for ensuring that the Policy Actions implemented as part of the policy promote an on-going resonance with the general public's understanding of Blue Carbon benefits. It is a cross-cutting element that underlies each of the previous policy components and actions.

8.1 Aims

A public awareness-raising programme around Blue Carbon management has one key aim. It will sensitise decision-makers, the general public, including the business community, about the range of benefits offered by Blue Carbon ecosystems in the Emirate, particularly focusing on emerging information about their role in combating global climate change. The development of such a programme will help to increase popular support for the protection of local Blue Carbon ecosystems and contribute to environmental education concerning an important global resource.

8.2 Objectives

At the broadest level there are two main objectives for building public awareness around Blue Carbon issues:

- Develop targeted programmes to raise awareness for key groups about the range of benefits, including carbon storage, associated with protecting Blue Carbon ecosystems; and
- Equip and develop a programme to coordinate all public awareness aspects of the implementation of the Blue Carbon policy.

8.3 Policy Action #10: Promote awareness

It is essential that civil society groups and individuals operate from a common understanding about the role of Blue Carbon in meeting the challenge of climate change. This will help to mobilise public support for new policies. In particular, it will be important to reach out to young people. Children, youth and teachers represent the potential for a future citizenry to be sensitised to the valuable role of these ecosystems. Raising awareness among this group will likely involve targeted awareness-raising events rather than updates to school curriculum.

Another key group is the media. Television, radio, social media, and print are effective in shaping how the message is communicated to the general public. The media should be educated and engaged on key issues to ensure that the message being communicated to the public is closely aligned to unfolding developments and avoids missteps of being overly conservative or optimistic about the role of Blue Carbon ecosystems. Business groups are yet another key constituency. The business community should be assisted through business seminars, exhibitions and dialogues. The specific elements of the Policy Action are summarised in the bullets below.

- **Programme development:** This involves working with technical experts to fashion a unifying message about the benefits of Blue Carbon ecosystems that can be adapted relative to specific target groups;
- **Coordination:** This involves the development of an overall strategy and action plan to coordinate public awareness campaigns and activities around Blue Carbon.

9 Next Steps

The Policy Actions discussed above emphasise the Emirate's commitment to contribute to promoting Blue Carbon as an important element in confronting global climate change. The policy reflects a desire to act in a decisive, proactive and collaborative manner with all of Abu Dhabi's stakeholders. Indeed, through concerted action among public and private entities in Abu Dhabi, the Policy's underlying vision of enhanced Blue Carbon knowledge, management, coordination and communication activities can and surely will be realised in the Emirate. Such concerted action has the benefit of aligning Abu Dhabi's sustainable development priorities within a global partnership to effectively confront climate change, as well as doing so in a way that reflects Abu Dhabi's unique culture and heritage.

The translation of this policy commitment into action is a separate step that necessarily requires careful deliberations on appropriate implementation mechanisms. Policy implementation is distinct from policy development and involves a number of steps that can codify the Policy Actions previously discussed within a framework of feasibility, institutional responsibility, and monitoring/evaluation procedures. At the very least, Immediate next steps will incorporate any implementation-focused inputs offered at the mid-level and high-level Blue Carbon policy workshops as well as a detailed assessment of key activities, institutional modalities, and effective monitoring protocols in order to translate strategic policy directions into concrete actions that are visible and measurable. The ultimate aim is the comprehensive operationalisation of the Abu Dhabi Blue Carbon Policy to the benefit of the Abu Dhabi Emirate, the UAE at large, the Arabian Gulf region, and the planet.

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