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

هيئة البيئة - أبوظبي
Environment Agency - ABU DHABI

Systematic Conservation Planning Assessments and Spatial Prioritizations

Supporting Technical Information for the Arabian Peninsula

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Abbreviations and Definitions

Abu Dhabi	Emirate of Abu Dhabi
ADCO	Abu Dhabi Company for Onshore Oil Operations
AGEDI	Abu Dhabi Global Environmental Data Initiative
BLM	Boundary Length Modifier
CBD	Convention on Biological Diversity
CLUZ	Conservation Land-Use Zoning
CMRECS	Abu Dhabi Coastal and Marine Resources and Ecosystem Classification System
CR	Critically Endangered – IUCN Red List Threat Status
DD	Data Deficient – IUCN Red List Threat Status
EAD	Environment Agency – Abu Dhabi
EAD GISDB	EAD's Geographical Information System Database
EBDB	EAD's Environmental Baseline Database
EEA	European Environment Agency
EIA	Environmental Impact Assessments
EN	Endangered – IUCN Red List Threat Status
eMISK	Environmental Monitoring Information System of Kuwait
ESRI	Environmental Systems Research Institute
EWS-WWF	Emirates Wildlife Society in association with Worldwide Fund for Nature
GEBCO	General Bathymetric Chart of the Oceans
IBA	Important Bird Areas
IPA	Important Plant Areas
IUCN	International Union for Conservation of Nature
KSA	Kingdom of Saudi Arabia
LoN	Letter of Notification
LT	Least Threatened – IUCN Red List Threat Status
MARXAN	MARine, and SPEXAN, itself an acronym for SPatially EXplicit ANnealing
NT	Near Threatened – IUCN Red List Threat Status
PFA	Priority Focus Area
Project	Local National and Regional Biodiversity Assessment Project
SCP	Systematic Conservation Planning
SPF	Species Penalty Factor
SRTM	NASA Shuttle Radar Topographic Mission
UAE	United Arab Emirates
UNEP	United Nations Environment Programme
UNEP-WCMC	UNEP - World Conservation Monitoring Centre
UPC	Abu Dhabi Urban Planning Council
USGS	United States Geological Survey
VLIZ	Flanders Marine Institute
VU	Vulnerable – IUCN Red List Threat Status

1 Introduction

1.1 Background

A systematic biodiversity assessment for the region was first proposed at the 11th Conservation Workshop for the Fauna of Arabia in Sharjah in 2010. A workshop produced a first rapid biodiversity assessment for the Arabian Peninsula (Holness, Knight, Sorensen, & Othman, 2011) and demonstrated that the approach could be applied to the region. At the plenary session of the subsequent First Conference on Biodiversity Conservation in the Arabian Peninsula 2010, it was recognized that there was a need to:

- Produce a habitat map for the Arabian Peninsula.
- Collate information on the distribution of species across the Arabian Peninsula.
- Use the habitat map and the species distribution maps to conduct a systematic conservation assessment for the Arabian Peninsula.
- On the basis of this conservation assessment, work towards a Regional Conservation Strategy that may include:
  - The restoration of traditional forms of resource management (e.g. hema).
  - The development of Trans-Boundary Conservation Areas.

The Environment Agency-Abu Dhabi (EAD) accepted the mandate from this international meeting and made a commitment at the Conference to support a Systematic Conservation Assessment for Arabia. This Abu Dhabi Global Environmental Data Initiative (AGEDI) Local, National and Regional Biodiversity Assessment Project (Project) is one of the results of that commitment. The Project is focused on the following three tracks:

- Track 1: Local - The Emirate of Abu Dhabi (Abu Dhabi).
- Track 2: National - The United Arab Emirates (UAE).
- Track 3: Regional - The Arabian Peninsula comprising Bahrain, Jordan, Kuwait, Oman, Qatar, Kingdom of Saudi Arabia (KSA), UAE and Yemen.

This report provides supporting technical information in relation to the Arabian Peninsula track of the Local, National and Regional Biodiversity Assessment Project to that published within the AGEDI project e-booklet *Systematic Conservation Planning Assessments and Spatial Prioritizations for the Emirate of Abu Dhabi, the United Arab Emirates and the Arabian Peninsula*.

1.2 Systematic Conservation Planning Concept

The Project is based on the Systematic Conservation Planning (SCP) concept. This is the process of deciding where, when and how to allocate limited biodiversity conservation resources to minimize the loss of biodiversity, ecosystem services and other valuable aspects of the natural environment. The benefits of such a robust evidence-based, conservation planning approach have been demonstrated in a wide

variety of marine and terrestrial environments and scales, from regions to reserves, across the globe.

Since it emerged in the 1990s (Margules & Pressey, 2000) and coupled with decision-support software such as MARXAN (Ball, Possingham, & Watts, 2009), GIS-based SCP has rapidly become an important tool for planning biodiversity conservation at various scales. MARXAN is freely available from the University of Queensland (http://www.uq.edu.au/MARXAN/) and the MARXAN process is reviewed in the Conservation Land-Use Zoning software (CLUZ) website (http://www.kent.ac.uk/dice/cluz/index.html). The principal reason for this widespread take-up is that SCP provides efficient spatial solutions to the sensitive, resource allocation problems required to identify ecologically representative and well-connected systems of Protected Areas and other effective area-based conservation measures. SCP is also cost efficient and reduces conflicts by minimizing spatial competition with other land use activities.

The planning process is essentially a sequential, data integration method that builds on the input of the best available data. This can add value to existing datasets. It is also highly dependent, especially in data-deficient areas, on the input of expert knowledge derived at workshops.

The SCP process can be broken down into a series of inter-linked activities, which are summarised in Figure 1-1 below. Each individual activity consists of a number of iterative steps and may require adaptive feedback loops.

Figure 1-1: Systematic Conservation Planning Process Summary

These stages for the Project are explained in more detail in the subsequent sections of this report.

1.3 Arabian Peninsula Planning Domain

The planning domain is defined as the area of coverage and interest of the Project. The terrestrial area of the Arabian Peninsula is 2,875,976 km^2 and a marine area of 1,406,787 km^2 bounded by the Exclusive Economic Zone (EEZ). The boundary used as the planning domain for Track 3 is shown in Figure 1-2. This is derived from Flanders Marine Institute (VLIZ) and Ergonomics and Safety Research Institute (ESRI) World Countries data sources (detailed in Section 3). The Arabian Peninsula for the purposes of this Project is comprised of the following countries:

- The Hashemite Kingdom of Jordan (Jordan).
- The Kingdom of Bahrain (Bahrain).
- The Kingdom of Saudi Arabia (KSA).
- The Republic of Yemen (Yemen).
- The State of Kuwait (Kuwait).
- The State of Qatar (Qatar).
- The Sultanate of Oman (Oman).
- The United Arab Emirates (UAE)

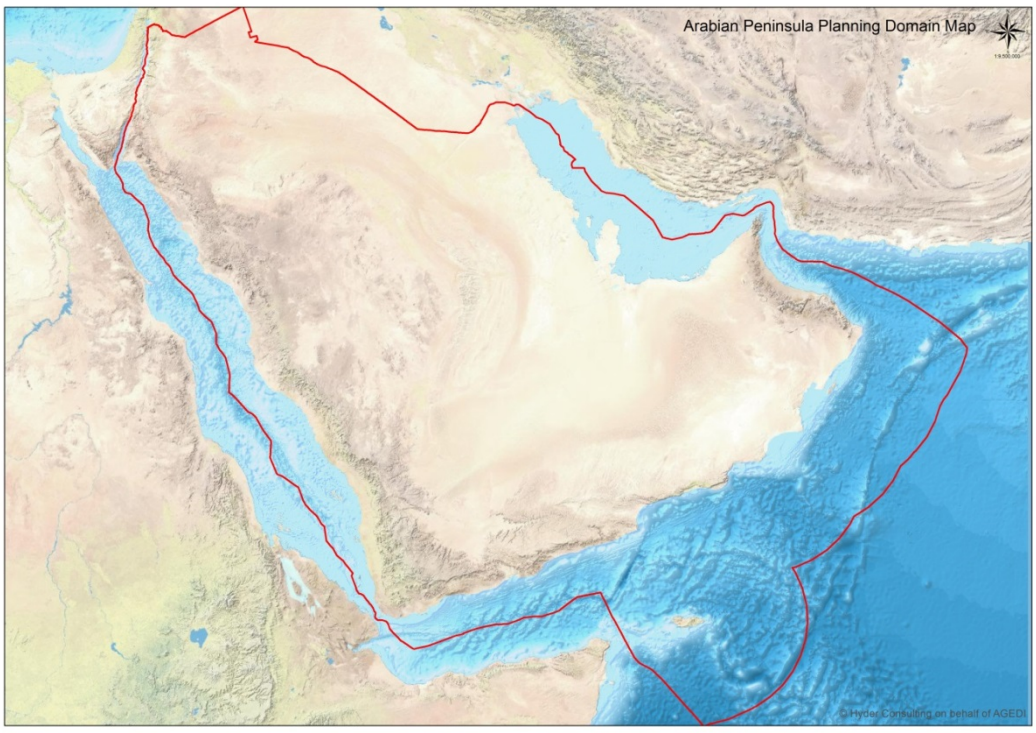


Figure 1-2: Arabian Peninsula Planning Domain used for the Project

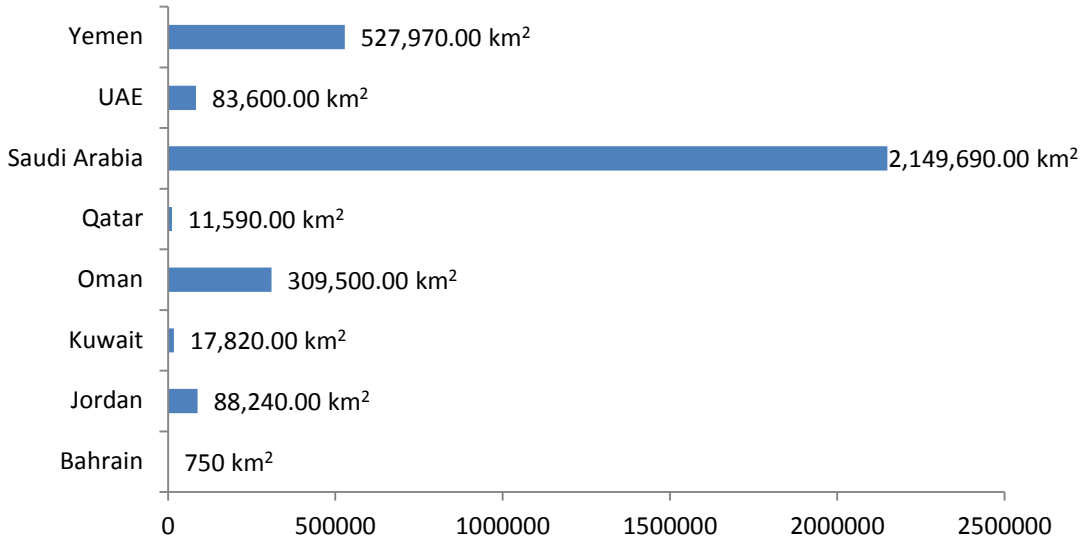


Figure 1-3: Land Area of each Arabian Peninsula Country

The land areas of each of the Arabian Peninsula countries are shown in Figure 1-3. The boundaries illustrated in this report should only be viewed and used as a planning domain boundary for the purpose of the Project and should not be used for any other purpose.

2 Data Acquisition and Stakeholder Engagement Methodology

2.1 Introduction

A key component of the Project was the acquisition of existing data to be used to derive the ecological, threat and opportunity layers which are the input layers for the spatial prioritization. This involved the identification of stakeholders, data scoping, stakeholder engagement, expert workshops, and the review of data and the incorporation of relevant data into the Base Data Archive.

Following completion of the stakeholder engagement and data acquisition period for the regional track, an Arabian Peninsula Base Data Archive Report was prepared which set out a detailed description of the methodology through which relevant Arabian Peninsula data was acquired for the Project and how the data was managed and reviewed for its suitability for inclusion in the Project. It also detailed the data sources and the final Arabian Peninsula component of the Base Data Archive. This section provides an outline of the engagement and summarises the data that was acquired and included in the Base Data Archive.

2.2 Stakeholder Engagement Planning

A Stakeholder Liaison Plan was prepared prior to the initiation of local, national and regional stakeholder engagement. This report identified an initial total of 227 stakeholder individuals who comprised of 102 stakeholder organisations and independent individuals (hereafter collectively referred to as entities, 57 at the local and national scales and 45 at the regional scale.

Through the stakeholder engagement process, additional entities were identified. At the conclusion of the stakeholder engagement process, the total number of stakeholders was 343 and comprised a total of 138 stakeholder entities with 67 at the local and national scales and 71 at the regional scale. A Stakeholder Engagement Tracker was used to manage stakeholder engagement and documented all correspondence between them and the Project.

Using a variety of sources, the Stakeholder Liaison Plan identified:

- Data focal points - These were leaders within overseas, regional, national or local organisations with which the Project could establish agreements and expedite and facilitate cooperation and involvement by a wider group of dependent data providers and experts (both defined below). Two groups of data focal points were identified: priority and general.

- Data providers - Data providers were technical specialists who have collated or collected or managed important biodiversity or related datasets or whose experience provided them with specialist knowledge. Two groups of data providers were identified: those that were ‘independent’ and with whom contact was made directly and ‘dependent’ who were known staff within organisations but where permissions were required from the data focal point to make contact.

- Experts - Experts were a subgroup of data providers with the greatest depth of knowledge in their specialist area. Again there were independent and dependent experts.

2.3 Stakeholder Engagement

Once stakeholders were identified, Letter of Notification (LoN) packages were prepared and issued. The LoN packages introduced the Project to the stakeholders and requested the nomination and contact details of a focal point. The stakeholder engagement process for the local scale was undertaken between April 18th 2012 and August 9th 2012.

Following the issue of the LoN packages and, once a nominee name was received, Request for Information (RFI) packages were issued. This commenced on May 9th 2012; each RFI package consisted of a detailed list of data required along with details of the appropriate format for data submission.

2.4 Stakeholder Meetings

Meetings were arranged for priority regional organisations who were considered to be the most likely to contribute relevant data to the Project. The remaining stakeholders were then met with if the data held was considered to be of high relevance to the Project and the establishment of administrative alliances with the entity was of importance to AGEDI.

Fourteen meetings in four countries were conducted at the regional level (excluding UAE) with key external stakeholders to introduce the Project and the team, the Project's methodology, and to discuss data availability. At some of the meetings, focal points invited other relevant stakeholder entities to explore potential involvement with the Project.

It should be noted that meetings with Saudi and Omani stakeholders were sought to introduce the project through formal presentations by the project team but a corresponding invitation was not received within the project timeline. This however did not preclude valuable support from both Oman and KSA as key specialists attended the EAD hosted project regional technical workshop of 11th and 12th November 2012. Additionally, further support was provided by these and other invited experts at the 14th Conservation Workshop held at the Breeding Centre for Endangered Arabian Wildlife in Sharjah of 3rd and 4th February 2013.

The Project Team was unable to visit Yemen because of the security situation. Despite this, a government focal point was provided and good communications were enabled with a range of stakeholders including attendance at both regional workshops.

2.5 Expert Workshops

Expert workshops were undertaken to review and verify the Base Data Archive, the derived layers, threat status, protection level and spatial prioritisation. The workshops also helped fill data gaps identified during the base data archiving exercise. In addition to the four workshops held at the local and national scale, three workshops were held at the regional scale.

One 'Regional Technical Workshop' was undertaken with a total of 37 experts on November 12th and 13th 2012 and a subsequent 'Regional Technical Workshop Continuation' was conducted on November 14th 2012 with Othman Llewellyn from Saudi Wildlife Authority (SWA).

Final conservation assessment outputs were presented at a 2-day workshop, within the 5-day 14th Conservation Workshop (CAMP) at the Breeding Centre for Endangered Arabian Wildlife (BCEAW) in Sharjah on February 3rd and 4th 2013. This workshop also

included a ranking of the PFAs by the attendees and acted as a capacity building workshop.

A summary of these is provided in Table 2-1.

Table 2-1: Summary of Workshops

No	Workshop	No. of Attendees	Workshop Purpose	Workshop Outputs
1	Regional Technical Workshop	37	To review the six Arabian Peninsula derived data layers and related products produced.	• Arabian Peninsula Integrated Habitat Map • Habitat Classification Description Maps showing important species areas • Species/Ecological Processes workshop metadata forms. • Additional data on opportunities and constraints
2	Regional Technical Workshop Continuation	1	Meeting with Othman Llewellyn from SWA to enhance the ecological habitat derived layer using the SWA's Arabian Peninsula Bioregional Classification.	• Improved Ecological Habitat Derived Layer
3	14th Conservation Workshop at the Breeding Centre for Endangered Arabian Wildlife in Sharjah	55	To review the PFAs and related products produced for the Project.	• An agreed list of the most important PFA for conservation action ranked against three criteria. • Knowledge transfer.

2.6 Data Scoping

2.6.1 Data Scoping Methods

The SCP process required well organised spatial data on biodiversity and related pressures/constraints and opportunities features. Prior to issuing requests to identified stakeholders for collaboration through the provision of data, a data scoping exercise was undertaken to help define the types of data and sources that would be required for each of the derived layers. The results were compiled within the Arabian Peninsula Data Scoping Report.

2.6.2 Data Criteria

The criteria described in the subsequent sections were a key consideration for the selection of relevant datasets for the Project.

2.3.2.1 Geospatial Data

A fundamental requirement in SCP assessments is that all data used must be spatial. As the principal outputs are spatial analysis and viewed on a map, the data used must have geographical context. Hence, if biodiversity or other land-use data do not have geospatial information associated with them, then these cannot be used for SCP.

2.3.2.2 Comprehensive Coverage

Completeness of the data is important for SCP and data supplied should preferably cover the entire planning area. In some cases it may be necessary to interpolate or extrapolate the data to create comprehensive data distributions.

2.3.2.3 Data Scale

The scale or resolution of the feature data sets needs to be appropriate for the area of interest or planning domain. MARXAN requires that the planning domain is divided into equal area planning units so that quantitative targets for each feature may be applied. The Arabian Peninsula assessments worked on hexagons with an area of 10 000ha or 100km^2 (this equates to sides of approximately 6.2km, a point to point distance of approximately 12km and a side to side distance of approximately 10km).

2.3.2.4 Equal Coverage across Taxa

Ideally, equal coverage for all selected taxa should be available for the planning domain. In practice this is unlikely to be the case, so there is a need to fill the gaps with expert inputs. SCP also makes use of proxies for missing data and poorly known taxa.

2.3.2.5 Original Habitat Extent and Current Distributions

There is a requirement to have at least an estimate of original extent of habitats. This is because within SCP targets for habitats are set against original extent.

2.3.2.6 Density vs. Presence / Absence

The outputs of the SCP process are most useful if they incorporate issues such as high density or core areas for species. Hence detailed distribution density data are useful for key species such as that generated from atlas fieldwork which employ timed counts within randomly selected, grid squares. However, this data is not a necessity.

2.3.2.7 Justification for Feature Inclusion

There is a need for clear documented justification for inclusion (or exclusion) of each feature (e.g. species). This requires a defendable and transparent basis for selecting the species and other features which are included in the conservation assessment. The Project satisfied this through several assessments discussed further in Section 2.7.

2.6.3 Data Types

The principal types of data required for SCP can be broken down into three biodiversity features and three other layer types. These are shown in Figure 2-4.

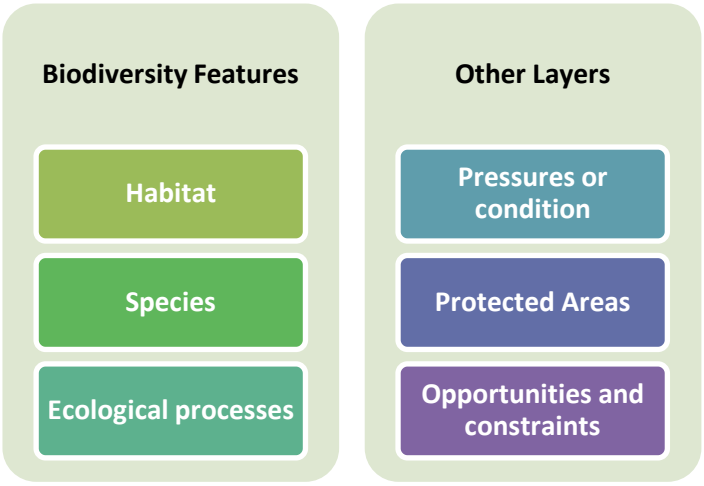


Figure 2-4: Summary of Principal Data Types Required for Systematic Conservation Planning

Details on these types of data required to prepare the derived layers for the SCP are further discussed below.

2.3.3.1 *Habitat Data*

Habitat data was used to produce an integrated habitat map. This habitat map was the basis for all subsequent analyses. Conservation targets were set against the original extent of each habitat type. The current ecosystem threat status was evaluated for these habitat types, as was the level of protection of each of these types ('gap analysis'). Conceptually, the baseline was the extent of habitat before significant anthropogenic impact on the planning domain.

The ideal dataset would be an integrated, hierarchically nested, high resolution, marine and terrestrial habitat map. The habitat classification may be based on maps produced for vegetation, bioregional classification and land cover. The lack of a refined and high resolution vegetation maps is common in many planning areas and the use of habitat proxy maps is thus well founded. The creation of a habitat proxy map which is sufficient for SCP does not remove the need for appropriate field or remote sensing-based mapping in the longer term. There is often the need to 'edge map' or create a seamless boundary between the separate marine and terrestrial classifications basing the edge on the higher resolution map and extending the land cover to the original habitat type to fill any gaps.

2.3.3.2 *Pressures or Condition Data*

The second key set of data required for systematic planning are data on the current remaining extent or condition of habitats or other biodiversity features. In the terrestrial context this is typically represented in a land cover or land use map, while in a marine environment this typically takes the form of a map of the major pressures on marine ecosystems (e.g. fishing effort and pollution) but can also include areas with direct transformation of marine habitats (e.g. harbour and oil infrastructure). There is generally a strong inverse relationship between levels of transformation in a landscape and biodiversity intactness (Scholes & Biggs, 2005), and these layers provide a key insight into remaining areas of high biodiversity value. Current and historical data are valuable to assess the state of transformation and loss of habitats.

Land Use (Terrestrial)

Land uses are classified in two categories based on their impact on biodiversity: habitat transforming and habitat degrading land uses. Transforming land uses include urban and industrial land uses which include structures such as buildings, roads, pipelines, power lines, and waste sites, and arable agriculture (e.g. planted fields and plantations).

Degraded habitats include overgrazed areas with high densities of camel and goats, and areas with significant groundwater impacts, and areas in close proximity to infrastructure where some level of degradation can be expected.

Pressures (Marine)

Typical marine pressures data include:

- Areas of high fishing effort or catch.
- Marine pollution.
- Landing site.
- Aquaculture.
- Marine structures (e.g. oil rigs).
- Coast development impacts on adjacent marine biodiversity.

2.3.3.3 *Protected Areas Data*

There are a range of Protected Areas designations. All included in this category are formally protected under the relevant legislation. All others are regarded as informally protected and placed within the Opportunities derived layer..

2.3.3.4 *Species Data*

Species data is used to enhance the spatial prioritization and hence the Project sought distribution data for species with restricted ranges or with particular habitat requirements. The distributions of widely occurring species were not included as these are catered for by targeting sufficient areas of each habitat type. There was thus a need to prioritise species for inclusion into the assessment. The principal priorities were the IUCN Red List Species together with regional and national assessments of threat together with culturally significant species.

The key species datasets for SCP included:

- Species distribution of rare, endangered and range limited species.
- Species breeding areas.
- Spawning sites.
- Migration stopovers.
- Over-wintering and specific foraging areas especially for mobile species such as marine fish, reptiles and mammals and flying species such as bats and birds.

2.3.3.5 Ecological Processes Data

The presence of species, and even habitats, is not sufficient to ensure long term persistence of biodiversity. Therefore there is a need to deliberately include the important ecological processes on which the persistence of biodiversity pattern depends. The identification of areas important for supporting ecological processes is a key activity for any conservation planning project, and this Project is no exception. However, data scoping revealed that little or no direct data on ecological processes existed for the region and other methods were used to fill this gap as detailed in Section 3.6. This is clearly a priority for any future iterations of the Project.

2.3.3.6 Opportunities and Constraints Data

Opportunities

Opportunity areas are all areas which are not formally protected but for one or a number of reasons offer the potential for enhancement of the Protected Area network due to sympathetic land use or land management. These are thus very important to identify for the spatial prioritization.

The primary opportunity areas are areas that receive a level of habitat or species protection but which are not formally (legally) recognised as Protected Areas such as:

- Fisheries Reserve.
- Private Protected Areas.
- Marine and Terrestrial Stewardship Areas.
- Traditional management areas (e.g. hema).

There are also areas under biodiversity-compatible land use controls. These areas form the basis for future expansion of conservation areas and include:

- Fishing areas, where low intensity traditional methods are used.
- Important Bird Area (IBA) and Important Plant Areas (IPA).
- Expert identified areas of conservation opportunity or low cost for conservation.
- Areas under control of organizations such as oil companies or the military, which although not primarily (or even deliberately) managed for biodiversity conservation, may have a biodiversity benefit due to the exclusion of activities such as grazing or uncontrolled off-road vehicle access.
- Sites protected for cultural reasons – e.g. natural areas of World Heritage Sites and their buffers.
- Sites of cultural importance, which have high touristic / cultural / traditional value to the local, national or global population, and where synergies may exist between conserving landscapes for cultural and biodiversity objectives.

Constraints

These areas provide the basis for identifying areas that are likely to be transformed in the future, that have been earmarked for development, where development has already

been approved, or where other factors reduce potential for effective conservation actions. These include:

- Land use and development plans including urban edges.
- Development and infrastructure projects.
- Areas with low conservation opportunity.
- Expert identified areas of high conservation cost.

2.6.4 Data Formats

A fundamental requirement of the SCP is that all data used must be spatial as the principal outputs are spatial analysis and will be viewed on a map. Thus, the data format used must have had a geographical context.

The appropriate data formats requested of contributors, detailed in the Arabian Peninsula Data Scoping Report, included the following:

- Environmental Systems Research Institute (ESRI) geodatabase, and this includes:
  - ESRI's Personal geodatabase (.mdb).
  - ESRI's File Based geodatabase (.gdb).
- ESRI Shapefile (.shp).
- ESRI ArcINFO export with no compression (.e00).
- Drawing Exchange Files (.dxf).
- Raster data.
- Geospatial PDF.

2.7 Data Review and Management

When data was received from a stakeholder, the following steps were undertaken:

- The data received from a stakeholder was recorded in the Incoming Data Register. This recorded the date of receipt, source and format.
- Data was then given an initial type and format review, and only spatial data was loaded into the Base Data Archive geodatabase. This is discussed in further detail in Section 2.7.1.
- Once all available data had been received with the data collection period of the Project, a further comprehensive review (discussed further in Section 2.7.3) was undertaken to determine the suitability of the feature classes for the derived layers. If the data was considered suitable then it was loaded into the relevant derived layers feature class.

2.7.1 Data Review for Base Data Archive

To enable data to be loaded into the Base Data Archive geodatabase a format review was required against the data format criteria described in Section 2.6.2.

During the data collection phase, a number of stakeholders shared essential and up to date datasets which were geospatial, but not yet mapped. A review of these datasets was undertaken to check that first, the datasets could be reworked into a correct format within the Project timeframe and that second, if the data were to be reworked, that only the most appropriate and relevant spatial data was reworked and incorporated into the Base Data Archive.

Where the data was not in the correct format but was deemed essential and up to date for the Project, it was converted to the correct geospatial format. This was an iterative process and was undertaken as data was provided over the data collection period. Examples of the type of data provided by stakeholders and the type of geoprocessing undertaken to convert these to a more suitable format included:

- Word documents - Maps relevant to the Project provided in Word documents were digitised into new feature classes.
- Excel workbooks - Relevant data provided in Excel format were converted into new point feature classes and then converted into correct coordinate system (defined in Section 3.4 of the UAE Data Scoping Report to load into the geodatabase.
- PDFs - Selected PDF documents were used to verify data received from other stakeholders. With PDFs containing maps relevant to the Project, the selected maps were converted into .geotiff files. These were then geo-referenced and used to capture data (e.g. Dubai Major Projects Plan).
- Images - Selected Images (.jpeg and other files) were used to verify data received from other stakeholders.
- Shapefile - Shapefiles (.shp files) were converted into the correct coordinate system to load into the geodatabase.
- Geodatabases - Feature classes were converted into the correct coordinate system to load into the geodatabase.
- AutoCAD - Select AutoCAD files (.dwg and .dxf files) were converted into the correct coordinate system to load into the geodatabase.
- MapInfo - Select MapInfo files (.map and .tab files) were converted into the correct coordinate system to load into the geodatabase.
- Raster datasets - Select raster files (.grid and other files) were converted into the correct coordinate system to load into the geodatabase.
- Google Earth - Select Google Earth files (.kmz and kml files) were converted into the correct coordinate system to load into the geodatabase.

Once the files were successfully converted, an assessment was employed to identify any invalid or topologically incorrect geometry. If any were found, the geometry of concern was corrected.

2.7.2 Base Data Archive Geodatabase

The Base Data Archive is an ESRI File Geodatabase (Version 10.0) into which data was categorised by six data types (referred to in the database as feature dataset – i.e. a collection of related Feature Classes that share a common coordinate system).These six types are listed below along with 'Other Layers' which is a feature dataset that holds data relevant to the Project but that did not fit within the other six data types (e.g. the regional planning domain boundary).

The seven feature datasets are as follows:

- Ecological Processes.
- Habitat.
- Opportunities and Constraints.
- Pressures and Conditions.
- Protected Areas.
- Species.
- Other Layers.

It should also be noted that any raster data received could not be held within the feature datasets due to their format and thus had to be saved separately but within the same geodatabase.

The feature classes (homogeneous collections of common features, each having the same spatial representation, such as points, lines, or polygons, and a common set of attribute columns) associated with the feature datasets have the following naming convention:

Geographical area of data_Source of data_Name of original feature class (e.g. UAE_GISDB_Habitats)

As the three planning domains are nested (i.e. Abu Dhabi is part of the UAE which in turn is part of the Arabian Peninsula), only one Base Data Archive geodatabase was created for all three scales. This allowed easier management of the geodatabase and for single datasets to be used at one or more planning domains.

Appendix A provides a list of all the feature classes relevant to the Arabian Peninsula planning domain. The Base Data Archive is a holding geodatabase of all potentially relevant spatial data but it sho**u**ld be noted that not all data loaded into the Base Data Archive was used to subsequently create the derived layers. Each feature class was subject to further checks as detailed in Section 2.7.3 prior to their use within the derived layers.

It should be noted that in many cases, particularly for species data, the data was contributed for use in the Project only and cannot be distributed or used for other purposes without specific permission from the data owner. These layers are identified in the Base Data Archive in Appendix A.

2.7.3 Data Review for Derived Layers

A review process was undertaken for each feature class to determine its inclusion or exclusion within each of the derived layers of the Derived Layers geodatabase. For each feature class to be loaded into the derived layer geodatabase the following checks were applied:

1. Temporal review - review of the temporal extent of the data to determine whether it is reflection of what currently exists or is out of date.

2. Quality review - review of the quality of the datasets against the criteria set out in Section 2.6.2 and determining whether it was fit for the Project's purpose.

Certain feature classes within the Base Data Archive were not incorporated into the derived layers because often, more comprehensive, more up to date or more complete feature classes were received and were integrated instead.

2.7.4 Derived Layers Geodatabase

Similarly to the Base Data Archive geodatabase, one 'Derived Layers' geodatabase was created to collect the derived layers. Within this geodatabase, each of the feature classes within the Base Data Archive were reviewed and only those deemed complete and relevant were loaded into the Derived Layers geodatabase. This activity converted a selection of Base Data Archive feature classes into one feature class in the Derived Layers geodatabase.

Additional fields were created for some feature classes to log the data sources, dates the data were loaded into the Derived Layers geodatabase and to record the geoprocessing the data had undergone to allow uploading into the geodatabase. In some cases, where data needed to be distributed, a simplified version of the layer was created with non-critical or confidential fields removed. This process has been adopted for the dissemination material for stakeholders. Metadata of the feature classes was then created for each feature class within the geodatabase. The metadata created followed the template described in ISO 19139: 2007 'Geographic information Metadata XML schema implementation'.

3 Data Inputs into Systematic Conservation Planning

3.1 Introduction

The Project's approach was based on the SCP concept, which represented the best practice in this field. The approach is an evidence-based method for identifying geographic areas of biodiversity importance, which involves:

- Mapping biodiversity features (such as ecosystems, species, spatial components of ecological processes).
- Mapping a range of information related to these biodiversity features and their ecological condition; setting quantitative targets for biodiversity features; analysing the information using software linked to GIS.
- Developing maps that provide headline indicators of the current status of ecosystems (namely the ecosystem threat status and ecosystem protection level assessments).
- Identification of spatial biodiversity priorities.

Systematic conservation planning is dependent on spatial data that may be obtained from existing spatial datasets, derived spatial datasets or through expert driven workshop processes. The key categories of spatial data are summarized in Table 3-2.

Table 3-2: Summary of Major Categories of Data Included in each of the Primary Analyses

	Ecosystem threat status	Ecosystem protection level	MARXAN spatial prioritization
Habitat	x	x	x
Condition	x		x
Protected Areas		x	x
Species			x
Ecological processes			x
Opportunities and constraints			x

3.2 Mapping and Classifying Habitats

The ability to map and classify habitats into different ecosystem types is a key basis for SCP. The integrated habitat map for the Arabian Peninsula served as a:

- Basis for setting targets for a representative set of ecologically distinct areas.
- Basis for identifying original extent of habitats.
- Broad proxy for other associated fauna and flora.

The integrated habitat map is comprised of a terrestrial and a marine portion. Both components were derived from existing geospatial data (with its intrinsic accuracy limitations), and used as a proxy for biodiversity planning for the Arabian Peninsula. The habitat map is not a detailed and definitive habitat map but has been derived for the purposes of this Project. It should not be regarded as a replacement for a detailed field-based survey.

3.2.1 Data Sources Used

The terrestrial component of the map was derived using the following data sources:

- Geology of Arabia geospatial data from United States Geological Survey (USGS) (http://www.orrbodies.com/resources/item/orr0041).
- Inland Waters geospatial data from Diva-GIS.org (http://www.diva-gis.org/).
- NASA Shuttle Radar Topographic Mission (SRTM) 90m v4 geospatial layers (http://srtm.csi.cgiar.org/).
- Data within Chapter 3 of the Draft Protected Areas System Plan for Saudi Arabia, Bioregional Classification tables and maps (Llewellyn, 2011).
- Biogeographical Zones of Jordan (El-Eisawi, 1996) provided by Royal Society for the Conservation of Nature.
- Satellite imagery from IKONOS and Google Earth.

The marine component of the map was derived using the following data sources:

- CMRECS (EAD, 2010) was used to derive marine (and coastal) habitat types in Abu Dhabi (e.g. mangroves, coral reef). This is part of the EAD's Environmental Baseline Database (EBDB).
- Island descriptions from the National Atlas of the UAE (UAE University, 1993).
- General Bathymetric Chart of the Oceans (GEBCO) bathymetric data (http://www.gebco.net/data_and_products/gridded_bathymetry_data/).
- Mangrove and seagrass geospatial data from the UNEP-WCMC http://data.unep-wcmc.org/datasets. This data ranged from 1997 to 2011.
- Unpublished coral reef distribution geospatial data from UAE and Oman surveys in 2010 from John Burt at New York University Abu Dhabi.
- Unpublished coral reef geospatial data from Environmental Monitoring Information System of Kuwait (eMISK). This and all other eMISK data was provided subject to a non-disclosure agreement.
- Marine habitat data from Qatar Ministry of Environment.
- Satellite imagery from IKONOS and Google Earth.

3.2.2 Process

3.2.2.1 Mapping Terrestrial Habitat

Creating the Arabian Peninsula integrated habitat layer was primarily a GIS-based activity coupled with expert review. The geology data from USGS was used as the basis for the terrestrial habitat map. KSA was the first country whose habitat was investigated partly because a Draft Bioregional Classification (Llewellyn, 2011) was made available to the Project and because KSA's land mass represented approximately 77% of the Arabian Peninsula.

Using the Bioregional Classification drafted for KSA, the geology polygons were refined across KSA. Some of the geology polygons were similar to the bioregional units and could therefore be directly allocated a habitat type. For other polygons it was required to split / merge and use satellite imagery to assign habitats.

As previously discussed, the Bioregional Classification (Llewellyn, 2011) only extended across KSA, therefore the habitat classification needed to be extended across the boundaries of the adjacent countries within the Arabian Peninsula region. New terrestrial habitat types were also identified that were not covered by the KSA Bioregional Classification and based on a number of published sources (Brown, 2001; El-Eisawi, 1996a; Ghazanfar & Fisher, 1998; Scholte, Al Khulaidi, & Kessler, 1991).

In the mountainous regions, altitude is of greater importance as an indicator of habitat type than geology therefore further enhancements were carried out using altitude-derived data based on the SRTM data.

During the Regional Technical Workshop (12-13th November 2012) refinement was carried out on Yemen, Oman and Jordan, particularly the Northern Yemen Highlands and the Yemen/Oman border, the Hajar Mountains, the Monsoon-affected vegetation in Dhofar and East Yemen, and the Jordan Steppe and Mediterranean habitats. The map was also reviewed in further detail with Othman Llewellyn of SWA, who provided a number of refinements including: a method of identification of pyroclastic and granitic outcrops within the Najd Pediplain using satellite imagery, geology and the paper maps detailing the KSA Bioregional Classification. In addition, boundaries between some of the habitat units were refined. It was also a recommendation that the inland sabkha located in the Ar-Rub al-Khali (Empty Quarter) needed to be identified within the habitat layer. The use of the Inland Water geospatial data from DIVA-gis.org was used to identify the extent of inland sabkha within this area. However the data was considered unreliable at identifying water bodies across the Arabian Peninsula.

The habitat layer was checked against existing broader habitat maps and classifications across the Arabian Peninsula using two important sources: one for the region and the other for West Yemen (De Pauw, 2002; Scholte et al., 1991) Classification names and groups were based on Bioregional Classification but then amended and additional habitat types added to cover the whole of the Arabian Peninsula.

3.2.2.2 Mapping Marine Habitat

The basis for the marine section of the integrated habitat layer was the WWF Marine EcoRegions, bathymetric data and data on specific marine habitats. At the highest level, marine areas were split according to WWF Marine EcoRegions. Once this was done, marine areas were stratified using GEBCO and CMRECS (EAD, 2010) bathymetric data. The stratification was based on the depth divisions used for the Abu Dhabi and UAE assessments, which were subsequently accepted at the Regional Technical Workshop. CMRECS (EAD, 2010) habitat data, UNEP-WCMC data on coral and seagrass, coral data from eMISK, marine habitat data received from the Ministry of Environment Qatar, and data on corals from Dr John Burt (New York University Abu Dhabi)were used to

define intertidal habitats. These included mangroves and saltmarshes and shallow (i.e. less than 15m) water habitats (e.g. coral reefs and seagrass beds). Data on specific habitats (e.g. deep reefs) within deeper marine habitats (i.e. greater than 15m) were lacking, and hence it was not possible to subdivide these areas. The Islands were identified as areas of land which had a height value greater than zero and were surrounded by a marine habitat. Satellite imagery and the use of experts at the Regional Technical Workshop with local field knowledge were also used to check the allocated coastal and marine habitat types.

Following the Regional Technical Workshop, the habitat classification was finalised and a total of 110 habitat types were defined.

To create an integrated habitat layer the marine and terrestrial required had to be combined in GIS. For this process, the marine habitats had precedence over the terrestrial environment to ensure that the small but important intertidal habitats were not lost.

This regional habitat classification scheme for terrestrial and marine habitats is presented in Table 3-3.

Table 3-3: Arabian Peninsula Habitat Classification Table

ID	EcoRegion	Habitat Group	Habitat Type	Summary Habitat Description	Reference
1	Islands	Islands	Islands - Arabian (Persian) Gulf	Islands in the Arabian (Persian) Gulf	(EAD, 2010)
2			Islands - Gulf of Aden	Islands in the Gulf of Aden	
3			Islands - Gulf of Oman	Islands in the Gulf of Oman	
4			Islands - Northern and Central Red Sea	Islands in the Northern and Central Red Sea	
5			Islands - Southern Red Sea	Islands in the Southern Red Sea	
6			Islands - Western Arabian Sea	Islands in the Western Arabian Sea	(EAD, 2010)
7			Socotra Archipelago	Open deciduous shrubland on the coastal plains and lower slopes of mountains and semi-evergreen sclerophyllous thicket and woodlands with *Rhus thyrsiflora, Boswellia armeero, Buxus hildebrandtii, Carphalea obovata* and *Croton sp* within the mountains. There are also areas of grassland and rocky vegetation.	(Ghazanfar & Fisher, 1998)
8	Coastal	Coastal	Oman Coastal Plain	The coastal plain from Musandam to Muscat is mainly *Acacia*-dominated gravel plains, sandy beaches and salt marshes with a few limestone headlands. Habitats from Muscat to Ras Al Hadd are characterised by steep rocky promontories dropping into the Gulf of Oman. The southern coastal plain coast is predominantly wide, beach and dune habitats.	(Pickering & Patzelt, 2008)
9			Gulf Coastal Sabkha and Sabkha Matti	Sabkha and Sabkha Matti are characterised by salt-encrusted sands often covering broad expanses of coastal plain. Coastal sabkha is devoid of vegetation due to the salinity of the substrate, although halophytes such as *Halopeplis perfoliata* may occur where there is a thin layer of sand on the surface.	(Brown & Böer, 2004)
10			Northern Gulf Coastal Plain	These comprise a matrix of coralline terraces, sand dunes and sabkhas. The sand-dominated habitats support open xeromorphic grassland and dwarf-shrubland.	(Llewellyn, 2011)
11			Red Sea Coastal Plain and Sabkha	The habitats are dominated by halophytic dwarf-shrubland with *Suaeda spp., Halopeplis perfoliata, Zygophyllum spp., Limonium axillare,* and *Aeluropus lagopoides.*	(Llewellyn, 2011)
12			Southern Coastal Plain	These are low-lying habitats and dominated by open thorn woodland with Acacia tortilis. The plains are flat and undulating and intersected by several wadis.	(Ghazanfar & Fisher, 1998) (Al-Khulaidi, 2012)
13			Southern Gulf Coastal Plain	Coastal plain habitats dominated by open thorn woodland and open shrubland.	

ID	EcoRegion	Habitat Group	Habitat Type	Summary Habitat Description	Reference
14			Tihamah Coastal Plain	Coastal plain between the Red Sea and the Tihama foot hills comprised of Metamorphic & granitic foothills & lava fields with open thorn woodland and open shrubland. Predominantly comprised of *Acacia spp., Commiphora spp., Maerua crassifolia, Balanites aegyptiaca, Salvadora persica, Panicum turgidum, Pennisetum divisum, Dobera glabra*, and *Euphorbia spp*.	(Llewellyn, 2011) (Al-Khulaidi, 2012)
15	Lowlands	Inland Plains and Sabkha	Ad-Dibdibah / Kuwait Alluvial Plain	Alluvial plain with very open xeromorphic dwarf-shrubland, predominantly comprised of *Haloxylon salicornicum*, *Anabasis articulata*, *Stipa capensis*, *Schismus barbata*, *Rostraria pumila*, *Ifloga spicata*, and *Arnebia decumbens.*	(Llewellyn, 2011)
16			At-Taysiyah Limestone Plain	Sandy karstic limestone plain with very open xeromorphic dwarf-shrubland. Predominantly comprised of *Rhanterium epapposum*, *Scrophularia hypericifolia*, *Artemisia monosperma*, *Haloxylon salicornicum*, *Deverra triradiata*, *Cutandia memphitica*, and *Stipa capensis*,	(Llewellyn, 2011)
17			Central Limestone Plain and Low Cuesta	Limestone plains & low cuestas with open xeromorphic thorn shrubland & dwarf-shrubland. Predominantly comprised of *Rhanterium epapposum*, *Lycium shawii*, *Acacia* spp, *Anastatica hierochuntica*, *Lasiurus scindicus*, *Panicum turgidum*, and *Tripogon* spp.	(Llewellyn, 2011)
18			Central Sand Plain	Sandstone & limestone plains & buttes with very open xeromorphic thorn shrubland & dwarf-shrubland. Predominantly comprised of *Haloxylon salicornicum*, *Rhanterium epapposum*, *Acacia tortilis*, *Panicum turgidum*, *Lasiurus scindicus*, *Pennisetum divisum*, *Pulicaria crispa*, *Plantago* spp., *Neurada procumbens*, *Arnebia decumbens*, and *Moltkiopsis ciliata*.	(Llewellyn, 2011)
19			Central Yemen Plain	Limestone and alluvial plains in northern Yemen with open xeromorphic thorn shrubland & dwarf-shrubland dominated by *Acacia tortilis* and *Calatropis.*	(Al-Khulaidi, 2012)
20			Eastern Desert Plain	Plains in eastern Oman with open xeromorphic thorn shrubland and dwarf-shrubland.	
21			Eastern Gravel Plain	Open gravel desert receiving less than 100mm of rainfall per annum. Consisting of rocky substrate of limestone, sandstone and shale with sparse covering of vegetation. Vegetation mainly consists of tree scrub, *Acacia tortilis* and *Prosopis cineraria*.	(Pickering & Patzelt, 2008)
22			Huqf - Plain, Outcrop and Dune	An area of relatively flat topography, mainly consisting of gravel desert broken by rock-scarps and occasional sand dunes. At the centre is a large depression with inland sabhka bounded to the north by the Al Huqf escarpment. Extensive woodlands of *Acacia tortilis* and *Prosopis cineraria* dominate near the large *wadis* to the south.	
23			Inland Sabkha	Salt flats in blind drainages. Barren with halophytic dwarf-shrubland. *Suaeda spp,. Seidlitzia rosmarinus, Zygophyllum spp., and Anabasis articulata.*	(Llewellyn, 2011)
24			Najd Pediplain	Granitic and metamorphic pediplain with very open xeromorphic dwarf-shrubland. Predominantly comprised of *Haloxylon salicornicum*, *Acacia tortilis*, *Lycium shawii*, *Indigofera spinosa*, *Salsola spinescens*, *Maerua crassifolia*, *Panicum turgidum*, *Lasiurus scindicus* and *Pennisetum divisum*.	(Llewellyn, 2011)

ID	EcoRegion	Habitat Group	Habitat Type	Summary Habitat Description	Reference
25			Northern Sandstone Plain and Plateau	Sandstone plains and plateaus with very open xeromorphic dwarf-shrubland. Predominantly comprised of *Salsola tetrandra*, *S. cyclophylla*, *Artemisia sieberi*, *Haloxylon salicornicum*, *Achillea fragrantissima*, *Traganum nudatum*, and *Rhanterium epapposum*.	(Llewellyn, 2011)
26			Western Sandstone Plain and Plateau	Sandstone plains and dissected plateaus with very open xeromorphic dwarf-shrubland. Predominantly comprised of *Retama raetam*, *Acacia* spp., *Haloxylon salicornicum*, *Rhanterium epapposum*, *Satureja thymbrifolia*, *Lycium shawii*, and *Gymnocarpos decandrus*,	(Llewellyn, 2011)
27	Deserts	Sand Sheets and Dunes	Ad-Dahna Dune, Sand Sheet and Plain Mosaic	Linear and star dunes, sand sheets and limestone plain with open xeromorphic dwarf-shrubland. Predominantly comprised of *Calligonum comosum*, *Artemisia monosperma*, *Stipagrostis drarii*, *Rhanterium epapposum*, *Cyperus conglomeratus*, and *Scrophularia hypericifolia*.	(Llewellyn, 2011)
28			Al-Jafurah Sand Dune	Barchanoid transverse and parabolic dunes with very open xeromorphic dwarf-shrubland. Predominantly comprised of *Calligonum comosum*, *Cyperus conglomeratus*, *Stipagrostis drarii*, *Haloxylon persicum*, *Panicum turgidum*, and *Leptadenia pyrotechnica*.	(Llewellyn, 2011)
29			An-Nafud al-Kabir Sand Dune	Transverse and linear dunes crescentic hollows with open xeromorphic shrubland and dwarf-shrubland. Predominantly comprised of *Calligonum comosum*, *Haloxylon persicum*, *Artemisia monosperma*, *Scrophularia hypericifolia*, *Stipagrostis drarii*, *Cyperus conglomeratus*, *Moltkiopsis ciliata*, *Monsonia nivea*, and *Centropodia fragilis*.	(Llewellyn, 2011)
30			Ar-Rub al-Khali Sand Dune	Linear, hooked and feather sand dunes with very open xeromorphic dwarf-shrubland. Predominantly comprised of *Calligonum crinitum, Cornulaca arabica, Tribulus macropterus var. arabicus, Cyperus macrorrhizus, Limeum arabicum,* and *Haloxylon persicum*. The habitats are characterised by sparse vegetation; limited to a few hardy species such as *Euphorbia riebeckii* and *Tetraena qatarensis* as well as grasses with scattered groups of *Prosopis cineraria* along wadi channels.	(Llewellyn, 2011) (Pickering & Patzelt, 2008)
31			Ar-Rub al-Khali Sand Massif and Sabkha	Star and giant crescentic sand dunes and salt flats with very open xeromorphic dwarf-shrubland. Predominantly comprised of *Calligonum crinitum*, *Cornulaca arabica*, *Tribulus macropterus* var. *arabicus*, *Cyperus macrorrhizus*, *Limeum arabicum*, *Zygophyllum hamiense*, *Z. mandavillei*, and *Seidlitzia rosmarinus.*	(Llewellyn, 2011)
32			Central Nafuds Sand Dune	Dome, linear and transverse dunes with open xeromorphic dwarf-shrubland. Predominantly comprised of *Calligonum comosum*, *Cyperus conglomeratus*, *Stipagrostis drarii*, *Centropodia forsskalii*, *C. fragilis, Monsonia nivea*, *Moltkiopsis ciliate, Haloxylon persicum*, and *Rumex pictus*.	(Llewellyn, 2011)
33			Eastern Sand Sheet and Dune	Karstic limestone plateau with very open xeromorphic dwarf-shrubland. Predominantly comprised of *Salsola tetrandra*, *S. cyclophylla*, *S. villosa*, *Atriplex leucoclada*, *Artemisia sieberi*, *Achillea fragrantissima*, *Traganum nudatum*, and *Valerianella* spp,.	(Llewellyn, 2011)

ID	EcoRegion	Habitat Group	Habitat Type	Summary Habitat Description	Reference
34			Wahiba Sand Dune	Small sand sea formed by winds of the southwest monsoon, mainly with longitudinal dunes. Northern and central parts with north-south oriented linear and fairly stable megadunes (100m) with broad interdune swales. In the south and southeast, relief is lower with active and varied dune forms. There are two principal plant community types – a well-defined association of *Calligonum crinitum* and *Cyperus* characteristic of mobile dune types. An association of *Heliotropum kotchyi, Panicum turgidum, Euphorbia riebeckii* and *Indigofera spp* found on more stable sand.	(Ghazanfar & Fisher, 1998) (Dutton, 1988) (Pickering & Patzelt, 2008)
35	Uplands	Plateaus	As-Summan Limestone Plateau	Karstic limestone plateau with very open xeromorphic dwarf-shrubland. Predominantly comprised of *Salsola tetrandra*, *S. cyclophylla*, *S. villosa*, *Atriplex leucoclada*, *Artemisia sieberi*, *Achillea fragrantissima*, *Traganum nudatum*, and *Valerianella* spp.	(Llewellyn, 2011)
36			Dhofar Plateau	With the coastline consisting of either wide gravel plains dominated by Acacia and sandy dune habitats or towards the Yemen boarder, rocky cliffs descending steeply into the Arabian Sea.	(Pickering & Patzelt, 2008)
37			Hadramaut Plateau	Open dwarf shrubland dominated by *Calatropis procera* through intensive overgrazing	(Al-Khulaidi, 2012)
38			Hisma Plateau	Rugged dissected sandstone plateau with open xeromorphic dwarf-shrubland. Predominantly comprised of *Retama raetam*, *Acacia* spp., *Capparis spinosa*, and *Globularia arabica.*	(Llewellyn, 2011)
39			Najran - Asir Plateau	Metamorphic granitic and sandstone dissected plateau with open thorn woodland and semi-desert shrubland. Predominantly comprised of *Acacia oerfota*, *A. gerrardii*, *A. tortilis*, *A. asak*, *Commiphora* spp., *Ziziphus spina-christi*, *Moringa peregrina*, *Euphorbia schimperiana*, *Salsola spinescens*, *Salvadora persica*, and *Chrysopogon plumulosus*.	(Llewellyn, 2011)
40			Northern Limestone Plateau	Small sand sea formed by winds of the southwest monsoon, mainly with longitudinal dunes	
41			Yemen Precambrian Plateau	Open xeromorphic grasslands including both *Stipagrostis* sparse grassland and *Chrysopogon* sparse grassland	(Al-Khulaidi, 2012)
42		Igneous	Central Volcanic Outcrop	Rugged basalt lava flows with open xeromorphic thorn shrubland and dwarf-shrubland. Predominantly comprised of *Acacia tortilis*, *A. ehrenbergiana*, *Aerva javanica*, *Farsetia* spp., *Salsola* spp., *Indigofera spinosa*, and *Cymbopogon* spp.	(Llewellyn, 2011)
43			Najd Pediplain - Granitic Outcrop	Granite exfoliation domes with xeromorphic thorn woodland and dwarf-shrubland. Predominantly comprised of *Acacia tortilis*, *Lycium shawii*, *Maerua crassifolia*, *Periploca aphylla*, *Chrysopogon plumulosus*, *Moringa peregrina*, *Commiphora myrrha*, *Flueggea virosa*, and *Phagnalon viridifolium*.	(Llewellyn, 2011)
44			Najd Pediplain - Pyroclastic Outcrop	Metamorphic and volcanic hills with open xeromorphic dwarf-shrubland and thorn shrubland. Predominantly comprised of *Lycium shawii*, *Acacia tortilis*, *Farsetia burtoniae*, *Blepharis ciliaris*, *Gymnocarpos decandrus*, *Stipagrostis plumosa*, and *Cymbopogon* spp.	(Llewellyn, 2011)

ID	EcoRegion	Habitat Group	Habitat Type	Summary Habitat Description	Reference
45			Northern Volcanic Outcrop	Rough basalt lava fields with open xeromorphic dwarf-shrubland. Predominantly comprised of *Salsola tetrandra*, *Traganum nudatum*, *Artemisia sieberi*, *Achillea fragrantissima*, *Deverra triradiata*, *Ferula* spp., *Agathophora alopecuroides*, *Prunus arabica*, and *Valerianella szovitsiana*.	(Llewellyn, 2011)
46			Yemen Volcanic Outcrop	Rugged basalt lava flows with open xeromorphic thorn shrubland and dwarf-shrubland.	
47	Mountains	Mountains and Hills	Asir Mountains - above 2000m	Metamorphic granitic and sandstone mountains with evergreen needle-leaved woodland and shrubland. Predominantly comprised of *Olea europaea*, *Juniperus procera*, *Acacia origena*, *Rhus retinorrhoea*, *Buddleja polystachya*, *Dodonaea angustifolia*, *Euryops arabicus*, *Juniperus phoenicea*, *Centaurothamnus maximus*, *Cichorium bottae*, and *Acokanthera schimper*.	(Llewellyn, 2011)
48			Asir Mountains - Juniper Woodland	Metamorphic granitic and sandstone mountains with dense evergreen needle-leaved woodland. Predominantly comprised of *Juniperus procera*, *Erica arborea*, *Hypericum revolutum*, *Celtis africana*, *Nuxia congesta*, *Debregeasia saenab*, *Pittosporum viridiflorum*, and *Pteris dentata*.	(Llewellyn, 2011)
49			Asir Mountains - 1500m to 2000m	Metamorphic granitic and sandstone mountains with semi-evergreen sclerophyllous woodland and shrubland. Predominantly comprised of *Tarchonanthus camphoratus*, *Teclea nobilis*, *Barbeya oleoides*, *Pistacia falcata*, *Ficus* spp., *Grewia* spp., *Aloe* spp., *Olea europaea*, and *Acokanthera schimperi*.	(Llewellyn, 2011)
50			Asir Mountains - 800m to 1500m	Metamorphic mountains with thorn woodland and shrubland. Predominantly comprised of *Acacia asak*, *A. etbaica*, *A. johnwoodii*, *Commiphora* spp., *Grewia* spp., *Euphorbia* spp., *Aloe* spp., *Adenium obesum*, and *Delonix elata*.	(Llewellyn, 2011)
51			Asir Mountains - Eastern Slope	Metamorphic granitic and sandstone incised plateau with open shrubland and xeromorphic grassland. Predominantly comprised of *Acacia origena*, *A. gerrardii*, *Lavandula dentata*, *Pennisetum setaceum*, *Themeda triandra*, *Hyparrhenia hirta*, *Dracaena serrulata*, *Euphorbia schimperiana*, *E. schimperi*, and *E. ammak.*	(Llewellyn, 2011)
52			Monsoon-affected Vegetation - above 1000m	On seaward slopes semi-evergreen woodlands predominate although much converted to *Themeda* grasslands. On the landward facing escarpments the land is not subject to *khareef* precipitation and cloud inundation and is dry with sparse xeromorphic scrub including *Boswellia*.	(Kilian, Hein, Hubaishan, & Arnold, 2004) (Raffaelli & Tardelli, 2006) (Ghazanfar & Fisher, 1998)

ID	EcoRegion	Habitat Group	Habitat Type	Summary Habitat Description	Reference
53			Monsoon-affected Vegetation - 500m to 1000m	Semi-evergreen Afro-montane shrublands at higher altitudes with *Olea europaea - Tarchonanthus camphoratus* woodland and semi-evergreen woodlands with *Anogeissus dhofarica.*	(Kilian et al., 2004) (Raffaelli & Tardelli, 2006) (Ghazanfar & Fisher, 1998)
54			Monsoon-affected Vegetation - below 500m	Stony coastal plains with sparse shrub and dwarf shrub vegetation. Lower slopes are semi-evergreen woodlands with *Anogeissus dhofarica* and *Acacia* spp.	(Kilian et al., 2004) (Raffaelli & Tardelli, 2006) (Ghazanfar & Fisher, 1998)
55			Hajar Mountains - Carbonate - below 500m	Carbonate (limestone and dolomite) with an elevation less than 500m. Common lower elevations species include *Euphorbia larica, Tephrosia apollinea, Acacia tortilis, Fagonia indica* and *Moringa peregrina*.	Feulner (2011)
56			Hajar Mountains - Jebel Hafit	Mountain slopes and scree with low vegetation cover, but often surprisingly species-rich. Trees (e.g. *Acacia tortilis*), stem succulents (e.g. *Euphorbia larica*), shrubs, dwarf shrubs and perennial grasses are characteristic elements of the flora.	(Brown & Böer, 2004)
57			Hajar Mountains - Musandam - above 1000m	Summit region above 1000m with a distinctive flora, consisting of wild olive trees plus the large shrub *Ehretia obtusifolia* and the low perennial *Melhania muricata*, plus high elevation species like *Convolvulus acanthocladus, Ephedra pachyclada* and *Phagnalon schweinfurthii*.	Feulner (2011)
58			Hajar Mountains - Musandam - 500m to 1000m	Very open deciduous dwarf shrubland	(Ghazanfar & Fisher, 1998)
59			Hajar Mountains - Musandam - below 500m	Very open deciduous dwarf shrubland	(Ghazanfar & Fisher, 1998)
60			Hajar Mountains - Eastern - above 1000m	Very open *Ceratonia oreothauma-Ziziphus hajarensis* woodland, semi-deciduous scrub and open semi-deciduous woodland.	(Ghazanfar & Fisher, 1998)
61			Hajar Mountains - Eastern - 500m to 1000m	Evergreen *Olea-Monothea-Dodonaea* shrubland, open *Juniperus* woodland	(Ghazanfar & Fisher, 1998)

ID	EcoRegion	Habitat Group	Habitat Type	Summary Habitat Description	Reference
62			Hajar Mountains - Western - above 2000m	Evergreen needle-leaved woodlands dominated by *Juniperus excelsa polycarpos*. The exposed, rocky slopes are dominated by gnarled juniper and olive trees with associated species. Temperate fruit such as plums, peaches and pomegranates are cultivated on the plateau in the Jabal Akhdar range.	(Ghazanfar & Fisher, 1998) (Pickering & Patzelt, 2008)
63			Hajar Mountains - Western - 1000m to 2000m	Very open *Ceratonia oreothauma-Ziziphus hajarensis* woodland, semi-deciduous scrub and open semi-deciduous woodland.	(Ghazanfar & Fisher, 1998)
64			Hajar Mountains - Western - 500m to 1000m	*Euphorbia larica* shrub communities dominate the very open dwarf shrubland.	(Ghazanfar & Fisher, 1998)
65			Hajar Mountains - below 500m	Below 500m, *Euphorbia larica* shrub communities dominate the very open dwarf shrubland.	(Ghazanfar & Fisher, 1998)
66			Hijaz Hills and Mountains - above 1500m	Granitic mountains with open evergreen needle-leaved woodland, thorn woodland and sclerophyllous shrubland. Predominantly comprised of *Juniperus phoenicea*, *Olea europaea*, *Sageretia thea, Dodonaea angustifolia*, *Acacia etbaica*, *A. asak*, *Origanum syriacum*, *Teucrium hijazicum*, *Dracaena serrulata*, and *Aloe porphyrostachys*.	(Llewellyn, 2011)
67			Hijaz Hills and Mountains - below 1500m	Metamorphic and granitic hills and mountains with open thorn woodland, shrubland, and dwarf-shrubland. Predominantly comprised of *Acacia tortilis*, *A. raddiana*, *A. asak*, *Moringa peregrina*, *Capparis decidua*, and *Lavandula* spp.	(Llewellyn, 2011)
68			Jabal Shammar	Rugged granitic and volcanic pinnacles and domes with xeromorphic thorn woodland and dwarf-shrubland. Predominantly comprised of *Acacia gerrardii*, *Searsia tripartita*, *Lycium shawii*, *Periploca aphylla*, *Cymbopogon commutatus*, *Thymelaea mesopotamica*, *Muscari tenuiflorum*, *Gladiolus italicus*, and *Lallemantia royleana*.	(Llewellyn, 2011)
69			Jabal Tuwayq	Dissected limestone cuesta with open xeromorphic thorn woodland and dwarf-shrubland. Predominantly comprised of *Acacia tortilis*, *A. gerrardii*, *Lycium shawii*, *Anvillea garcinii*, *Gymnocarpos decandrus*, *Ochradenus baccatus*, *Anastatica hierochuntica*, *Tripogon* spp., and *Oropetium* spp.	(Llewellyn, 2011)
70			Madyan Mountains - above 1000m	Metamorphic and granitic hills and mountains with open thorn woodland, shrubland, and cold-deciduous woodland. Predominantly comprised of *Acacia raddiana*, *A. tortilis*, *Retama raetam*, *Artemisia* spp., *Pistacia khinjuk*, *Origanum syriacum*, and *Prunus korshinskyi*,	(Llewellyn, 2011)
71			Madyan Mountains - below 1000m	Granitic and metamorphic mountains with open evergreen needle-leaved woodland and cold-deciduous woodland. Predominantly comprised of *Juniperus phoenicea*, *Pistacia khinjuk*, *Globularia arabica*, *Cotoneaster nummularia*, *Prunus korshinskyi*, *Myrtus communis*, *Tulipa biflora*, and *Thymus decussatus*.	(Llewellyn, 2011)

ID	EcoRegion	Habitat Group	Habitat Type	Summary Habitat Description	Reference
72			Tihamah Foothills - below 500m	Metamorphic and granitic foothills and lava fields with open thorn woodland and open shrubland. Predominantly comprised of *Acacia* spp., *Commiphora* spp., *Maerua crassifolia*, *Balanites aegyptiaca*, *Salvadora persica*, *Panicum turgidum*, *Pennisetum divisum*, *Dobera glabra*, and *Euphorbia* spp.	(Llewellyn, 2011)
73			Yemen Highlands - above 2000m	Evergreen needle-leaved woodlands dominated by *Juniperus procera.*	(Ghazanfar & Fisher, 1998)
74			Yemen Highlands - 1000m to 2000m	Semi-evergreen sclerophyllous woodland and shrubland with *Tarchonanthus camphoratus*, *Teclea nobilis*, *Barbeya oleoides*, *Pistacia falcata*, *Ficus* spp., *Grewia* spp., *Aloe* spp., *Olea europaea*, and *Acokanthera schimperi* from similar altitude band within Asir Highlands description. *Acacia-Commiphora* deciduous woodland and evergreen and semi-deciduous shrubland.	(Llewellyn, 2011) (Ghazanfar & Fisher, 1998)
75			Yemen Highlands - 500m to 1000m	*Acacia asak*, *A. etbaica*, *A. johnwoodii*, *Commiphora* spp., *Grewia* spp., *Euphorbia* spp., *Aloe* spp., *Adenium obesum*, and *Delonix elata* from similar altitude band within Asir Highlands description.	(Llewellyn, 2011)
76	Jordan	Jordan	Forest and Non-forest	Evergreen oak (*Quercus coccifera),* Aleppo pine (*Pinus halapensis*), deciduous oak and Juniper forests together with Garigue type Mediterranean habitats dominated by *Rhamnus palaestinus* and *Artemisa herba-alb.*	(El-Eisawi, 1996)
77			Steppe	Irano-turanian vegetation dominated by *Retama raetam*, *Ziziphus lotus* and *Ferula communis*. In the south *Pistacia atlantica* and *Anabasis syriaca* dominate.	(El-Eisawi, 1996)
78			Acacia and Rocky Sudanian	*Acacia raddiana* and *A. tortilis* dominated vegetation.	(El-Eisawi, 1996)
79	Arabian (Persian) Gulf	Deeper than 15m	Deeper than 15m	Areas with a permanent overlaying water column greater than 15m in depth.	(EAD, 2010)
80		Intertidal	Algal Mats	Sheltered low-angle intertidal areas typically composed of unconsolidated sediments (sand or mud) with extensive cover of algal or microbial mats.	(EAD, 2010)
81			Mangroves	Intertidal areas dominated by true mangroves and associates.	(EAD, 2010)
82			Rocky Platforms	Exposed low-angle intertidal shoreline terrace characterised by bedrock or boulders which singly or in combination have an aerial cover of 75% or more.	(EAD, 2010)
83			Saltmarsh	Intertidal areas dominated by emergent halophytic herbaceous vegetation and shrubs.	(EAD, 2010)
84			Tidal flats (no algal mats)	Exposed intertidal substrates having greater than 25% cover of particles smaller than gravel.	(EAD, 2010)
85		Shallow Water	Coral Reef	Areas characterized by a substrate or environmental setting largely constructed by the reef-building activities of warm water corals and associated organisms. Live corals may or may not be present.	(EAD, 2010)

ID	EcoRegion	Habitat Group	Habitat Type	Summary Habitat Description	Reference
86		Habitats	Other Shallow Water	Other areas with a permanent overlaying water column less than 15m in depth.	(EAD, 2010)
87			Seagrass / macro-algal beds	Sub-tidal benthic substrates, generally composed of unconsolidated sediments, and characterised by greater than 10% cover of rooted vascular seagrass species.	(EAD, 2010)
88	Gulf of Aden	Deeper than 15m	Deeper than 15m	Areas with a permanent overlaying water column greater than 15m in depth.	
89		Intertidal	Mangroves	Intertidal areas dominated by true mangroves and associates.	
90		Shallow Water Habitats	Coral Reef	Areas characterized by a substrate or environmental setting largely constructed by the reef-building activities of warm water corals and associated organisms. Live corals may or may not be present.	
91			Other Shallow Water	Areas with a permanent overlaying water column less than 15m in depth.	
92			Seagrass / macro-algal beds	Sub-tidal benthic substrates, generally composed of unconsolidated sediments, and characterised by greater than 10% cover of rooted vascular seagrass species.	
93	Gulf of Oman	Deeper than 15m	Deeper than 15m	Areas with a permanent overlaying water column greater than 15m in depth.	
94		Intertidal	Mangroves	Intertidal areas dominated by true mangroves and associates.	
95		Shallow Water Habitats	Coral Reef	Areas characterized by a substrate or environmental setting largely constructed by the reef-building activities of warm water corals and associated organisms. Live corals may or may not be present.	
96			Other Shallow Water	Areas with a permanent overlaying water column less than 15m in depth.	
97	Northern and Central Red Sea	Deeper than 15m	Deeper than 15m	Areas with a permanent overlaying water column greater than 15m in depth.	
98		Intertidal	Mangroves	Intertidal areas dominated by true mangroves and associates.	
99		Shallow Water Habitats	Coral Reef	Areas characterized by a substrate or environmental setting largely constructed by the reef-building activities of warm water corals and associated organisms. Live corals may or may not be present.	
100			Other Shallow Water	Areas with a permanent overlaying water column less than 15m in depth.	
101			Seagrass / macro-algal beds	Sub-tidal benthic substrates, generally composed of unconsolidated sediments, and characterised by greater than 10% cover of rooted vascular seagrass species.	
102	Southern Red Sea	Deeper than 15m	Deeper than 15m	Areas with a permanent overlaying water column greater than 15m in depth.	
103		Intertidal	Mangroves	Intertidal areas dominated by true mangroves and associates.	

ID	EcoRegion	Habitat Group	Habitat Type	Summary Habitat Description	Reference
104		Shallow Water Habitats	Coral Reef	Areas characterized by a substrate or environmental setting largely constructed by the reef-building activities of warm water corals and associated organisms. Live corals may or may not be present.	
105			Other Shallow Water	Areas with a permanent overlaying water column less than 15m in depth.	
106			Seagrass / macro-algal beds	Sub-tidal benthic substrates, generally composed of unconsolidated sediments, and characterised by greater than 10% cover of rooted vascular seagrass species.	
107	Western Arabian Sea	Deeper than 15m	Deeper than 15m	Areas with a permanent overlaying water column greater than 15m in depth.	
108		Intertidal	Mangroves	Intertidal areas dominated by true mangroves and associates.	
109		Shallow Water Habitats	Coral Reef	Areas characterized by a substrate or environmental setting largely constructed by the reef-building activities of warm water corals and associated organisms. Live corals may or may not be present.	
110			Other Shallow Water	Areas with a permanent overlaying water column less than 15m in depth.	

3.2.3 Outputs

The terrestrial and marine habitats components were combined into one integrated habitat map presented in Figure 3-5 (the associated habitat legend is presented in Figure 3-6), and in large format in Appendix B.1. This habitat map was then used for the threat status and protection level assessments, and the spatial prioritization.

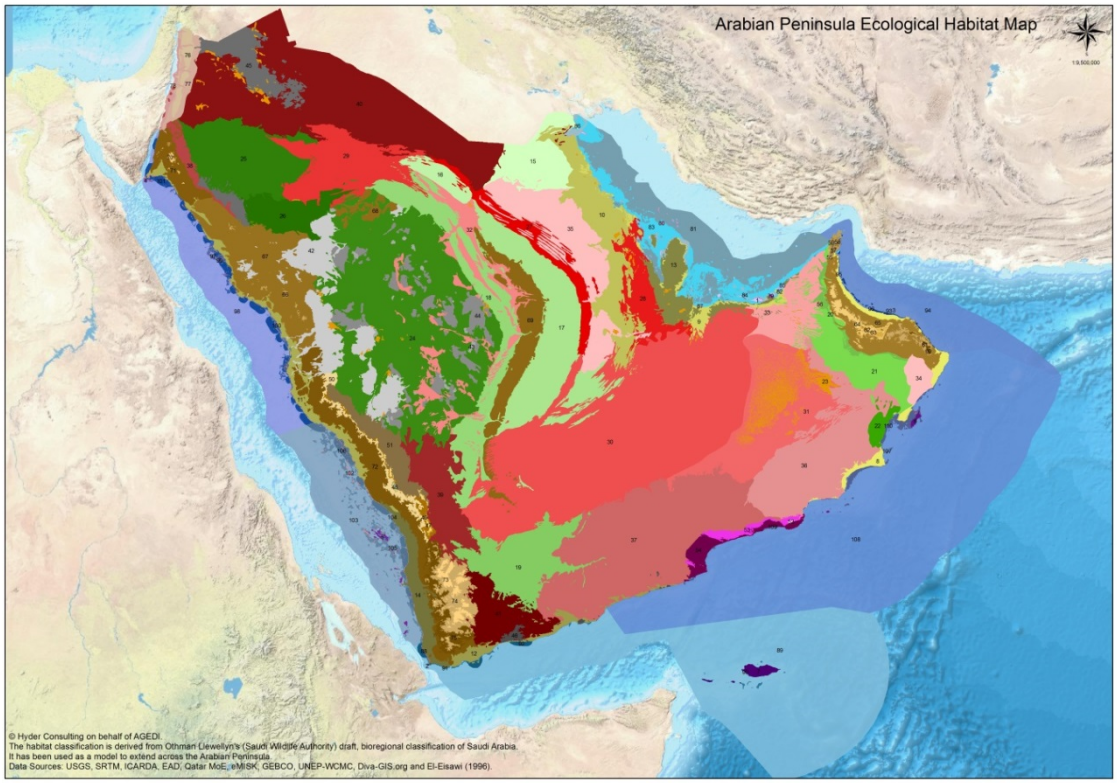


Figure 3-5: Integrated Terrestrial and Marine Habitat Map of the Arabian Peninsula

(Note: Map legend provided in Figure 3-6)

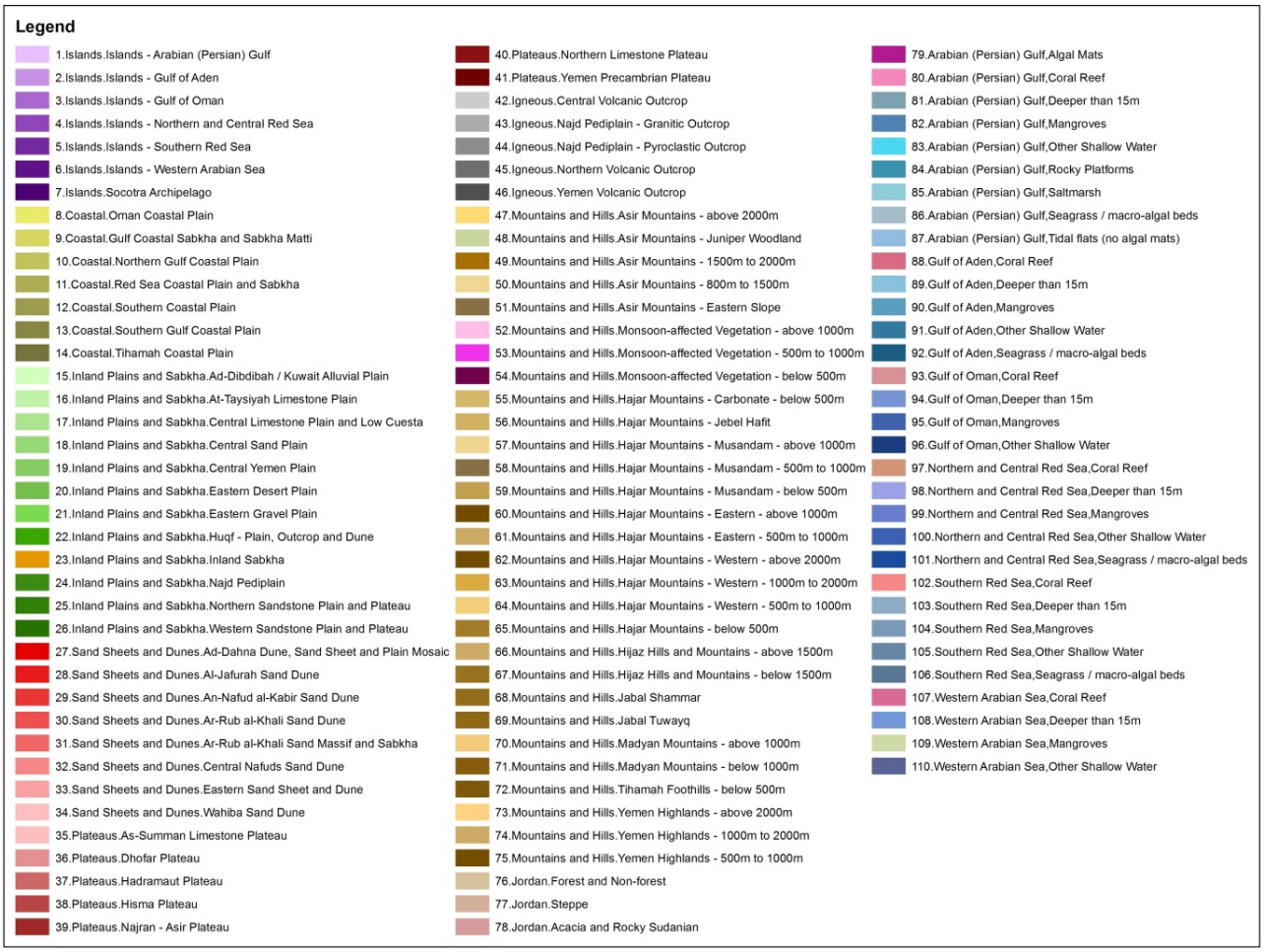


Figure 3-6: Legend of Arabian Peninsula Integrated Habitat Map as shown in Figure 3-5

3.3 Mapping Ecosystem Condition

There was a need to map the condition or ecological integrity of ecosystems which identifies where ecosystems have been lost or degraded. Changes in the condition of ecosystems are caused by multiple interacting drivers of change, such as land cover change through urbanization or agriculture, over-grazing or over-harvesting of resources, and pollution of aquatic environments. The major drivers of change or pressures on ecosystems differ in terrestrial and marine environments, and their relative importance varies considerably amongst ecosystem types. Measuring and mapping ecological condition is complex, and requires different approaches in terrestrial and marine environments.

3.3.1 Data Sources Used

The following sources of data were used to create the habitat condition derived layer:

- Abu Dhabi Company for Onshore Oil Operations (ADCO) – Island Roads (Zirku), Oil and Gas Pipelines, Plantations (Dates, Fruits, Tree), Infrastructure, Oil Tanks, Island Temporary Buildings and Island Runway.
- EBDB – Powerlines, Permanent Made Surfaces, Roads, Power stations, Waste Sites, Wastewater sites.
- Plot data from the Department of Municipal Affairs – Abu Dhabi.
- EAD Fisheries Database - Fishing Ground Grid and Landing Sites; some data also regularly published in Statistical Bulletins (EAD, 2009).
- International data on fishing effort, shipping intensity, gas flares and pollution (Halpern et al., 2008).
- Northern Emirates Land Use Data. This data was capture as part of the Soil Survey of the Northern Emirates (2010-2012).
- Umm Al Quwain Municipality Land Use data.
- Ajman Municipality Land Use Data.
- Ministry of Planning and International Cooperation, Government of Yemen and International Food Policy Research Institute.
- Qatar Ministry of Environment.
- Food and Agriculture Organisation.
- RSCN.
- Middle East Geospatial Forum and Library of Congress
- eMISK.
- Data capture exercise undertaken by the Project team using satellite imagery from Google Earth.

3.3.2 Process

The Project's approach to mapping the condition of habitats was to develop maps of individual pressures (e.g. areas with high fishing intensity or with coastal development), and from these develop a proxy or surrogate for ecological condition. Ecological condition was not measured directly in most cases, and was inferred from spatial data on a range of pressures in the marine and terrestrial environments. Ecological conditions can range from natural or near-natural through to extremely modified. For the purposes of applying standard SCP methods to the Project, condition has been summarised into three comparable categories each for terrestrial and marine habitats, namely natural, degraded or transformed for terrestrial habitats, and good, fair or poor for marine habitats. This data provided the key measures of transformed habitats and established a basis for determining areas of low conservation opportunity and high conflict with other land use activities. In some cases (e.g. planted forests), a transformed habitat may be prioritized because of its importance for species or ecological processes. In other cases, transformed or degraded areas may be important for linkages and corridors, and hence may be targeted for corridor restoration projects.

3.3.2.1 Mapping Terrestrial Habitat Condition

A proxy map of ecosystem condition for terrestrial areas was developed as little direct mapping of ecosystem condition is available in the Arabian Peninsula. This process followed the following stages:

- Available data on land use, land cover, infrastructure, agricultural practices and fisheries were collated as part of the Base Data Archive.
- Although good quality data on landcover and infrastructure were available from Kuwait, Qatar, the UAE, Jordan, and to some extent for Yemen; this data was largely lacking for KSA and Oman. Hence, it was necessary to supplement the available data with additional manual mapping of land use and infrastructure where there were gaps in the data. In addition, all areas were checked and gaps filled e.g. where recent developments were not reflected in municipal datasets.
- The available data were then classified into categories based on the severity and permanence of impacts on natural ecosystems as follows :
    - **Transformed areas**: Any area of land that could never be returned to its natural state and includes built up areas, farms, plantations, roads, car parks, pavements, runways, utility areas, waste sites and power stations. In some cases, individual data points and lines were buffered by set distances based on an expert analysis of likely extent of impact area.
    - **Degraded areas**: Any area of land that could be rehabilitated to its natural state and includes buffers around transformed areas. Expert judgement was used to assess the likely extent of habitat degradation found around features associated with habitat transformation e.g. it was assumed that areas within 250m of major roads be degraded.
    - **Natural areas**: These were all terrestrial areas which were not classified as natural or degraded.

3.3.2.2 Mapping Marine Habitat Condition

Development of a marine ecosystem condition map was more of a challenge than the terrestrial one due to:

- The significant gaps in marine data. (It should be noted that limited data on marine pressures were provided during the data collation phase and that hence the project had to rely heavily on international collated datasets (Halpern et al., 2008).

- Marine pressures very seldom result in complete destruction of a marine habitat in the same way that an urban area impacts on a terrestrial habitat.

- Marine pressures are often cumulative (i.e. habitat degradation may be the result of a number of different contributory factors).

- Marine impacts are not necessarily felt at the same site as the source of impact (e.g. waste water treatment outfalls may impact a wide area).

- The data are often fairly broad (e.g. fisheries data are typically collected on a grid basis).

A proxy map of ecosystem condition for marine areas was developed using very different methods to those used in the terrestrial environment. In order to differentiate these results from those used in the terrestrial assessment different categories were used, namely good, fair and poor. A method successfully utilized for South Africa's marine assessment (Sink et al., 2012) was used which was in turn developed from a method used to first map marine pressures internationally (Halpern et al., 2008). This process followed the following stages:

- A hexagon grid with units of 100km^2, which is identical to the one which will later be used as the planning units for the systematic spatial prioritization, was created for the marine areas. This grid was used as the basis for summarising each of the individual pressure layers.

- Pressure layers were developed in a standard format (with values ranging from 0 for no pressure to 1 for the highest levels of pressure) for each of the major types of impact on marine habitats. The following pressure layers were developed:

    - Coastal development: The proportion of transformed terrestrial area in the coastal grid squares was calculated. The proportion developed was normalized to a 0-1 range using the n/n_{max} method, where n is the specific value and n_{max} is the highest value in the datasets.

    - Structural impacts: The proportion of each grid square that had been dredged or reclaimed was calculated. These proportions were converted to a 0-1 ratio using the formula n/n_{90} where n is the actual value for a grid and n_{90} is the 90th percentile value. Values above 1 were then reclassified to 1. This approach normalized distributions which would otherwise have their values distorted by skewed distributions and a few high values.

    - Shipping intensity: International data on shipping intensity from (Halpern et al., 2008) were used to calculate average shipping intensity values per grid square. These values were converted to a 0-1 ratio using the formula n/n_{90} where n is the actual value for a grid and n_{90} is the 90th percentile value. Values above 1 were then reclassified to 1. This approach normalized distributions which would otherwise have their values distorted by skewed distributions and a few high values.

    - Oil and gas (fields and pipelines): Oil and gas fields identified in the Halpern et al. (2008) study based on gas flares were used, since no detailed data on well locations was available. These data were supplemented by data on oil and gas fields and pipelines from Library of Congress (http://memory.loc.gov/ammem

/index.html). Pipelines were buffered by 100m. All these datasets were combined, and the portion of each grid cell which fell within the identified oil and gas wells, fields and infrastructure dataset was calculated. Values were converted to a 0-1 range using the n/n_{max} method.

- Fishing effort: Direct data on fishing effort or catch was not available to the study. Use was therefore made of international fisheries data (Halpern et al., 2008). Fishing intensity data for demersal destructive fisheries, demersal non-destructive fisheries (both high and low by catch), and pelagic (both high and low by catch) were combined to obtain a single fishing intensity value. This value was modified for areas of high and low intensity fishing identified in Kuwait during the expert workshops. Values were converted to a 0-1 ratio using the formula n/n_{90} where n is the actual value for a grid and n_{90} is the 90th percentile value. Values above 1 were then reclassified to 1. This approach normalized distributions which would otherwise have their values distorted by skewed distributions and a few high values.

- Pollution levels: The international spatial assessment of marine pollution levels undertaken for the Halpern et al. (2008) study was used. Values were converted to a 0-1 ratio using the formula n/n_{90} where n is the actual value for a grid and n_{90} is the 90th percentile value. Values above 1 were then reclassified to 1.

- As many of the above layers were internationally derived and fairly broad, a 'poor condition supplement' grid was developed based on the areas where there were known to be in poor condition based on finer scale or local expert data. These areas included areas of high trawling intensity in Kuwait and dredged or reclaimed areas. All these areas were given a score of 1.

- Cumulative pressure values for each grid hexagon were calculated. The formula used, which was iteratively derived based on values used elsewhere and calibrated against the UAE data, was N_{Total} = (3*Coastal development impacts) + (2*Structural impacts) + (Shipping impacts) + (2*Oil and gas impacts) + (Fisheries impacts) + (2*Pollution impacts) + 2*(Poor condition supplement).This value was then used as a derived total marine pressures proxy score.

- The marine pressures proxy scores were then divided into three categories based on natural breaks in the value distributions. The group with the highest values was considered to be under highest pressure and was classed as 'poor', the middle group as 'fair' and the group with the lowest pressure values as 'good'. For hexagons which crossed into UAE waters, the condition class calculated for the UAE took precedence.

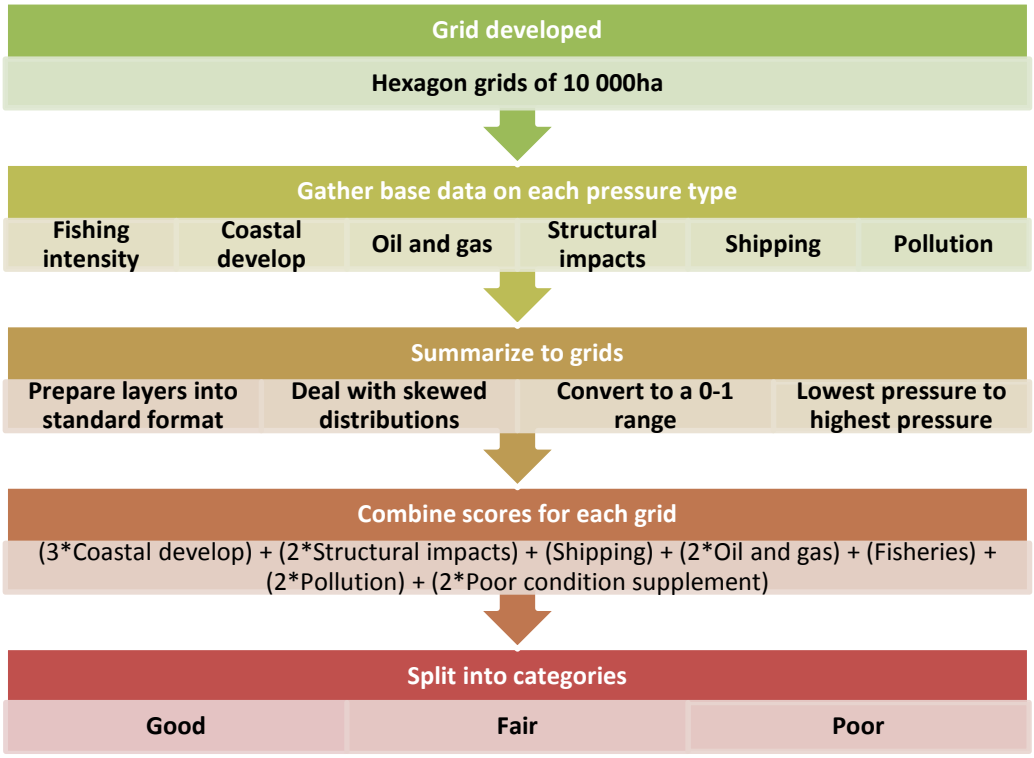


Figure 3-7: Marine Habitat Condition Methodology

3.3.3 Outputs

After both the terrestrial and marine components of the layer were derived they were then integrated to create a habitat condition layer which provided complete coverage of the planning domain. For intertidal coastal habitats (e.g. mangroves and salt marshes) a precautionary approach to mapping habitat condition was applied using a composite of the terrestrial and marine values. Transformed and degraded values from the terrestrial layers always took precedence. But where the marine pressures mapped an area as 'poor' and the terrestrial mapped an area as 'natural', this was reclassified to 'degraded'. Marine 'fair' areas did not result in a reclassification of terrestrial 'natural' areas.

The habitat condition map is presented in Figure 3-8, and in large format in Appendix B.2. The Habitat Condition map was then used for the threat status assessment and in the spatial prioritization.

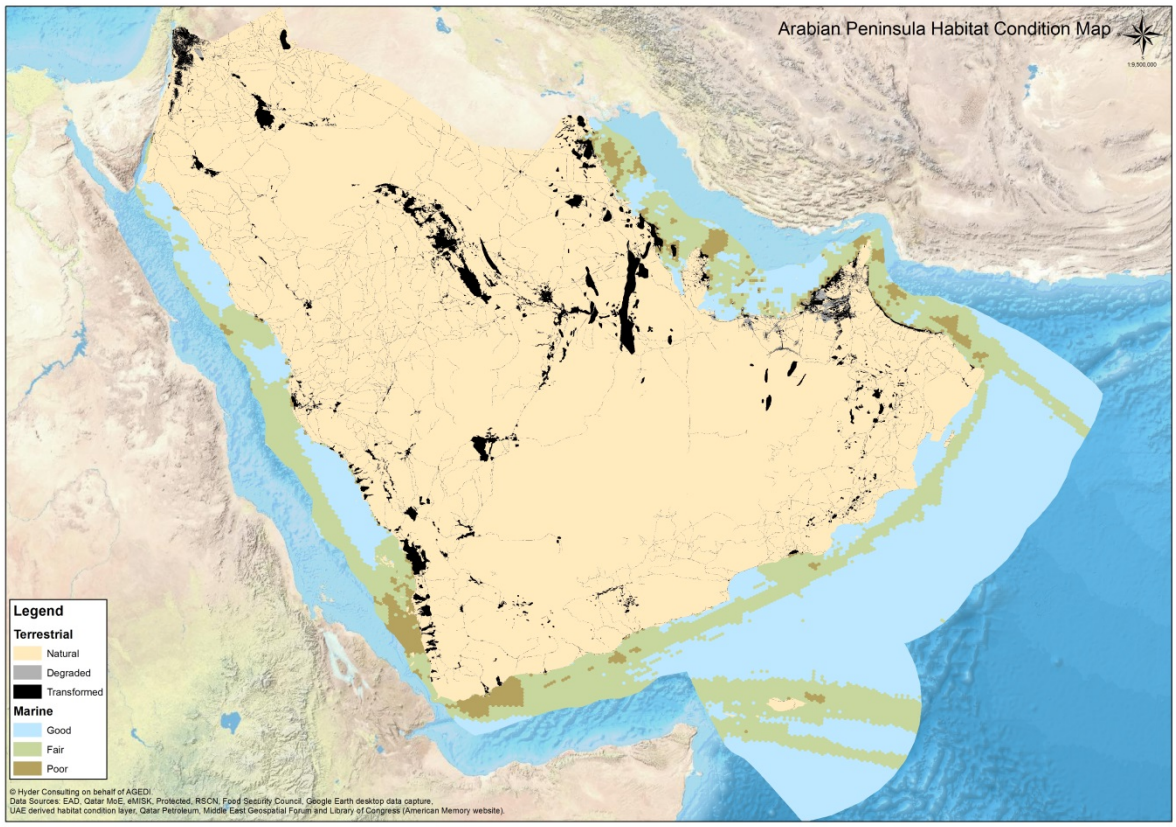


Figure 3-8: Arabian Peninsula Habitat Condition Map used in the Project

3.4 Mapping Protected Areas

The Protected Area layer is used in the assessment of ecosystem protection level and in the spatial prioritization process.

3.4.1 Data Sources Used

The Protected Area GIS boundaries for the Arabian Peninsula were obtained from the following sources:

- EBDB contained Abu Dhabi's Protected Area boundaries.
- CMRECS (EAD, 2010) provided marine Protected Area boundaries.
- BCEAW provided Protected Areas data for the UAE.
- Fujairah Municipality provided Wadi Wurayah Core zone.
- BCEAW provided UAE Northern Emirate conservation areas.
- Emirates Marine Environment Group provided Jebel Ali Protected Area.
- RSCN provided Protected Areas and Special Conservation Zone for Jordan.
- Othman Llewellyn, SWA provided KSA Protected Areas.
- Downloaded the Fourth National Report by Bahrain for Convention on Biological Diversity.
- Bahrain Public Commission for Protection Marine Resources, Environment and Wildlife (PCPMREW) provided Protected Areas document which required capturing.
- Dr Abdul Wali Al Khulaidi (Agricultural Research Authority, Yemen) provided Protected Areas across Yemen.
- David Insall provided Protected Area information for Oman.
- Dr Rebecca Klaus provided the Marine Protected Area dataset for the Arabian Peninsula region (Van Lavieren & Klaus, 2013) and subject to a non-disclosure statement: '*The information attached is provided to EAD only for analysis purposes as part of the spatial prioritization for conservation for the Arabian Peninsula region. Original data should not be shared and the information should not be used for any publications without the prior consent of the above mentioned data provider'.*
- Ministry of Environment, Qatar provided Protected Areas across Qatar.
- Protected Planet.net downloaded Protected Areas across the Arabian Peninsula.
- eMISK provided Protected Areas across Kuwait.
- Dr Abdul Karim Nasher (Sana'a University - Yemen) provided Socotra Islands Marine Protected Area.

3.4.2 Process

Only formally designated Protected Areas were included in the Protected Areas Layer. During the Regional Technical Workshop and through subsequent correspondence with selected contacts within each country, the Project undertook a review confirming Protected Area names, statuses, and boundaries. The list of Protected Areas is as follows:

Bahrain		
1. Mashtan Island	2. Tubli Bay	3. Dohat Arad
4. Al Areen Wildlife	5. Bulthama Protected Area	6. Hawar Islands
Jordan		
1. Azraq Wetland Reserve	2. Dibeen Forest Reserve	3. Qatar Nature Reserve
4. Shaumari Wildlife Reserve	5. Dana Biosphere Reserve	6. Rahmeh
7. Wadi Rum Protected Area	8. Mujib Biosphere Reserve	9. Homret Main-Sweimeh
10. Ajloun Forest Reserve	11. Fifa Nature Reserve	12. Yarmouk River
13. Homret Maeen	14. Wadi Ibn Hammad	15. Rahmah_Excluded
KSA		
1. Majami' al-Hadb	2. Al-Khunfah	3. Jabal Shada
4. Nafud al-'Urayq	5. At-Taysiyah	6. Umm al-Qamari
7. Saja/Umm Al-Rimth	8. Ibex Reserve	9. Harrat al-Harrah
10. Mahazat as- Sayd	11. Farasan Islands	12. At-Tubayq
13. Al Jandaliyah	14. Al-Ahsa' National Park	15. Hima Quraysh
16. Asir National Park	17. Sabkhat al-Fasl	18. The Haram of Makkah
19. Dhina Waterfall	20. Rawdat at-Tanhah	21. The Haram of Al-Madinah
22. Jabal al-Kawr	23. Hafr al-Batin	24. Hima Huraymila National Park
25. Rawdat Khuraym	26. Yanbu' Coastal Conservation Area	27. Al-Ha'ir Wetland
28. Dhahran Nature Reserve	29. Al-Haysiyah	30. Wadi as-Suq
31. Hafr al-Batin	32. 'Uruq Bani Ma'arid	33. Wadi Laban
34. Al-Ghat National Protected Areark		
Kuwait		
1. Al-Sulaibikhat Natural Reserve	2. Om Neqa Natural Reserve	3. Demilitarized Zone Natural Reserve
4. Sabah Al-Ahmad Natural Reserve	5. Umm Gudair Natural Reserve	6. Al-Qurain Hill Natural Reserve
7. Jahra Natural Reserve	8. Wadi Al Batin Natural Reserve	9. Mubarak Al-Kabeer Natural Reserve
10. Al-Doha Reserve Natural Reserve	11. Al-Howaimeliah Natural Reserve	

Oman		
1. The Khawrs of the Salalah Coast	2. Jebel Samhan	3. Al Saleel
4. Ra's Al Hadd	5. Jebel Akhdhar Reserve	6. Arabian Oryx
7. Ad Dimaniyat Islands		
Qatar		
1. Al Wusail	2. Al Reem	3. Um Alamad
4. Khor Al Adaid	5. Um Qarn	6. Al Rafa
7. Al Thakhira	8. Sunai	9. New Al Mashabiya
10. Al Eraiq		
UAE		
1. Marawah Marine	2. Houbara Protected Area	3. Dubai Desert
4. Al Yasat	5. Al Wathba Wetland Reserve	6. Ras Al Khor Wildlife Sanctuary
7. Bul Syayeef	8. Al Zawraa (Khour Ajman) Protected Area	9. Jabal Ali
10. Arabian Oryx	11. Al Naseem	12. Wadi Wurayah
13. Al-Badia Protected Area	14. Dedna Protected Area	15. Sir Bu Nuer
16. Jazerat Al Tuyur	17. Al Aqah Protected Area	18. Al-Ramthaa
19. Wadi Al-Helw Protected Area	20. Khor Kalbaa Protected Area	21. Jabal Al-Fayah
22. Al Gheil Protected Area	23. Al Berdy Protected Area	24. Al-madina
25. Al-zolaimaa		
Yemen		
1. Hawf Protected Area	2. Socotra Islands Protected Area - Socotra 2	3. Socotra Islands Protected Area - Darsa
4. Utmah Protected Area	5. Socotra Islands Protected Area - Samha	6. Socotra Islands Protected Area - Abd El Kuri
7. Jebel Bura	8. Socotra Islands Protected Area - Socotra 3	9. Socotra Islands Protected Area - Kaal Faraon
10. Socotra Islands Protected Area - Socotra 1		

3.4.3 Outputs

The Protected Area map is presented in Figure 3-9, and in large format in Appendix B.3. The Protected Areas map was then used for the protection level assessment and in the spatial prioritization.

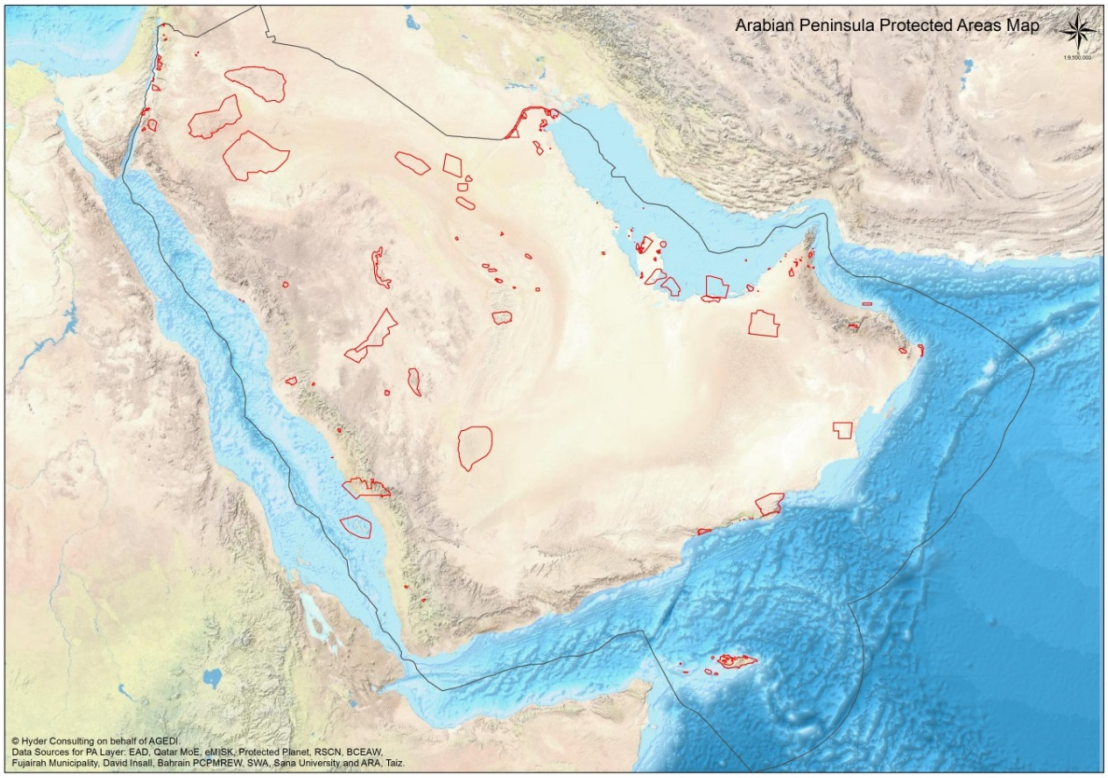


Figure 3-9: Arabian Peninsula Protected Area map used in the Project

3.5 Mapping Species

Species distribution data provided an important means of refining the spatial prioritization by identifying discrete areas within habitats where species were confined and reliant for their long term survival. These areas were hence included and weighted to ensure that relevant species ranges were wholly or partially incorporated within the final spatial prioritization.

3.5.1 Data Sources Used

A wide range of data was reviewed especially from the published literature. This included atlases for species groups such as birds (Jennings, 2010; R. Porter & Aspinall, 2010), and mammals (Harrison & Bates, 1991). Unfortunately the scale of mapping was in all cases too coarse to be usefully incorporated in the assessments.

Globally available species distribution data sets such as the IUCN Red List maps from IUCN (downloaded from www.iucnredlist.org) and BirdLife International (http://www.birdlife.org/action/science/species/global_species_programme/) were reviewed and selected data or species with discrete ranges was used.

In addition, IUCN was in the process of producing two new regional assessments; for freshwater species (fish, invertebrates and plants) and for reptiles and amphibians. GIS map data from both of these were kindly supplied prior to publication. The reptile and amphibian assessment is now published (Cox, Mallon, Bowles, Els, & Tognelli, 2012). The freshwater assessments remain under review but the maps outputs were deemed advanced enough to be utilised (Ian Harrison and Fareed Krupp *pers.comm*.).

Other key data sets included:

- BCEAW had already collated a wide range of published and unpublished data on rare and threatened species (Holness et al., 2011).
- Unpublished locations of endemic plants in Yemen from Dr Abdul Wali Al Khulaidi (Agricultural Research Authority)
- Unpublished locations of Oman marine species (Robert Baldwin, Environment Society of Oman)
- Unpublished locations of hawksbill turtle satellite tracking locations (Marina Antonopoulos, EWS-WWF, UAE).
- Unpublished rare species locations and key areas across KSA (Othman Llewellyn, SWA)

A summary list of the feature classes included as individual species derived layers is provided in Table 3-4. There is much species data that could be added to this first collation but this would take considerable time to both obtain from the many species specialists across the region and, in many cases, to reformat for this GIS-based analysis. Figure 3-10 illustrates four examples of species that have been included within the species derived layers.

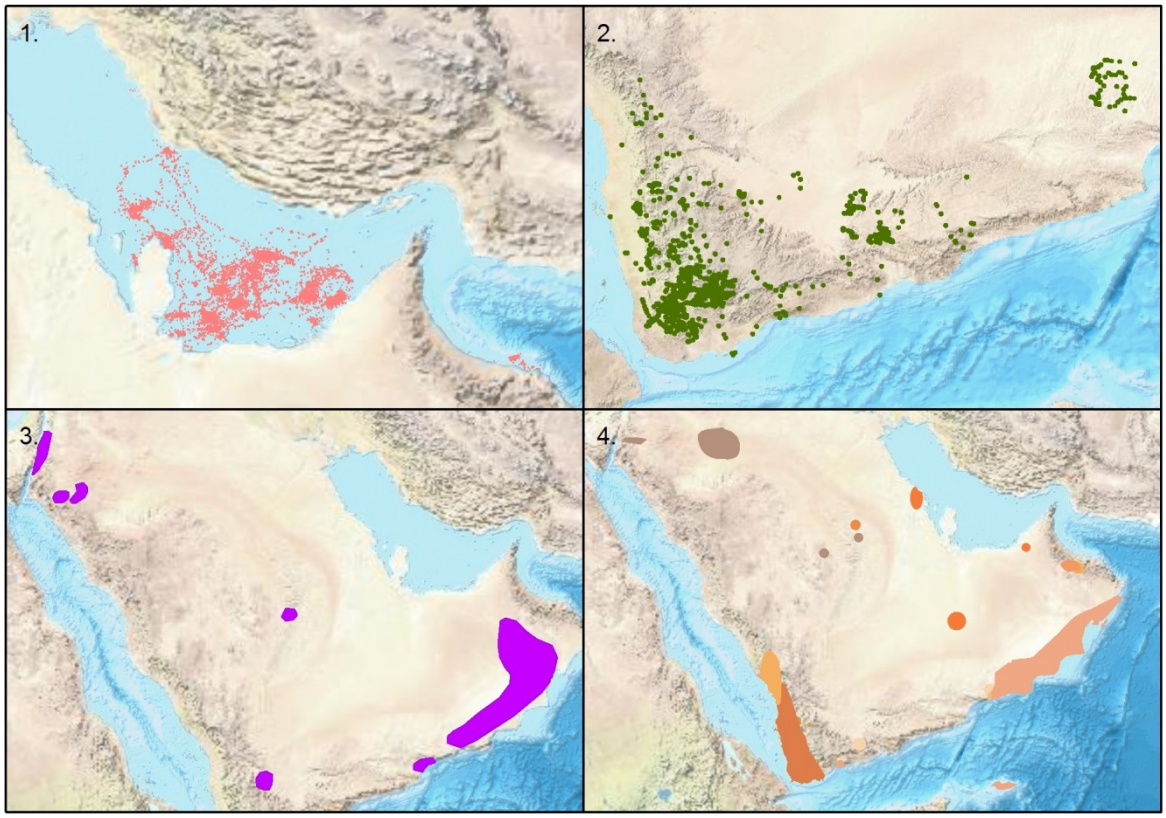
Table 3-4: List of Species Data Sources and Feature Classes

33	Feature Class	Description
Birdlife International	Arabian Peninsula_Birdlfe_Passer_euchlorus_A	Standard IUCN/BirdLife mapped polygons
Birdlife International	Arabian Peninsula_Birdlife_Acrocephalus_griseldis_C	Standard IUCN/BirdLife mapped polygons
Birdlife International	Arabian Peninsula_Birdlife_Alectoris_melanocephala_A_C	Standard IUCN/BirdLife mapped polygons
Birdlife International	Arabian Peninsula_Birdlife_Amaurornis_phoenicurus_A_C	Standard IUCN/BirdLife mapped polygons
Birdlife International	Arabian Peninsula_Birdlife_Ammoperdix_heyi_A_C	Standard IUCN/BirdLife mapped polygons
Birdlife International	Arabian Peninsula_Birdlife_Ardea_goliath	Standard IUCN/BirdLife mapped polygons
Birdlife International	Arabian Peninsula_Birdlife_Botaurus_stellaris	Standard IUCN/BirdLife mapped polygons
Birdlife International	Arabian Peninsula_Birdlife_Bucanetes_githagineus_A	Standard IUCN/BirdLife mapped polygons
Birdlife International	Arabian Peninsula_Birdlife_Burhinus_capensis	Standard IUCN/BirdLife mapped polygons
Birdlife International	Arabian Peninsula_Birdlife_Eremalauda_dunni_A	Standard IUCN/BirdLife mapped polygons
Birdlife International	Arabian Peninsula_Birdlife_Falco_biarmicus_A	Standard IUCN/BirdLife mapped polygons
Birdlife International	Arabian Peninsula_Birdlife_Geronticus_eremita	Standard IUCN/BirdLife mapped polygons
Birdlife International	Arabian Peninsula_Birdlife_Gypus_fulvus_A	Standard IUCN/BirdLife mapped polygons
Birdlife International	Arabian Peninsula_Birdlife_Passer_hemileucus	Standard IUCN/BirdLife mapped polygons
Birdlife International	Arabian Peninsula_Birdlife_Pelecanus_crispus	Standard IUCN/BirdLife mapped polygons
Birdlife International	Arabian Peninsula_Birdlife_Platalea_leucorodia	Standard IUCN/BirdLife mapped polygons
Birdlife International	Arabian Peninsula_Birdlife_Porphyrio_porphyrio	Standard IUCN/BirdLife mapped polygons
Birdlife International	Arabian Peninsula_Birdlife_Prunella_fagani	Standard IUCN/BirdLife mapped polygons
Birdlife International	Arabian Peninsula_Birdlife_Pterocles_coronatus	Standard IUCN/BirdLife mapped polygons

33	Feature Class	Description
Birdlife International	Arabian Peninsula_Birdlife_Pterocles_orientalis	Standard IUCN/BirdLife mapped polygons
Birdlife International	Arabian Peninsula_Birdlife_Rhodopechys_obsoletus_A	Standard IUCN/BirdLife mapped polygons
Birdlife International	Arabian Peninsula_Birdlife_Serinus_menachensis	Standard IUCN/BirdLife mapped polygons
Birdlife International	Arabian Peninsula_Birdlife_Serinus_rothschildi	Standard IUCN/BirdLife mapped polygons
Birdlife International	Arabian Peninsula_Birdlife_Serinus_syriacus	Standard IUCN/BirdLife mapped polygons
Birdlife International	Arabian Peninsula_Birdlife_Torgos_tracheliotos_A	Standard IUCN/BirdLife mapped polygons
Birdlife International	Arabian Peninsula_Birdlife_Treron_waalia_A	Standard IUCN/BirdLife mapped polygons
Birdlife International	Arabian Peninsula_Birdlife_TS_Cisticola_haesitatus	Standard IUCN/BirdLife mapped polygons
Birdlife International	Arabian Peninsula_Birdlife_TS_Falco_concolor_A	Standard IUCN/BirdLife mapped polygons
Birdlife International	Arabian Peninsula_Birdlife_TS_Rhynchostruthus_percivali_A	Standard IUCN/BirdLife mapped polygons
Birdlife International	Arabian Peninsula_Birdlife_Turdoides_altirostris	Standard IUCN/BirdLife mapped polygons
Birdlife International	Arabian Peninsula_Birdlife_Vanellus_gregarius_A	Standard IUCN/BirdLife mapped polygons
Birdlife International	Arabian Peninsula_Birdlife_Vanellus_leucurus	Standard IUCN/BirdLife mapped polygons
Birdlife International	Arabian Peninsula_Sooty_Falcon_Breeding_Sites	Standard IUCN/BirdLife mapped polygons
The Breeding Centre for Endangered Arabian Wildlife	BCEAW datasets	Range of collated data on rare and threatened species. See Holness et al 2011 for description.
EWS-WWF	Arabian Peninsula_EWSWWF_TurtleTracking	This layer represents turtle tracking data.
IUCN - CI Global Assessment Team	Arabian Peninsula_IUCNSSC_Freshwater_Crabs	Standard IUCN/BirdLife mapped polygons
IUCN - CI Global Assessment Team	Arabian Peninsula_IUCNSSC_Freshwater_Dragonflies	Standard IUCN/BirdLife mapped polygons

33	Feature Class	Description
IUCN - CI Global Assessment Team	Arabian Peninsula_IUCNSSC_Freshwater_Fish	Standard IUCN/BirdLife mapped polygons
IUCN - CI Global Assessment Team	Arabian Peninsula_IUCNSSC_Freshwater_Molluscs	Standard IUCN/BirdLife mapped polygons
IUCN - CI Global Assessment Team	Arabian Peninsula_IUCNSSC_Freshwater_Plants	Standard IUCN/BirdLife mapped polygons
IUCN - CI Global Assessment Team	Arabian Peninsula_IUCNSSC_Reptiles	Standard IUCN/BirdLife mapped polygons
Saudi Wildlife Authority	Arabian Peninsula_OL_Saudi_Arabia_Species	Polygons provided by Othman Llewellyn and digitised.
Environment Society of Oman	Arabian Peninsula_RB_Oman_Mammals	Polygons provided by Robert Baldwin and digitised.
Agricultural Research Authority, Taiz	Arabian Peninsula_Yemen_Endemic_Plants	Yemen endemic plants provided originally by Abdul Wali Al Khulaidi (Agricultural Research Authority, Taiz and CMEP). Originally provided as points but these were buffered by 500m.
IUCN	IUCN_Amphibians_Duttaphry_stomaticus	Standard IUCN/BirdLife mapped polygons
IUCN	IUCN_Amphibians_Duttaphrynus_arabicus_A	Standard IUCN/BirdLife mapped polygons
IUCN	IUCN_Amphibians_Duttaphrynus_dhufarensis_A	Standard IUCN/BirdLife mapped polygons
IUCN	IUCN_Amphibians_Duttaphrynus_scorteccii	Standard IUCN/BirdLife mapped polygons
IUCN	IUCN_Amphibians_Pelophylax_bedriagae	Standard IUCN/BirdLife mapped polygons
IUCN	IUCN_Amphibians_Pelophylax_ridibundus	Standard IUCN/BirdLife mapped polygons
IUCN	IUCN_Mammals_Arabitragus_jayakari_C	Standard IUCN/BirdLife mapped polygons
IUCN	IUCN_Mammals_Asellia_patrizii_C	Standard IUCN/BirdLife mapped polygons
IUCN	IUCN_Mammals_Capra_nubiana_C	Standard IUCN/BirdLife mapped polygons

33	Feature Class	Description
IUCN	IUCN_Mammals_Eidolon_helvum_C	Standard IUCN/BirdLife mapped polygons
IUCN	IUCN_Mammals_Equus_hemionus_C	Standard IUCN/BirdLife mapped polygons
IUCN	IUCN_Mammals_Gazella_dorcas_C	Standard IUCN/BirdLife mapped polygons
IUCN	IUCN_Mammals_Hipposideros_megalotis_C	Standard IUCN/BirdLife mapped polygons
IUCN	IUCN_Mammals_Panthera_pardus	Standard IUCN/BirdLife mapped polygons
IUCN	IUCN_Mammals_Pipistrellus_rueppellii	Standard IUCN/BirdLife mapped polygons
IUCN	IUCN_Mammals_Tadarida_midas	Standard IUCN/BirdLife mapped polygons
IUCN	IUCN_Mammals_Tadarida_niangarae	Standard IUCN/BirdLife mapped polygons
IUCN	IUCN_Mammals_Vormela_peregusna	Standard IUCN/BirdLife mapped polygons



1. EWS in association with WWF, Marine Research Foundation et al. Marine Turtle Conservation Project - Preliminary analysis by H. El Alkamy (EAD) on foraging grounds and migratory trajectories from satellite tracking of post-nesting hawksbill turtles in the Gulf region.
2. Endemic plants of Yemen supplied by Abdul Wali Al Khulaidi (Agricultural Research Authority).
3. Pterocles coronatus (crowned sandgrouse) distribution supplied by Birdlife International.
4. 19 discrete reptile distributions supplied by IUCN.

Figure 3-10: Examples of Species Data used in the Spatial Prioritization for the Arabian Peninsula

3.5.2 Process

If species ranges were large and occupied areas equivalent to one or more entire habitat types then these distributions would not improve the spatial prioritization (no matter how high the priority of the species). Hence these species data were not used.

This species review was initially carried out by the Project team and then by the Regional Technical Workshop attendees. The workshop also led to the creation of a number of mapped important species or assemblage areas, most of which were valid for inclusion within the prioritization because these were discrete and mapped with sufficient accuracy.

Species ranges used in the spatial prioritization were scored using a simple 1-4 scale; with '1' representing lowest priority and '4' highest priority. Species that were on the IUCN Red List as Critically Endangered (CR) or Endangered (EN) were all scored as 4, Vulnerable (VU) 3, Data Deficient (DD) and Near Threatened (NT) 2. A Locally Threatened category was also included based on Abu Dhabi or UAE Red Data Lists and was also scored as 4. Species ranges where data accuracy or usefulness was poor or the records were not usable were scored as '0'.

3.5.3 Outputs

Species, like ecological processes are embedded within the spatial prioritization process and therefore it is not useful to produce a separate species layer.

3.6 Mapping Ecological Processes

Identification and protection of habitats and species areas is not in itself sufficient to ensure the long term persistence of biodiversity. A variety of ecological processes, which operate at a variety of geographic scales (e.g. from international migration routes for key species through to local level pollination processes) and time scales (e.g. from short term season movements of species through to long term processes linked to groundwater infiltration and movement), are responsible for ensuring the long term persistence of biodiversity. These process areas are particularly important in the context of changing environments, especially through global climate change. Identification of areas important for supporting ecological processes is a key activity for any systematic conservation planning project. However, data scoping revealed that little of no direct data on ecological processes exists for the region. The Project therefore focussed on filling this gap in spatial knowledge, and accommodated ecological processes in the conservation planning process.

3.6.1 Data Sources Used

Direct spatial data sources on ecological processes were largely unavailable. As spatial data sources on ecological process were largely unavailable, various proxies for ecological processes were developed:

- The integrated habitat map. See Figure 3-5.
- The habitat condition map was used to identify largest, most connected and least impacted fragments. See Figure 3-8.
- The derived species datasets were used to identify high diversity areas, see Section 3.5.
- Experts identified process areas from the Regional Technical Workshop.

3.6.2 Process

Processes were incorporated into the conservation planning process by:

- The Regional Technical Workshop was heavily focussed on the aspects needed to ensure long term ecological sustainability of species. These areas include key aspects like major feeding, breeding and resting grounds for migratory birds; and areas of particularly high numbers or dense concentrations of keystone species as opposed to just the general distributions of these species. For example, all Important Bird Areas were included.
- Data on habitat and process requirements for key species (e.g. breeding beaches for turtles, turtle foraging areas and dugong foraging areas) were refined during the Regional Technical Workshop. This data was supplemented by MaxEnt modelling by H. Al Alqamy (EAD) in order to identify core habitat areas important for long term persistence of these species. Turtle foraging areas were derived from raw data on turtle tracking provided by EWS-WWF. Areas with high densities of recorded occurrences were identified as being important for turtle foraging and breeding.

- The workshop was also used to identify linkages and connectivity important for species, as well as key remaining contiguous intact habitat (e.g. linkages for dugong between the major marine Protected Areas).

- The outputs from the initial conservation assessments (particularly of ecosystem threat status) were processed to identify which were the critical remaining fragments of threatened habitat types. The largest, most connected and least impacted fragments for these key habitat types were identified, and these areas were then included as an additional feature in the conservation planning prioritization to ensure that these areas which are likely to be most important for supporting ecological processes are included.

- The habitat map was developed based on key landscape attributes such as altitude, vegetation, soil and geology combinations. Particular effort was invested in producing habitat maps which represented the full range of mountain habitat types. The inclusion of these types separately into the conservation planning process, rather than as a generic 'mountain' type, ensured that these highly diverse areas which are important for ecological processes, and contain key ecotones and niche habitats, were fully incorporated. In addition, the workshop identified a number of features in the topographically diverse mountain areas, with their strong altitude gradients and their associated importance for climate change adaptation.

- Specific habitat types that are important for ecological processes were targeted which have higher protection targets (e.g. 80% for mangroves, corals and saltmarshes).

- Habitats with a high diversity of features were targeted. These areas were seen to particularly important for maintaining a range of species, and hence were targeted both within the MARXAN algorithm, but also by including high diversity grid cells as a feature in their own right in the prioritization.

- Hydrological process areas (such as freshwater wadis) were included with higher targets than other terrestrial habitat types.

- The most connected and important areas in terms of linkages are deliberately identified in the conservation planning process. MARXAN was optimized to help design ecologically coherent landscapes, by identifying which areas were best linked into the remainder of the landscape.

- The conservation planning process deliberately dealt with marine and terrestrial areas at the same time in the spatial prioritization to ensure that the two were effectively linked. It would have been easier to do them separately, but bringing them together ensured key connectivity of coastal habitats.

3.6.3 Outputs

Ecological processes are largely embedded in the spatial prioritization process (and in various layers which have previously been presented such as areas important for various species), and therefore it is not useful (and in most cases possible) to produce a separate ecological process layer.

3.7 Mapping Opportunities and Constraints

SCP not only considers biodiversity elements in the spatial prioritization but also opportunities and constraints. In order to remain systematic an area is never included just because it is an opportunity and an area is never excluded just because it is difficult

if that area is necessary for targets and there is no alternative (i.e. irreplaceable). Opportunities can include areas such as existing conservation initiatives, identified but not protected priority areas and areas that are protected for other reasons (e.g. cultural sites, security sites).Constraints can include areas flagged for development.

3.7.1 Data Sources Used

The opportunities and constraints GIS layer was derived using data from the following sources:

- CMRECS (EAD, 2010) archaeological sites and fishing right boundaries, EBDB important bird areas, bird wetland areas, EBDB Buhoor areas, EBDB environmental permit applications for developments, EBDB development sites where Environmental Impact Assessments (EIA) have been received by EAD, EAD GISDB archaeological important sites in Abu Dhabi, oilfields in the UAE, pearl diving sites (i.e. oyster beds) in UAE.
- Abu Dhabi Urban Planning Council (UPC) datasets – Plan Abu Dhabi 2030 and Plan Al Gharbia 2030, UPC proposed coastal conservation zones in Abu Dhabi, UPC proposed coastal park in Abu Dhabi, UPC proposed coastal stewardship zone in Abu Dhabi, development sites applications in Abu Dhabi which have been submitted to UPC, proposed nature reserves in Abu Dhabi, proposed Protected Areas in the Abu Dhabi.
- Tourism and Culture Authority Abu Dhabi datasets – Al Ain World Heritage Site and buffer zone boundaries, archaeological important sites in Abu Dhabi, archaeological important sites on Marawah Island, archaeological structures of importance in Liwa, Plan Al Ain 2030 future development boundaries.
- ADCO datasets – archaeological buffer zones, concession area boundaries, land oil fields.
- Department of Municipal Affairs datasets – planned development plots.
- Tourism Development & Investment Company – one dune protection zone on Saadiyat Island in Abu Dhabi.
- Birdlife International - Location (points and polygons) of Important Bird Areas in the Arabian Peninsula.
- Umm Al Quwain Municipality - Location of archaeological important sites within the Emirate of Um al Quwain, location of planned development sites within the Emirate of Umm al Quwain.
- Fujairah Municipality - Location of buffer zone around Wadi Wurayah Protected Area in Fujairah, location of proposed ecotourism zone around Wadi Wurayah Protected Area.
- Breeding Centre for Endangered Arabian Wildlife - Proposed conservation areas in UAE.
- Dubai Major Projects Plan - Boundary of planned future development in Dubai.
- Proposed Protected Areas across the KSA supplied by Saudi Wildlife Authority.
- Proposed and buffer zones for Protected Areas in Jordan supplied by RSCN.

- Proposed Protected Areas in Yemen supplied by Agricultural Research Authority.
- Proposed Protected Areas across Oman supplied by David Insall.
- Important habitats in KSA identified by Saudi Wildlife Authority (SWA).
- Important coral reef areas identified by Qatar Natural History Museum.
- No fishing areas in Kuwait identified by eMISK.

3.7.2 Process

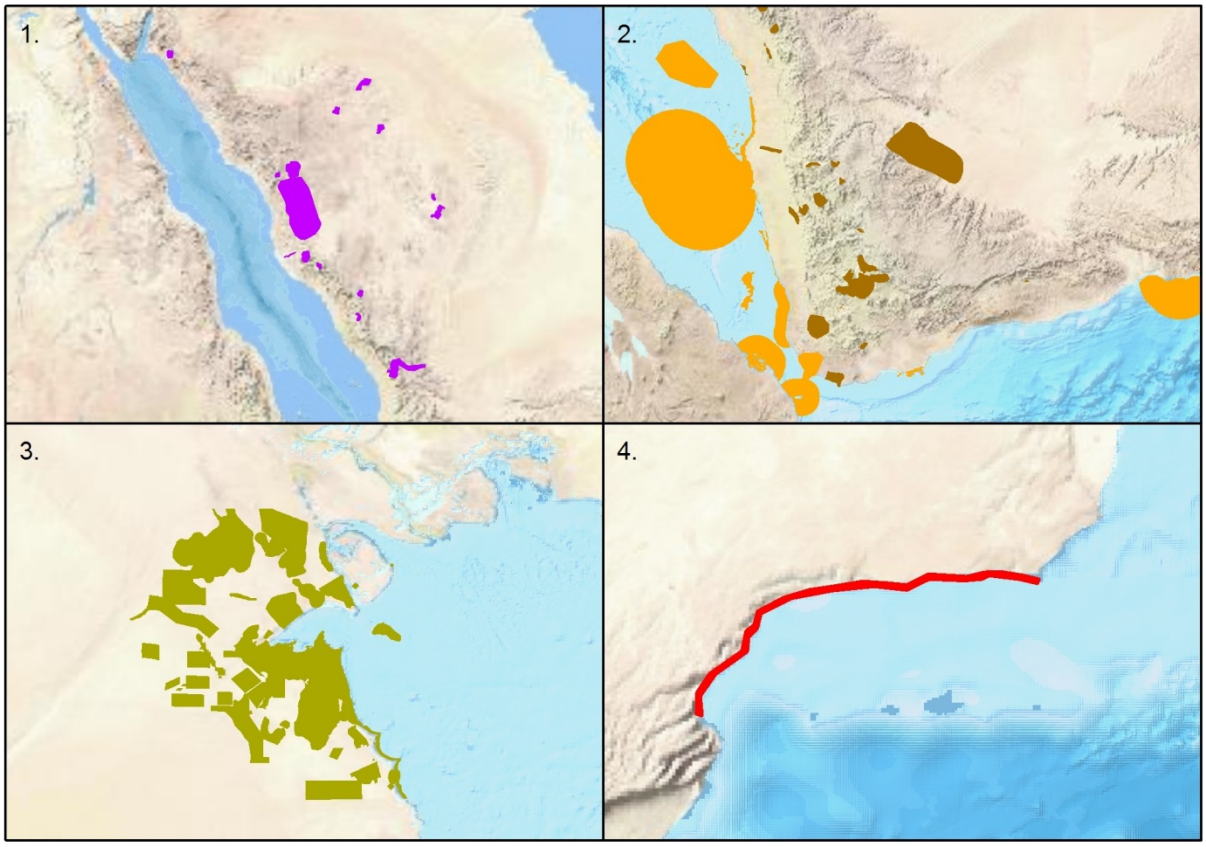
A number of data sources were reviewed for their applicability as an opportunity or constraint. Those which were deemed appropriate were allocated a value as follows:

- 3: strong opportunity.
- -1: slight constraint.
- 2: moderate opportunity.
- 1: slight opportunity.
- -2: moderate constraint.
- -3: strong constraint.

It should be noted that unlike the habitat and pressures layers the opportunities and constraints layer did not require complete coverage of the planning domain, as even partial inclusion improves the spatial prioritization at a local level. It is also acceptable within this layer to have overlapping polygons.

The summary of opportunities and constraints used for the Arabian Peninsula spatial prioritization is shown in Appendix B.4.

Examples of opportunity and constraints inputs into the opportunity and constraints layer are presented in Figure 3-11. Section 3.8 outlines how these layers were used in the development of cost surfaces. Certain opportunity areas were also included as features in the spatial prioritization, and these are examined in Section 4.6.



1. Opportunity - Proposed Protected Areas across KSA supplied by Saudi Wildlife Authority.
2. Opportunity - Important Bird Areas supplied by Birdlife International.
3. Constraints - Master Plan for Kuwait supplied by eMISK.
4. Constraints - Proposed coastal road in Oman supplied by Robert Baldwin.

Figure 3-11: Examples of Opportunity and Constraints across the Arabian Peninsula

3.8 Development of Cost Surfaces

Cost surfaces are used in the spatial prioritization process to help guide the MARXAN selection algorithm.

3.8.1 Data Sources Used

The cost surface was developed from the following layers:

- The habitat condition map was used to identify 'Natural'/'Good' areas, 'Degraded'/'Fair' areas, and 'Transformed'/'Poor' areas (see Section 3.3).
- The opportunities and constraints layers (see Section 3.7).

3.8.2 Process

A cost surface summarizing the cost of inclusion of additional areas into the Protected Area network was developed based on habitat condition, and the opportunities and constraints data:

3.8.2.1 Habitat condition

Habitat condition was the primary input into the cost surface layer. The objective was to strongly favour the selection of intact areas, to slightly avoid selection of degraded areas and strongly avoid selection of transformed areas. This was achieved by:

- Coding the habitat condition map with Natural/Good areas = 0.1, Degraded/Fair areas = 1, and Transformed/Poor areas = 10.
- The resultant layer was converted to a 1000m raster grid.
- Zonal statistics were used to calculate average condition scores per hexagonal planning unit, with 10 being the score for a completely transformed area and 0.1 the score for a completely natural planning unit.

3.8.2.2 Opportunities

Areas representing good opportunities for conservation actions (Section 3.7) were included at lower cost in the analysis. This was achieved by:

- Identifying all units with opportunities, and scoring these as per Section 3.7.
- Clipping the full extent of the opportunity areas (which were often broadly identified) to the remaining Natural/Good extent in order to ensure that only intact areas were prioritized.
- The resultant layer was converted to a 1000m raster grid.
- Zonal statistic where used to calculate average opportunity scores per hexagonal planning unit, with '0' being the score for a unit with no identified opportunities and '3' being the maximum possible score.

3.8.2.3 Constraints

Areas representing constraints to conservation actions (Section 3.7) were included at higher cost in the analysis. This was achieved by:

- Identifying all units with constraints, and scoring these as per Section 3.7.
- The resultant layer was converted to a 1000m raster grid.
- Zonal statistics were used to calculate average constraint scores per hexagonal planning unit.

- The values were linearly converted to a 0-10 range, with 0 being the planning units with no constraints, and 10 being planning units with the largest extent of strong constraints.

3.8.2.4 *Cost Surface*

Creating the combined cost surface: The final cost surface was produced using the following formula:

- Total cost = Basic cost + Condition modifier + Constraints modifier – Opportunities modifier where:
    - ‘Total cost’ = Cost of included a planning unit in the MARXAN analysis.
        - ‘Basic cost’= 3*Area(ha)
        - ‘Condition modifier’ = Area(ha)*Condition score
        - ‘Constraints modifier’ = Area(ha)*Constraints score
        - ‘Opportunities modifier’ = Area(ha)*Opportunities score

3.8.3 Outputs

The cost surface is shown in Figure 3-12 (and in large format in Appendix B.5), where highest cost values occur on coastal plains, in the Arabian Gulf, in a central band across KSA and in Jordan, due to the concentration of multiple pressures in these areas and the prevalence of constraints on conservation activity (e.g. areas identified for future development). Conversely lowest cost areas are found outside of the oil development and agricultural areas, especially in the mountainous arc in the west and south of the Arabian Peninsula.

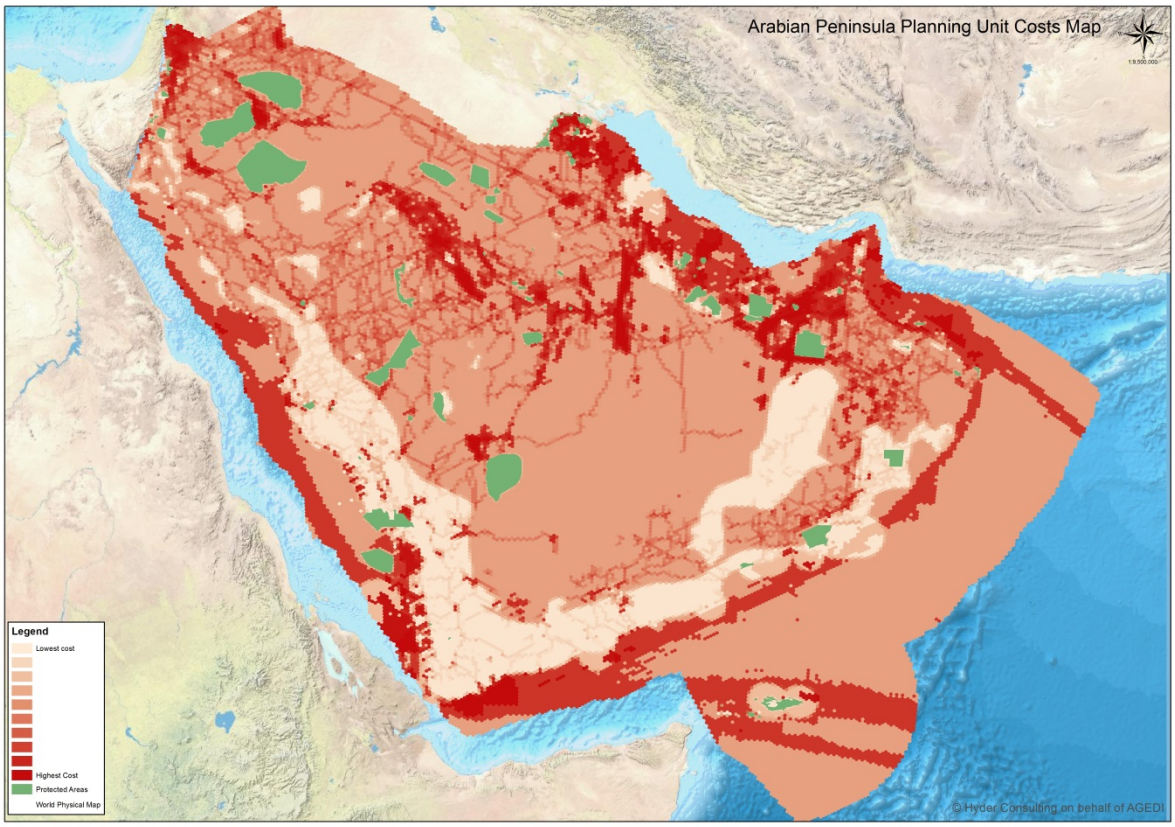


Figure 3-12: Planning Unit Costs used in the Analyses

3.9 Data Limitations

The project integrated all available biodiversity data received either through stakeholder engagement or desktop research. Therefore the maps are as accurate as the current data permits and in all areas the data quality was adequate for the purposes of this SCP process. In some areas the data was of a much higher quality. As a result the maps and data are good for strategic planning and analysis at 1:200,000 scale but for more detailed analysis, for example at 1:50,000, then further survey and detailed data collection would be required which was beyond the scope of this Project.

4 Systematic Conservation Planning Process

4.1.1 Introduction

The Project's approach was based on a systematic conservation planning concept, which represents the best practice in this field. This approach is a scientific method for identifying geographic areas of biodiversity importance, which involves:

- Mapping biodiversity features (such as ecosystems, species, spatial components of ecological processes).
- Mapping a range of information related to these biodiversity features and their ecological condition.
- Setting quantitative targets for biodiversity features; analyzing the information using software linked to GIS.
- Developing maps that show spatial biodiversity priorities. The configuration of priority areas is designed to be spatially efficient (i.e. to meet biodiversity targets in the smallest area possible) and to avoid conflict with other land and water resource uses where possible.

The systematic approach emphasises the need to conserve a representative sample of ecosystems (where an integrated marine and terrestrial habitat classification is used as a proxy for ecosystems) and their species (the principle of representation) as well as the ecological processes that allow them to persist over time (the principle of persistence), and to set quantitative biodiversity and protection targets that tell us how much of each biodiversity feature should be maintained in a natural or near-natural state, or should be included within Protected Areas. These principles of systematic biodiversity planning are reflected in the headline indicators of the initial conservation assessments, namely the ecosystem threat status and ecosystem protection level, through the use of biodiversity targets and thresholds.

4.2 Introduction to the Headline Indicators

4.2.1 Ecosystem Threat Status

Ecosystem threat status represents the degree to which ecosystems are still intact, or alternatively losing vital aspects of their structure, function or composition, on which their ability to provide ecosystem services ultimately depends. Threat status has traditionally been assessed for species, in the form of national or global Red Lists that draw attention to species threatened with extinction. It is less usual for threat status to be assessed at the ecosystem or habitat level, though this is an emerging trend internationally (Rodríguez et al., 2011). Assessing threat status and protection level at the ecosystem scale supports a landscape or seascape approach to managing and conserving biodiversity, and provides a robust basis for biodiversity monitoring and state of biodiversity or environment reporting. The main steps in assessing the ecosystem threat status are presented in Figure 4-13.

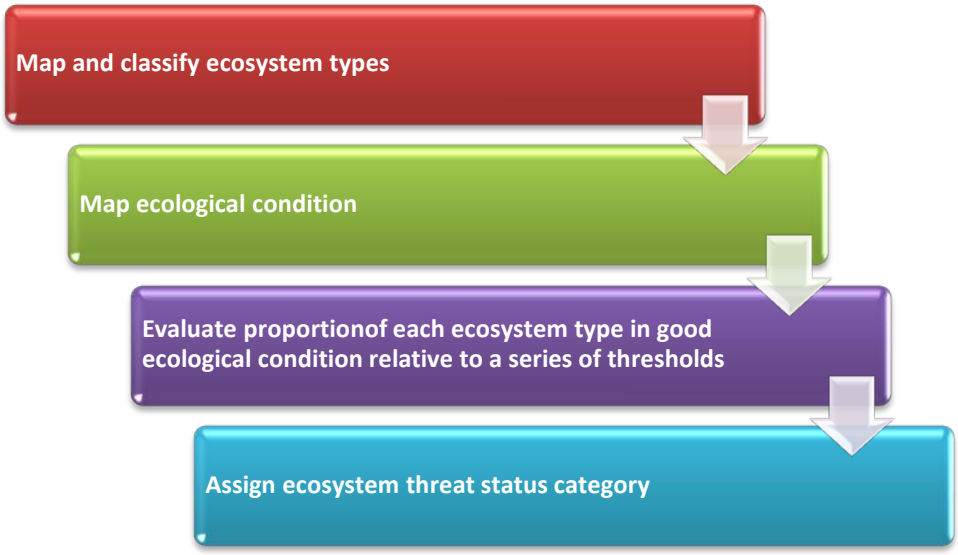


Figure 4-13: Principal Steps in Assessing Ecosystem Threat Status

4.2.2 Ecosystem Protection Level

Ecosystem protection level determines whether ecosystems are adequately protected or under-protected. Protected means included in a formally proclaimed or declared protected area such as a Nature Reserve, Protected Area or Marine Protected Area which has formal legal status. In the past, the extent of protection was usually reported on simply by giving the overall proportion of land or sea protected. However, these figures do not provide any information about which specific ecosystems are well protected and which are poorly protected. Across the world, the location of Protected Areas has historically been driven by a range of factors, mostly unrelated to biodiversity importance, resulting in a Protected Area network that does not represent all ecosystem types and excludes key ecological processes. This means the Protected Area network is not as effective at protecting biodiversity and providing ecosystem services as it could be. Therefore it is important, as is done in this assessment, to examine the representative of the Protected Area network at an ecosystem level.

The main steps in assessing ecosystem protection level in marine and terrestrial environments are shown in Figure 4-14.

Figure 4-14: Principal Steps in Assessing Ecosystem Protection Level in Marine and Terrestrial Environments

Ecosystem threat status and ecosystem protection level are assessed independently of each other. The threat status cannot be inferred from protection level, or the other way around. While threat status and protection level co-vary for some ecosystems, this is not always the case, especially for aquatic ecosystems. For example, an ecosystem type may be least threatened and have no protection, or may be critically endangered and well protected (e.g. if all areas of a habitat type outside of a Protected Area have been lost), although this second example is less likely in practice.

4.3 Biodiversity and Ecosystem Protection Targets

A key characteristic of a SCP approach is the use of quantitative targets. For the current assessment biodiversity targets and protection targets, both of which are defined in terms of portions of the original extent of each habitat type have been used. Ideally one set of targets, which would be derived directly from ecological characteristics of the ecosystem concerned would be used. However two sets of targets have been used in this assessment to allow for the comparable evaluation of ecosystem threat status of all habitat units, while still accommodating and reporting against the strategic objectives for Protected Area expansion e.g. meeting international commitments such as Convention on Biological Diversity (CBD) targets. Note that targets for non-habitat biodiversity features (e.g. species and processes) are dealt with in Section 4.6.

4.3.1 Biodiversity Targets

Assessments of ecosystem threat status require biodiversity targets to be set for ecosystem types. These targets are used to evaluate the current relative level of threat to each ecosystem. The biodiversity target is the minimum proportion of each ecosystem type that needs to be kept in a natural or near-natural state in the long term in order to maintain viable representative samples of all ecosystem types and the majority of species associated with those ecosystems.

Biodiversity targets should preferably be based on the ecological characteristics of the ecosystem concerned, and ideally, the biodiversity target would be calculated based on a detailed knowledge of species richness, diversity and ecosystem function. However, a recent international review suggests that in most cases data do not exist to derive targets

based on biodiversity characteristics, that the results obtained using assumed and flat-baseline targets produce comparable results in most planning environments, and that the time and effort invested in target formulation is better expended elsewhere in the conservation planning process (S. Porter, Sink, Holness, & Lombard, 2011). Further, the data required to derive detailed species area curves do not exist for the Arabian Peninsula. Therefore a flat target of 25% of the original extent of each ecosystem type was set. This value was set by taking the mid-point of the targets used in the South African National Biodiversity Assessment (Driver et al., 2011), where the scientifically formulated species-area relationship was used to set biodiversity targets which vary between 16% and 36% of the original extent of each ecosystem type. Biodiversity targets may be refined over time as scientific knowledge and data improves. Importantly, they are the baseline against which the current relative level of threat to each ecosystem is assessed. Therefore although it is not ideal to use generalized targets, these still allow a good picture of the relative level of threat to each ecosystem to be developed. Biodiversity targets are given in Table 4-7.

4.3.2 Ecosystem Protection Targets

Ecosystem protection targets: Ecosystem protection targets are quite different to biodiversity targets in that while they are also designed to allow relative evaluation of habitat types, they also reflect desired strategic or political objectives for Protected Area expansion which may differ between habitats or be independent of biodiversity criteria. The ecosystem protection targets used for this assessment were based on:

- The CBD has been ratified by all countries within the Arabian Peninsula, and hence forms a robust starting point for setting protected area targets for the region. CBD Strategic Goal C Target 11 specifies 17% of terrestrial habitat types and 10% of marine habitat types should be included within protected areas. Importantly, unlike previous CBD targets which were for aggregated national protected area networks, these are representative targets, i.e. these portions are required of each habitat type to ensure a representative reserve network. Based on workshop feedback on the importance of different habitat types in the region, intertidal habitat types have been placed with terrestrial rather than marine habitats, in order to use the more appropriate higher target percentage.

- Higher targets for key marine habitats were used, following the approach taken in the planning for Abu Dhabi and the UAE assessments. Targets were set at 80% of area for mangroves, coral reef, and salt marsh. A target of 34% was used for sea-grass beds.

- For extremely rare habitat types, where the original area of the type was under 10km^2, the target was set at 100%; while if the original area was under 20km^2, the target was specified as 80% of the full extent of the habitat type.

Ecosystem protection targets are given in Table 4-5.

Table 4-5: Biodiversity and Ecosystem Protection Targets Used for the Arabian Peninsula Assessments

Ecoregion	Habitat Name	Original Extent (km^2)	Protection Target %	Protection Target (km^2)	Biodiversity target %	Biodiversity target (km^2)
1. Islands	Islands - Arabian (Persian) Gulf	802.9	17	136.5	25	200.7
	Islands - Gulf of Aden	16.3	80	13.0	25	4.1
	Islands - Gulf of Oman	0.2	100	0.2	25	0.1
	Islands - Northern and Central Red Sea	200.5	17	34.1	25	50.1
	Islands - Southern Red Sea	1,222.7	17	207.9	25	305.7
	Islands - Western Arabian Sea	772.3	17	131.3	25	193.1
	Socotra Archipelago	3,882.8	17	660.1	25	970.7
2. Coastal	Gulf Coastal Sabkha and Sabkha Matti	11,483.9	17	1,952.3	25	2,871.0
	Northern Gulf Coastal Plain	66,165.4	17	11,248.1	25	16,541.3
	Oman Coastal Plain	13,860.0	17	2,356.2	25	3,465.0
	Red Sea Coastal Plain and Sabkha	24,911.1	17	4,234.9	25	6,227.8
	Southern Coastal Plain	12,869.8	17	2,187.9	25	3,217.5
	Southern Gulf Coastal Plain	29,981.9	17	5,096.9	25	7,495.5
	Tihamah Coastal Plain	24,079.6	17	4,093.5	25	6,019.9
3. Lowlands	Ad-Dibdibah / Kuwait Alluvial Plain	38,226.4	17	6,498.5	25	9,556.6
	At-Taysiyah Limestone Plain	13,071.3	17	2,222.1	25	3,267.8
	Central Limestone Plain and Low Cuesta	110,903.0	17	18,853.5	25	27,725.8
	Central Sand Plain	80,815.9	17	13,738.7	25	20,204.0

Ecoregion	Habitat Name	Original Extent (km^2)	Protection Target %	Protection Target (km^2)	Biodiversity target %	Biodiversity target (km^2)
	Central Yemen Plain	67,158.8	17	11,417.0	25	16,789.7
	Eastern Desert Plain	6,354.8	17	1,080.3	25	1,588.7
	Eastern Gravel Plain	46,091.2	17	7,835.5	25	11,522.8
	Huqf - Plain, Outcrop and Dune	7,241.6	17	1,231.1	25	1,810.4
	Inland Sabkha	28,419.2	17	4,831.3	25	7,104.8
	Najd Pediplain	249,469.0	17	42,409.7	25	62,367.3
	Northern Sandstone Plain and Plateau	74,909.9	17	12,734.7	25	18,727.5
	Western Sandstone Plain and Plateau	29,469.6	17	5,009.8	25	7,367.4
4. Deserts	Ad-Dahna Dune, Sand Sheet and Plain Mosaic	29,614.6	17	5,034.5	25	7,403.7
	Al-Jafurah Sand Dune	31,822.7	17	5,409.9	25	7,955.7
	An-Nafud al-Kabir Sand Dune	66,454.0	17	11,297.2	25	16,613.5
	Ar-Rub al-Khali Sand Dune	378,046.0	17	64,267.8	25	94,511.5
	Ar-Rub al-Khali Sand Massif and Sabkha	95,578.2	17	16,248.3	25	23,894.6
	Central Nafuds Sand Dune	51,342.9	17	8,728.3	25	12,835.7
	Eastern Sand Sheet and Dune	36,302.2	17	6,171.4	25	9,075.6
	Wahiba Sand Dune	10,365.0	17	1,762.1	25	2,591.3
5. Uplands	As-Summan Limestone Plateau	79,266.2	17	13,475.3	25	19,816.6
	Central Volcanic Outcrop	69,646.2	17	11,839.9	25	17,411.6
	Dhofar Plateau	111,869.0	17	19,017.7	25	27,967.3

Ecoregion	Habitat Name	Original Extent (km^2)	Protection Target %	Protection Target (km^2)	Biodiversity target %	Biodiversity target (km^2)
	Hadramaut Plateau	202,427.0	17	34,412.6	25	50,606.8
	Hisma Plateau	8,803.0	17	1,496.5	25	2,200.8
	Najd Pediplain - Granitic Outcrop	3,271.4	17	556.1	25	817.9
	Najd Pediplain - Pyroclastic Outcrop	42,034.4	17	7,145.9	25	10,508.6
	Najran - Asir Plateau	53,363.8	17	9,071.9	25	13,341.0
	Northern Limestone Plateau	199,343.0	17	33,888.3	25	49,835.8
	Northern Volcanic Outcrop	35,954.8	17	6,112.3	25	8,988.7
	Yemen Precambrian Plateau	38,207.6	17	6,495.3	25	9,551.9
	Yemen Volcanic Outcrop	3,335.3	17	567.0	25	833.8
6. Mountains	Asir Mountains - Eastern Slope	26,351.1	17	4,479.7	25	6,587.8
	Asir Mountains - Juniper Woodland	281.1	17	47.8	25	70.3
	Asir Mountains - 800m to 1500m	10,992.3	17	1,868.7	25	2,748.1
	Asir Mountains - 1500m to 2000m	4,759.8	17	809.2	25	1,190.0
	Asir Mountains - above 2000m	1,275.9	17	216.9	25	319.0
	Hajar Mountains - Jebel Hafit	202.8	17	34.5	25	50.7
	Hajar Mountains - below 500m	34,073.3	17	5,792.5	25	8,518.3
	Hajar Mountains - Carbonate - below 500m	315.8	17	53.7	25	79.0
	Hajar Mountains - Eastern - 500m to 1000m	3,327.7	17	565.7	25	831.9
	Hajar Mountains - Eastern - above 1000m	685.1	17	116.5	25	171.3

Ecoregion	Habitat Name	Original Extent (km^2)	Protection Target %	Protection Target (km^2)	Biodiversity target %	Biodiversity target (km^2)
	Hajar Mountains - Musandam - below 500m	1,486.1	17	252.6	25	371.5
	Hajar Mountains - Musandam - 500m to 1000m	633.0	17	107.6	25	158.2
	Hajar Mountains - Musandam - above 1000m	65.1	17	11.1	25	16.3
	Hajar Mountains - Western - 500m to 1000m	6,338.2	17	1,077.5	25	1,584.6
	Hajar Mountains - Western - 1000m to 2000m	1,339.0	17	227.6	25	334.7
	Hajar Mountains - Western - above 2000m	51.0	17	8.7	25	12.7
	Hijaz Hills and Mountains - below 1500m	79,253.8	17	13,473.1	25	19,813.4
	Hijaz Hills and Mountains - above 1500m	850.0	17	144.5	25	212.5
	Jabal Shammar	8,079.9	17	1,373.6	25	2,020.0
	Jabal Tuwayq	46,974.5	17	7,985.7	25	11,743.6
	Madyan Mountains - below 1000m	17,373.6	17	2,953.5	25	4,343.4
	Madyan Mountains - above 1000m	689.7	17	117.2	25	172.4
	Monsoon-affected Vegetation - below 500m	13,096.4	17	2,226.4	25	3,274.1
	Monsoon-affected Vegetation - 500m to 1000m	6,963.2	17	1,183.8	25	1,740.8
	Monsoon-affected Vegetation - above 1000m	170.6	17	29.0	25	42.6
	Tihamah Foothills - below 500m	52,352.4	17	8,899.9	25	13,088.1
	Yemen Highlands - 500m to 1000m	14,916.2	17	2,535.8	25	3,729.1
	Yemen Highlands - 1000m to 2000m	22,444.8	17	3,815.6	25	5,611.2
	Yemen Highlands - above 2000m	6,781.4	17	1,152.8	25	1,695.3

Ecoregion	Habitat Name	Original Extent (km^2)	Protection Target %	Protection Target (km^2)	Biodiversity target %	Biodiversity target (km^2)
7. Jordan	Acacia and Rocky Sudanian	3,699.4	17	628.9	25	924.8
	Forest and Non-forest	6,536.8	17	1,111.3	25	1,634.2
	Steppe	9,073.8	17	1,542.6	25	2,268.5
1. Arabian (Persian) Gulf	Algal Mats	193.2	17	32.8	25	48.3
	Mangroves	208.1	80	166.5	25	52.0
	Rocky Platforms	164.9	17	28.0	25	41.2
	Saltmarsh	51.3	80	41.0	25	12.8
	Tidal flats (no algal mats)	342.5	17	58.2	25	85.6
	Coral Reef	762.9	80	610.4	25	190.7
	Other Shallow Water	43,058.0	10	4,305.8	25	10,764.5
	Seagrass / macro-algal beds	5,754.6	34	1,956.6	25	1,438.7
	Deeper than 15m	89,013.1	10	8,901.3	25	22,253.3
2. Gulf of Aden	Mangroves	0.1	100	0.1	25	0.0
	Coral Reef	132.7	80	106.2	25	33.2
	Other Shallow Water	2,057.0	10	205.7	25	514.3
	Seagrass / macro-algal beds	2,733.1	34	929.3	25	683.3
	Deeper than 15m	410,293.0	10	41,029.3	25	102,573.0
3. Gulf of Oman	Mangroves	3.1	100	3.1	25	0.8
	Coral Reef	60.8	80	48.6	25	15.2

Ecoregion	Habitat Name	Original Extent (km^2)	Protection Target %	Protection Target (km^2)	Biodiversity target %	Biodiversity target (km^2)
	Other Shallow Water	1,530.8	10	153.1	25	382.7
	Deeper than 15m	85,120.6	10	8,512.1	25	21,280.2
4. Northern and Central Red Sea	Mangroves	14.4	80	11.5	25	3.6
	Coral Reef	2,082.2	80	1,665.8	25	520.6
	Other Shallow Water	3,870.8	10	387.1	25	967.7
	Seagrass / macro-algal beds	12,362.4	34	4,203.2	25	3,090.6
	Deeper than 15m	88,769.9	10	8,877.0	25	22,192.5
5. Southern Red Sea	Mangroves	35.8	80	28.7	25	9.0
	Coral Reef	1,691.9	80	1,353.5	25	423.0
	Other Shallow Water	12,997.7	10	1,299.8	25	3,249.4
	Seagrass / macro-algal beds	9,161.6	34	3,114.9	25	2,290.4
	Deeper than 15m	91,526.1	10	9,152.6	25	22,881.5
6. Western Arabian Sea	Mangroves	0.2	100	0.2	25	0.0
	Coral Reef	151.5	80	121.2	25	37.9
	Other Shallow Water	7,312.0	10	731.2	25	1,828.0
	Deeper than 15m	542,165.0	10	54,216.5	25	135,541.0

4.4 Ecosystem Threat Status Assessment

Ecosystem threat status evaluates the degree to which ecosystems are still intact or alternatively losing vital aspects of their structure, function or composition. Ecosystem types are categorised as Critically Endangered, Endangered, Vulnerable or Least Threatened (LT), based on the proportion of each ecosystem type that remains in good ecological condition relative to a series of thresholds. 'Critically Endangered', 'Endangered' and 'Vulnerable' ecosystem types are collectively referred to as 'Threatened', the ecosystem equivalent of threatened species as defined by the IUCN 'Red List' process (IUCN Standards And Petitions Subcommittee, 2010)

The following definitions describe the ecosystem threat status categories (Figure 4-15).

- ***Critically Endangered (CR) ecosystems*** are ecosystem types that have very little of their original extent left in natural or near-natural condition. Most of the ecosystem type has been severely or moderately modified from its natural state. These ecosystem types are likely to have lost much of their natural structure and functioning, and species associated with the ecosystem may have been lost. Few natural or near-natural examples of these ecosystems remain. Any further loss of natural habitat or deterioration in condition of the remaining healthy examples of these ecosystem types must be avoided, and the remaining healthy examples should be the focus of urgent conservation action.

- ***Endangered (EN) ecosystems*** are ecosystem types that are close to becoming critically endangered. Any further loss of natural habitat or deterioration of condition in these ecosystem types should be avoided, and the remaining healthy examples should be the focus of conservation action.

- ***Vulnerable (VU) ecosystems*** are ecosystem types that still have the majority of their original extent left in natural or near-natural condition, but have experienced some loss of habitat or deterioration in condition. These ecosystem types are likely to have lost some of their structure and functioning, and will be further compromised if they continue to lose natural habitat or deteriorate in condition. Maps of biodiversity PFAs should guide planning, resource management and decision-making in these ecosystem types.

- ***Least Threatened (LT) ecosystems*** are ecosystem types that have experienced little or no loss of natural habitat or deterioration in condition. Maps of biodiversity PFAs should guide planning, resource management and decision-making in these ecosystem types.

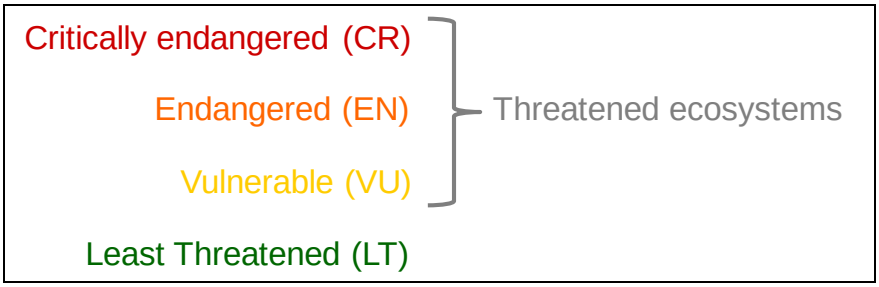


Figure 4-15: Ecosystem Threat Status Categories

In all environments, the proportion of each ecosystem type that remains in 'Good' (or 'Natural') ecological condition (Section 4.1.1) was evaluated against a series of thresholds, as shown in Figure 4-16 to determine ecosystem threat status:

- The first of these thresholds (set at the biodiversity target of 25%) defined the cut-off for Critically Endangered ecosystems. The remaining portion of 'Good' / 'Natural' habitat against this threshold was evaluated. Ecosystem types that had less than this proportion of their original extent in good/natural ecological condition are likely to have lost much of their structure and functioning, and species associated with the ecosystem may have been lost.

- The second threshold (set at the biodiversity target plus 20%, i.e. 45% as the biodiversity target is 25%) defined the cut-off for endangered ecosystems, and indicates ecosystems that are close to becoming Critically Endangered. Again, the remaining portion of 'Good' / 'Natural' habitat against this threshold was evaluated.

- The third threshold (set at 90%) defined the cut-off point for 'Vulnerable' ecosystems. Ecosystem types that have reached this point are likely to have lost some of their structure and functioning, and will be further compromised if they continue to lose natural habitat or deteriorate in condition. Unlike the previous two thresholds, both 'Good' / 'Natural' and 'Degraded' / 'Fair' areas were evaluated against this threshold.

- In addition to the above evaluations, minimum levels of complete habitat destruction that were necessary to confirm endangered status were set. If a habitat type crossed the endangered threshold as it had little or no natural/good habitat remaining, but where less than 20% of the habitat type was completely transformed (i.e. in cases where there were large portions of 'Degraded' / 'Fair' habitat), these habitats were considered to be vulnerable. Note, this minimum level was not applied for types which crossed the critically endangered threshold.

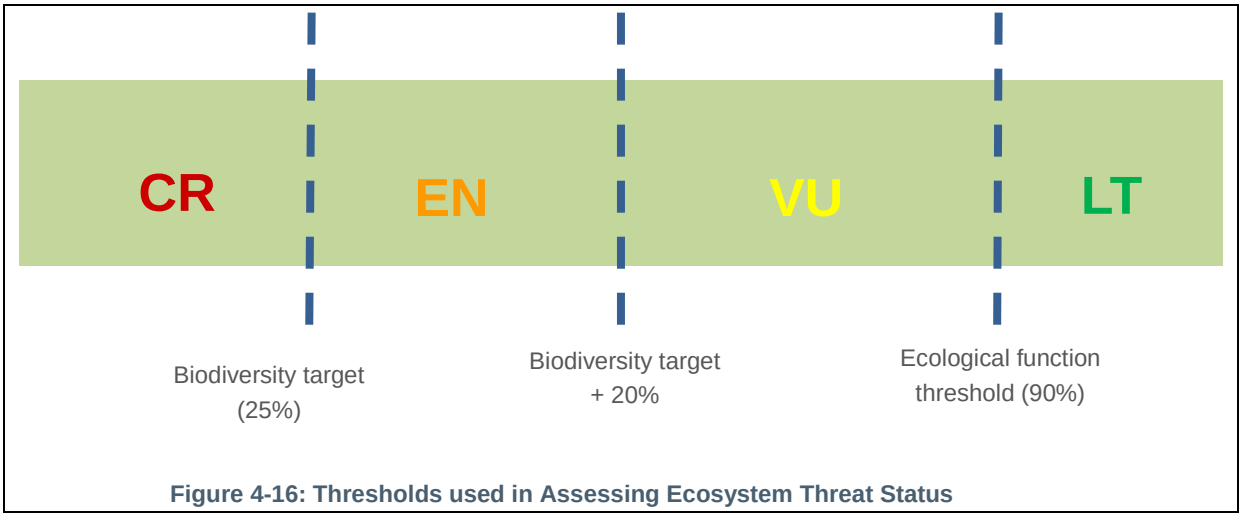


Figure 4-16: Thresholds used in Assessing Ecosystem Threat Status

4.5 Ecosystem Protection Level Assessment

Ecosystem protection level provides a measure of the extent to which ecosystems are adequately protected or under-protected. Ecosystem types were categorised as well protected, moderately protected, poorly protected, or not protected. Moderately protected, poorly protected and unprotected ecosystem types are collectively referred to as under-protected ecosystems, as shown in Figure 4-17.

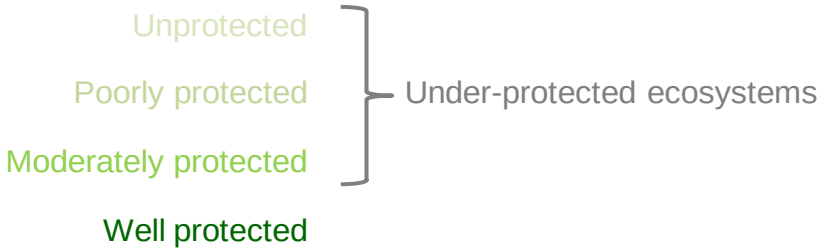


Figure 4-17: Ecosystem Protection Categories

Once ecosystem types were mapped and classified, the next step was to map existing Protected Areas. Protected Areas are areas of land or sea that are formally protected by law and managed mainly for biodiversity conservation. The proportion of each ecosystem type that falls within a Protected Area is calculated and compared with the protection target for that ecosystem type, to determine ecosystem protection level, as shown in Table 4-6.

If at least 90% of the protection target had been met in a Protected Area, the ecosystem type was considered well protected. Conversely, if the ecosystem type did not occur in any Protected Area at all or if less than 5% of the protection target has been met in a Protected Area, the ecosystem was considered not protected. This category was deliberately not restricted to types with exactly 0 protection for two reasons: the first was that pragmatically GIS data and ecological mapping are never 100% correct, and hence small slivers or mis-mapped areas can result in an overly positive result being presented; the second was that even if some areas of a habitat type were included in a Protected Area, they were unlikely to be offering significant protection if the areas were very small or if the sections of habitat that were included were small or isolated.

Table 4-6: Ecosystem Protection Level Categories and Thresholds

Proportion of protection target met in a Protected Area			
Zero or less than 5% of protection target	5-49% of protection target	50-90% of protection target	>90% of protection target
Unprotected	Poorly protected	Moderately protected	Well protected

4.6 MARXAN Process for Spatial Prioritization

The MARXAN decision support tool developed by Ian Ball and Hugh Possingham was utilised for the Spatial Prioritization analysis. This is the most widely adopted site selection tool used by conservation groups globally, having been applied to local and regional planning efforts in over 60 countries around the world (Ball et al., 2009). MARXAN is designed to provide an objective approach to site prioritization which is adaptable and repeatable based on an algorithm that evaluates very large numbers of possible alternatives and retains the most efficient solutions given a specific set of criteria. It is a stand-alone software program that provides decision support to conservation planners identifying efficient areas that combine to satisfy ecological, social and economic objectives. It utilises data on species, habitats, ecosystems and other biodiversity features; combined with data on planning unit costs; to identify sets of sites which meet all biodiversity representation goals, while minimizing the total cost of the solution and hence ensuring a spatially optimal configuration of sites.

Figure 4-18 summarizes the general approach and methodology to spatial prioritization used in this Project. The approach follows a number of steps. Firstly, key input data on biodiversity features were collated (Section 3.2, 3.5 and 3.6), as were data on pressures and current condition of habitats (Section 3.3 and 3.7), and the existing Protected Areas (Section 3.4). In addition, quantitative targets were set for how much of each of each biodiversity feature was required in the Protected Areas network (Section 4.2). The opportunities and constraints data were used to identify the areas of least cost to existing land uses (Section 3.8). These components were iteratively combined in MARXAN to identify the potential priority areas for inclusion in the Protected Area network or for other place based conservation actions (examined in Section 5).

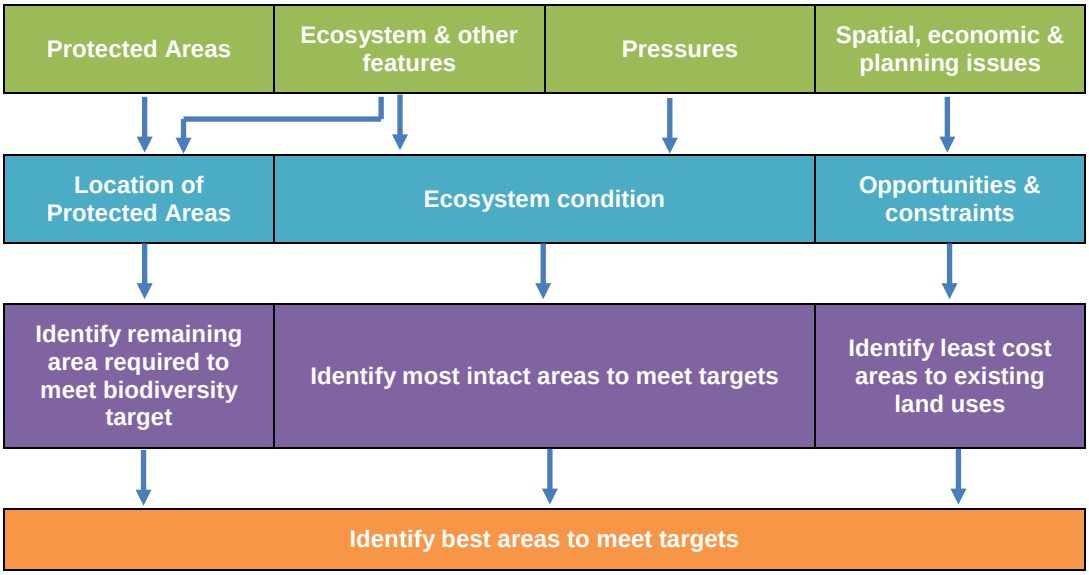


Figure 4-18: Overview of Spatial Prioritization Process

The SCP process implemented a number of design principles or rules during the spatial prioritization:

- The assessment intended to meet targets for all features while reducing conflict with other competing land uses. A cost surface approach was used to avoid transformed and degraded areas, to favour areas where opportunities existed for conservation activities or alternatively where costs for implementing conservation were lowest, while avoiding areas with known constraints for conservation activities or where costs for implementing conservation activities were highest.

- The assessment aimed to avoid fragmented landscapes as far as possible. Intact landscapes were favoured through the use of cost surfaces.

- The assessment aimed to meet all targets as far as possible but did not force the selection of transformed or poor condition areas. This balance was obtained by an iterative calibration of the MARXAN input variables.

- Natural/good condition areas were strongly favoured before degraded/fair condition areas, which in turn were favoured before transformed areas. This was undertaken both by using the cost surface and by utilizing 'dummy features', where two versions of the habitat map and duplicate biodiversity features were used. One habitat map was clipped to the remaining natural condition areas and one to the remaining natural and degraded areas. The consequence of this approach was that once the layers were combined, the selection algorithm ensured that targets were always first met in natural areas, as these would contribute to meeting targets for both the main and the dummy feature, and then if necessary find additional areas to meet targets in degraded areas. Transformed areas were not available for meeting habitat targets, as by definition these are areas where habitat has been lost.

- Large intact areas of Critically Endangered and Endangered habitats were identified. The habitat condition data and the integrated habitat map were used to identify the areas of Endangered habitat that were over 500ha in extent, and areas of Critically Endangered habitat that were over 250ha in extent. High targets were used to force these areas into the analysis.

- High diversity areas were identified by examining all of the input data and identifying planning units where more than seven biodiversity features were found. These planning units were included as a separate biodiversity feature in the spatial prioritization.

- Targets were set for areas with high conservation opportunity, in order to favour selection of these areas. Targets were set based on a sliding scale linked to size of the identified area (See Table 4-8). This ensured that small precisely identified areas were strongly included with high proportional targets, but broadly identified area had fairly low targets, in order to ensure that areas of conservation opportunity were only identified if they were required for meeting targets for biodiversity features and would not be selected if they were not useful for meeting biodiversity targets. See details below for additional targets used in the SCP process.

- An attempt was made to identify contiguous blocks of high priority areas rather than a scatter of priority sites. This was done through careful calibration of the boundary length modifier to ensure the production of an appropriately clumped output without becoming unnecessarily spatially inefficient.

Setting quantitative targets for biodiversity features is central to the systematic conservation planning methodology. The study utilized the protection targets for habitats detailed in Section 4.2. Targets were also set for the range of other biodiversity features used in the planning process (Table 4-7). These targets were set based on those used for similar features in other conservation plans. In addition, a number of supplementary targets were used in the design phase of the conservation assessment.

Table 4-7: Summary of Targets for Arabian Peninsula Biodiversity Features

Targeted Feature	Target	Comments
Primary habitat features		
Terrestrial and marine habitats of the Arabian Peninsula (natural) Terrestrial & Coastal Marine Special types (including corals and mangroves but excluding sea-grass) Sea-grass Extremely rare types (<10km^2) Rare types (<20km^2)	 17% 10% 80% 34% 100% 80%	Targets were set against the full, original extent of each habitat type. For details see Table 4-6. Only natural areas were available to meet targets.
Terrestrial and marine habitats of the Arabian Peninsula (natural and degraded) Terrestrial & Coastal Marine Special types (including corals and mangroves but excluding sea-grass) Sea-grass Extremely rare types (<10km^2) Rare types (<20km^2)	 17% 10% 80% 34% 100% 80%	Targets were set against the full, original extent of each habitat type. For details see Table 4-6. Natural and degraded areas were available to meet targets. The objective of including two sets of similar set of habitat features (one just for natural areas, and one for natural and degraded areas), was that this ensures that natural areas were selected first, but that degraded areas were nevertheless available to meet targets if they could not be met in better condition sites.
Species, process and opportunity features		
Species (e.g. species core distributions, turtle and dugong foraging areas, key breeding sites), expert identified areas ((e.g. identified areas for protected area expansion, process areas, high diversity sites) and opportunity areas, unless listed separately. Smallest features Largest feature	 90% 30%	Individual targets were set for each species, process area or opportunity area based on their extent. Target percentages were based on a linear scale from the smallest feature which had a 90% target to largest at 30%. In-between features were linearly allocated target percentages between these two extremes based on individual feature size.
Mountain process proxy (Arabian Tahr and Arabian Leopard core sites) Important Bird Areas Yemen Threatened Plant Sites	70% 80% 80%	Targets were set against remaining natural extent, i.e. these targets were never used to force inclusion of degraded or transformed sites.
Heavily under-protected habitats in close proximity to Protected Areas	60%	A 'dummy' biodiversity feature was created utilizing all intact unprotected and poorly protected habitat types within 10km of existing Protected Areas. This was used to ensure that where heavily under-protected habitats were present in close proximity to existing Protected Areas Protected Areas Protected Areas, that these would be favoured for selection to meet the primary planning targets.
Strongly threatened habitats in close proximity to Protected Areas	80%	A 'dummy' biodiversity feature was created utilizing all intact Critically Endangered and Endangered habitat types within 10km of existing Protected Areas. This was used to ensure that these areas would be favoured for selection to meet the primary planning targets.
Priorities from the UAE plan: UAE Priority Focus Areas	100%	PFAs from the finer scale Abu Dhabi and UAE plans were forced into the regional outputs to ensure alignment.

The MARXAN analysis used the following approach:

- Data layers were prepared using ESRI ArcGIS 10.

- Planning units were developed using an iterative process to identify the most appropriate planning units in relation to the scale of the input data. Hexagonal units with an area of 10,000ha or 100km^2, which gives a side length of 6.2km and a side to side distance of 10km, were found to be most appropriate. In addition, all Protected Areas were integrated into the planning unit layer.

- Boundary lengths between each planning unit were calculated in metres. These boundary lengths are used, in combination with the Boundary Length modifier (BLM), to identify spatially efficient and connected combinations of planning units.

- Data, targets and cost surfaces were inputted into the MARXAN decision support tool using the CLUZ interface in ArcView 3.2 developed by Dr Bob Smith, Durrell Institute of Conservation and Ecology (http://www.kent.ac.uk/dice/cluz/).

- Data on 436 distinct biodiversity features were included into the analysis. These were used to develop a 'site by features matrix' which describes how much of each habitat type is found within each planning unit.

- The analysis used MARXAN version 1.8.10.

- The analysis followed standard MARXAN processes as outlined in the MARXAN good practices handbook (Ardron, Possingham, & Klein, 2008).

- A cost surface was used to ensure preferential selection of least transformed, high opportunity and least conflict sites. This cost surface development is described in Section 3.8.

- An iterative approach was used to identify appropriate Species Penalty Factor (SPF) values and BLM. Satisfactory inclusion of biodiversity features in a spatially efficient and ecologically connected layout was obtained using an SPF value of 1,000,000,000 and a BLM of 1.5. These values were calibrated using an iterative manual calibration method compliant with the objectives outlined in the MARXAN good practices handbook (Ardron et al., 2008)

- A final MARXAN run was undertaken using 100 runs of 1,000,000 iterations each. This was used to define site selection frequency for the spatial prioritization. The basic output of the MARXAN-based process described here is a selection frequency map. This map gives an idea of how important each planning unit is for meeting targets, and summarizing the number of times (expressed as a percentage) that a planning unit is included in potential spatial configurations which meet the targets and minimize costs according to the parameters used in the MARXAN analysis.

- Once a stable site selection frequency output from MARXAN was obtained, a set of summary PFAs for the Project was developed, as these aided the understanding of the spatial prioritization, are useful for describing selected areas, and are easier to include in implementation plans. To do this, all planning units which were selected more than 60% of the time were dissolved into contiguous blocks. PFAs were then defined by manually grouping the blocks of contiguous high selection frequency areas based on ecological characteristics, adjacency (or near adjacency) and linkages via Protected Areas. These PFAs were then manually cleaned by removing large transformed areas from the planning units as well as any small isolated sections of planning units were the isolated section did not contain the key features which were responsible for the selection of the planning unit.

- The outputs of the SCP process are presented in Section 5.

5 Systematic Conservation Planning Outputs

5.1 Introduction

As explained in Sections 3 and 0, the Project's approach is based on the SCP concept. The systematic approach emphasises the need to conserve a representative sample of ecosystems (where an integrated marine and terrestrial habitat classification is used as a proxy for ecosystems) and their species (the principle of representation) as well as the ecological processes that allow them to persist over time (the principle of persistence), and to set quantitative biodiversity and protection targets that tell us how much of each biodiversity feature should be maintained in a natural or near-natural state, or should be included within Protected Areas. The Project has produced three primary spatial planning outputs:

- **Ecosystem threat status** represents the degree to which ecosystems are still intact, or alternatively losing vital aspects of their structure, function or composition, on which their ability to provide ecosystem services ultimately depends. This analysis utilized the habitat map, quantitative biodiversity targets for each habitat type, and then used the map of current condition to evaluate (against a series of thresholds)if sufficient areas remain in a natural or near-natural state.

- **Ecosystem protection level** describes whether ecosystems are adequately protected or under-protected. 'Protected' means included in a formally proclaimed or declared Protected Area such as a Nature Reserve, Protected Area or Marine Protected Area which has formal legal status. This analysis utilizes the habitat map, quantitative Protection targets for each ecosystem type, and maps of Protected Areas to evaluate whether sufficient habitat of each type has been protected. Importantly, this move beyond reporting on the overall proportion of land or sea protected, but rather examined the representiveness of the Protected Area network at an ecosystem level.

- The **MARXAN spatial prioritization** identifies where conservation actions (including all place based conservation activities, but particularly focussed on Protected Area expansion) should be prioritized in order to maximize gains and minimize potential future loss of biodiversity, while at the same time minimizing socio-economic impacts and conflict with other land uses. The analysis utilized the datasets used in the ecosystem threat status and protection level assessments (i.e. habitat, condition and Protected Areas maps), in addition to data on additional biodiversity features (including species and ecological processes), and opportunities and constraints on conservation. The data was derived from formal datasets and as well as from systematically gathered workshop/expert inputs.

Ecosystem threat status, protection level and the spatial priorities are key underlying requirements for a strategic approach to prioritizing conservation actions, efficiently using available resources and minimizing conflict between conservation and other activities or land uses.

This section summarizes spatially and in a tabular form the outputs of the assessments of ecosystem threat status and protection level for the Arabian Peninsula, as well as the spatial priorities identified in the MARXAN assessment. Each section also includes a narrative description of the important habitats or areas highlighted by the analysis.

5.2 Ecosystem Threat Status

The outputs of the initial assessments of ecosystem threat status for the Arabian Peninsula are shown in Figure 5-19 and Table 5-8 (and a larger version in Appendix C.1).

Figure 5-19: Ecosystem Threat Status for the Arabian Peninsula

Table 5-8: Ecosystem Threat Status for the Arabian Peninsula

Ecoregion	Habitat Name	Original Extent (km^2)	Biodiversity target %	Biodiversity target (km^2)	Area in a natural/good state (km^2)	Area in a degraded/fair state (km^2)	Area in a transformed/poor state (km^2)	Ecosystem Threat Status
Terrestrial								
1. Islands	Islands - Arabian (Persian) Gulf	802.9	25	200.7	637.4	70.3	95.3	Vulnerable
	Islands - Gulf of Aden	16.3	25	4.1	16.3	0.0	0.0	Least Threatened
	Islands - Gulf of Oman	0.2	25	0.1	0.2	0.0	0.0	Least Threatened
	Islands - Northern and Central Red Sea	200.5	25	50.1	200.5	0.0	0.0	Least Threatened
	Islands - Southern Red Sea	1,222.7	25	305.7	1,221.1	1.1	0.5	Least Threatened
	Islands - Western Arabian Sea	772.3	25	193.1	683.4	53.0	35.9	Least Threatened
	Socotra Archipelago	3,882.8	25	970.7	3,816.4	39.9	26.5	Least Threatened
2. Coastal	Gulf Coastal Sabkha and Sabkha Matti	11,483.9	25	2,871.0	9,511.9	548.8	1,423.2	Vulnerable
	Northern Gulf Coastal Plain	66,165.4	25	16,541.3	49,054.3	860.2	16,250.9	Vulnerable
	Oman Coastal Plain	13,860.0	25	3,465.0	11,823.6	239.3	1,797.1	Vulnerable
	Red Sea Coastal Plain and Sabkha	24,911.1	25	6,227.8	21,157.1	759.6	2,994.4	Vulnerable
	Southern Coastal Plain	12,869.8	25	3,217.5	11,769.2	187.9	912.7	Least Threatened
	Southern Gulf Coastal Plain	29,981.9	25	7,495.5	26,096.5	1,203.0	2,682.4	Least Threatened
	Tihamah Coastal Plain	24,079.6	25	6,019.9	16,070.6	328.1	7,680.9	Vulnerable
3. Lowlands	Ad-Dibdibah / Kuwait Alluvial Plain	38,226.4	25	9,556.6	35,244.1	538.0	2,444.3	Least Threatened
	At-Taysiyah Limestone Plain	13,071.3	25	3,267.8	12,845.0	105.0	121.3	Least Threatened
	Central Limestone Plain and Low Cuesta	110,903.0	25	27,725.8	105,176.0	667.0	5,060.0	Least Threatened

Ecoregion	Habitat Name	Original Extent (km^2)	Biodiversity target %	Biodiversity target (km^2)	Area in a natural/good state (km^2)	Area in a degraded/fair state (km^2)	Area in a transformed/poor state (km^2)	Ecosystem Threat Status
	Central Sand Plain	80,815.9	25	20,204.0	66,721.8	743.2	13,350.9	Vulnerable
	Central Yemen Plain	67,158.8	25	16,789.7	65,420.4	223.3	1,515.1	Least Threatened
	Eastern Desert Plain	6,354.8	25	1,588.7	5,042.2	306.3	1,006.3	Vulnerable
	Eastern Gravel Plain	46,091.2	25	11,522.8	41,888.1	1,061.2	3,141.9	Least Threatened
	Huqf - Plain, Outcrop and Dune	7,241.6	25	1,810.4	7,092.3	88.2	61.0	Least Threatened
	Inland Sabkha	28,419.2	25	7,104.8	26,774.2	352.9	1,292.1	Least Threatened
	Najd Pediplain	249,469.0	25	62,367.3	234,705.0	3,920.0	10,844.0	Least Threatened
	Northern Sandstone Plain and Plateau	74,909.9	25	18,727.5	72,143.4	714.3	2,052.2	Least Threatened
	Western Sandstone Plain and Plateau	29,469.6	25	7,367.4	29,091.7	187.9	190.0	Least Threatened
4. Deserts	Ad-Dahna Dune, Sand Sheet and Plain Mosaic	29,614.6	25	7,403.7	27,773.1	136.2	1,705.3	Least Threatened
	Al-Jafurah Sand Dune	31,822.7	25	7,955.7	28,597.2	177.3	3,048.2	Least Threatened
	An-Nafud al-Kabir Sand Dune	66,454.0	25	16,613.5	65,543.2	99.2	811.6	Least Threatened
	Ar-Rub al-Khali Sand Dune	378,046.0	25	94,511.5	374,993.0	1,035.0	2,018.0	Least Threatened
	Ar-Rub al-Khali Sand Massif and Sabkha	95,578.2	25	23,894.6	93,483.4	381.0	1,713.8	Least Threatened
	Central Nafuds Sand Dune	51,342.9	25	12,835.7	47,531.2	280.5	3,531.2	Least Threatened
	Eastern Sand Sheet and Dune	36,302.2	25	9,075.6	26,597.5	3,691.5	6,013.2	Vulnerable
	Wahiba Sand Dune	10,365.0	25	2,591.3	10,361.2	1.5	2.3	Least Threatened
5. Uplands	As-Summan Limestone Plateau	79,266.2	25	19,816.6	73,733.2	656.9	4,876.1	Least Threatened
	Central Volcanic Outcrop	69,646.2	25	17,411.6	67,675.7	1,010.5	960.0	Least Threatened

Ecoregion	Habitat Name	Original Extent (km^2)	Biodiversity target %	Biodiversity target (km^2)	Area in a natural/good state (km^2)	Area in a degraded/fair state (km^2)	Area in a transformed/poor state (km^2)	Ecosystem Threat Status
	Dhofar Plateau	111,869.0	25	27,967.3	105,203.0	1,974.0	4,692.0	Least Threatened
	Hadramaut Plateau	202,427.0	25	50,606.8	198,557.0	1,686.0	2,184.0	Least Threatened
	Hisma Plateau	8,803.0	25	2,200.8	8,634.4	91.4	77.1	Least Threatened
	Najd Pediplain - Granitic Outcrop	3,271.4	25	817.9	3,239.3	19.1	13.0	Least Threatened
	Najd Pediplain - Pyroclastic Outcrop	42,034.4	25	10,508.6	41,009.0	583.9	441.5	Least Threatened
	Najran - Asir Plateau	53,363.8	25	13,341.0	51,252.6	497.7	1,613.5	Least Threatened
	Northern Limestone Plateau	199,343.0	25	49,835.8	187,763.0	3,465.0	8,115.0	Least Threatened
	Northern Volcanic Outcrop	35,954.8	25	8,988.7	34,267.7	696.0	991.1	Least Threatened
	Yemen Precambrian Plateau	38,207.6	25	9,551.9	37,746.6	140.2	320.8	Least Threatened
	Yemen Volcanic Outcrop	3,335.3	25	833.8	3,277.4	31.4	26.6	Least Threatened
6. Mountains	Asir Mountains - Eastern Slope	26,351.1	25	6,587.8	23,449.9	489.9	2,411.3	Least Threatened
	Asir Mountains - Juniper Woodland	281.1	25	70.3	241.7	23.7	15.7	Least Threatened
	Asir Mountains - 800m to 1500m	10,992.3	25	2,748.1	10,876.7	47.3	68.3	Least Threatened
	Asir Mountains - 1500m to 2000m	4,759.8	25	1,190.0	4,674.8	12.0	73.0	Least Threatened
	Asir Mountains - above 2000m	1,275.9	25	319.0	1,157.3	20.9	97.7	Least Threatened
	Hajar Mountains - Jebel Hafit	202.8	25	50.7	115.7	5.4	81.6	Vulnerable
	Hajar Mountains - below 500m	34,073.3	25	8,518.3	32,073.4	904.5	1,095.4	Least Threatened
	Hajar Mountains - Carbonate - below 500m	315.8	25	79.0	259.8	22.2	33.9	Vulnerable
	Hajar Mountains - Eastern - 500m to 1000m	3,327.7	25	831.9	3,320.8	2.7	4.2	Least Threatened

Ecoregion	Habitat Name	Original Extent (km^2)	Biodiversity target %	Biodiversity target (km^2)	Area in a natural/good state (km^2)	Area in a degraded/fair state (km^2)	Area in a transformed/poor state (km^2)	Ecosystem Threat Status
	Hajar Mountains - Eastern - above 1000m	685.1	25	171.3	685.1	0.0	0.0	Least Threatened
	Hajar Mountains - Musandam - below 500m	1,486.1	25	371.5	1,418.2	19.6	48.3	Least Threatened
	Hajar Mountains - Musandam - 500m to 1000m	633.0	25	158.2	632.9	0.1	0.1	Least Threatened
	Hajar Mountains - Musandam - above 1000m	65.1	25	16.3	65.1	0.0	0.1	Least Threatened
	Hajar Mountains - Western - 500m to 1000m	6,338.2	25	1,584.6	6,249.0	50.9	38.3	Least Threatened
	Hajar Mountains - Western - 1000m to 2000m	1,339.0	25	334.7	1,322.3	9.9	6.7	Least Threatened
	Hajar Mountains - Western - above 2000m	51.0	25	12.7	51.0	0.0	0.0	Least Threatened
	Hijaz Hills and Mountains - below 1500m	79,253.8	25	19,813.4	76,485.0	1,289.6	1,479.2	Least Threatened
	Hijaz Hills and Mountains - above 1500m	850.0	25	212.5	844.4	2.5	3.1	Least Threatened
	Jabal Shammar	8,079.9	25	2,020.0	7,932.4	70.8	76.7	Least Threatened
	Jabal Tuwayq	46,974.5	25	11,743.6	42,690.4	542.0	3,742.1	Least Threatened
	Madyan Mountains - below 1000m	17,373.6	25	4,343.4	16,951.6	232.9	189.1	Least Threatened
	Madyan Mountains - above 1000m	689.7	25	172.4	689.7	0.0	0.0	Least Threatened
	Monsoon-affected Vegetation - below 500m	13,096.4	25	3,274.1	12,362.5	241.5	492.4	Least Threatened
	Monsoon-affected Vegetation - 500m to 1000m	6,963.2	25	1,740.8	6,800.5	97.1	65.6	Least Threatened
	Monsoon-affected Vegetation - above 1000m	170.6	25	42.6	170.6	0.0	0.0	Least Threatened
	Tihamah Foothills - below 500m	52,352.4	25	13,088.1	48,216.5	652.1	3,483.8	Least Threatened
	Yemen Highlands - 500m to 1000m	14,916.2	25	3,729.1	14,648.1	114.8	153.3	Least Threatened
	Yemen Highlands - 1000m to 2000m	22,444.8	25	5,611.2	21,924.4	143.0	377.4	Least Threatened

Ecoregion	Habitat Name	Original Extent (km^2)	Biodiversity target %	Biodiversity target (km^2)	Area in a natural/good state (km^2)	Area in a degraded/fair state (km^2)	Area in a transformed/poor state (km^2)	Ecosystem Threat Status
	Yemen Highlands - above 2000m	6,781.4	25	1,695.3	6,690.0	48.8	42.6	Least Threatened
7. Jordan	Acacia and Rocky Sudanian	3,699.4	25	924.8	2,897.6	84.1	717.7	Vulnerable
	Forest and Non-forest	6,536.8	25	1,634.2	2,548.3	72.3	3,916.3	Endangered
	Steppe	9,073.8	25	2,268.5	6,405.6	181.8	2,486.5	Vulnerable
Marine								
1. Arabian (Persian) Gulf	Algal Mats	193.2	25	48.3	163.0	23.4	6.7	Least Threatened
	Mangroves	208.1	25	52.0	88.4	69.4	50.3	Endangered
	Rocky Platforms	164.9	25	41.2	152.0	11.8	1.1	Least Threatened
	Saltmarsh	51.3	25	12.8	21.5	24.0	5.7	Vulnerable
	Tidal flats (no algal mats)	342.5	25	85.6	250.1	77.9	14.4	Least Threatened
	Coral Reef	762.9	25	190.7	103.5	518.5	140.9	Critically Endangered
	Other Shallow Water	43,058.0	25	10,764.5	14,313.6	21,480.3	7,264.1	Vulnerable
	Seagrass / macro-algal beds	5,754.6	25	1,438.7	1,783.4	1,754.6	2,216.6	Endangered
	Deeper than 15m	89,013.1	25	22,253.3	33,109.1	43,957.0	11,947.0	Vulnerable
2. Gulf of Aden	Mangroves	0.1	25	0.0	0.0	0.1	0.0	Critically Endangered
	Coral Reef	132.7	25	33.2	6.7	120.7	5.3	Critically Endangered
	Other Shallow Water	2,057.0	25	514.3	313.6	1,144.7	598.7	Critically Endangered
	Seagrass / macro-algal beds	2,733.1	25	683.3	0.6	1,677.3	1,055.2	Critically Endangered
	Deeper than 15m	410,293.0	25	102,573.0	218,720.0	173,735.0	17,838.0	Least Threatened

Ecoregion	Habitat Name	Original Extent (km^2)	Biodiversity target %	Biodiversity target (km^2)	Area in a natural/good state (km^2)	Area in a degraded/fair state (km^2)	Area in a transformed/poor state (km^2)	Ecosystem Threat Status
3. Gulf of Oman	Mangroves	3.1	25	0.8	1.0	0.8	1.3	Endangered
	Coral Reef	60.8	25	15.2	1.5	50.2	9.2	Critically Endangered
	Other Shallow Water	1,530.8	25	382.7	90.6	680.1	760.1	Critically Endangered
	Deeper than 15m	85,120.6	25	21,280.2	29,949.9	43,217.7	11,953.0	Vulnerable
4. Northern and Central Red Sea	Mangroves	14.4	25	3.6	11.6	1.2	1.6	Vulnerable
	Coral Reef	2,082.2	25	520.6	1,449.8	469.9	162.5	Least Threatened
	Other Shallow Water	3,870.8	25	967.7	2,734.7	914.0	222.2	Least Threatened
	Seagrass / macro-algal beds	12,362.4	25	3,090.6	7,864.1	4,059.6	438.7	Least Threatened
	Deeper than 15m	88,769.9	25	22,192.5	37,940.2	49,619.6	1,210.1	Vulnerable
5. Southern Red Sea	Mangroves	35.8	25	9.0	10.2	15.4	10.2	Endangered
	Coral Reef	1,691.9	25	423.0	883.0	532.7	276.2	Vulnerable
	Other Shallow Water	12,997.7	25	3,249.4	6,029.6	5,134.1	1,834.0	Vulnerable
	Seagrass / macro-algal beds	9,161.6	25	2,290.4	4,938.5	2,459.4	1,763.7	Vulnerable
	Deeper than 15m	91,526.1	25	22,881.5	29,772.5	47,771.2	13,982.4	Vulnerable
6. Western Arabian Sea	Mangroves	0.2	25	0.0	0.1	0.0	0.0	Vulnerable
	Coral Reef	151.5	25	37.9	129.2	21.6	0.7	Least Threatened
	Other Shallow Water	7,312.0	25	1,828.0	6,431.8	772.9	107.3	Least Threatened
	Deeper than 15m	542,165.0	25	135,541.0	437,320.0	103,458.0	1,387.0	Least Threatened

5.3 Ecosystem Protection Level

The outputs of the initial assessments of ecosystem protection level for the Arabian Peninsula are shown in Figure 5-20 and Table 5-9 (and a larger version in Appendix C.2).

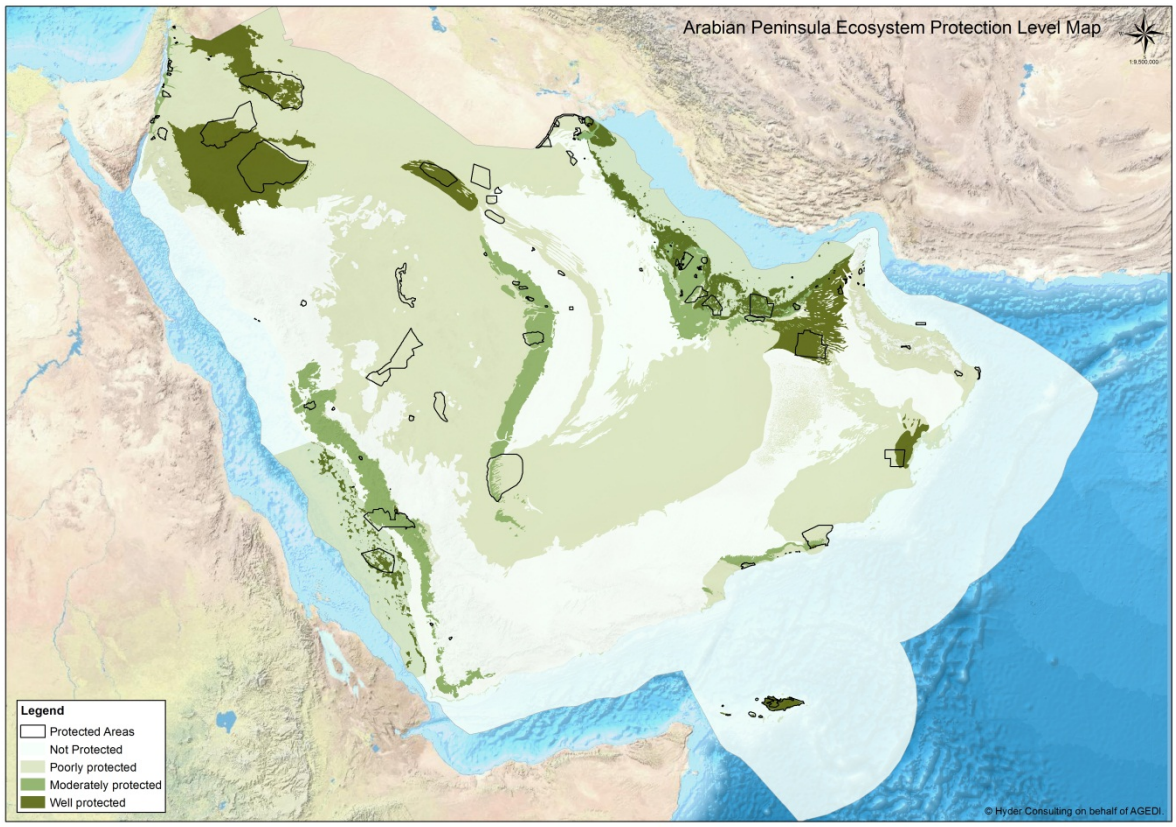


Figure 5-20: Ecosystem Protection Level for the Arabian Peninsula

Table 5-9: Ecosystem Protection Levels for the Arabian Peninsula

Ecoregion	Habitat Name	Original Extent (km^2)	Protection Target %	Protection Target (km^2)	Protected Area (km^2)	Percentage of Protection target attained	Protection Level
Terrestrial							
1. Islands	Islands - Arabian (Persian) Gulf	802.9	17	136.5	158.5	116.1	Well protected
	Islands - Gulf of Aden	16.3	80	13.0	0.0	0.0	Not Protected
	Islands - Gulf of Oman	0.2	100	0.2	0.2	100.0	Well protected
	Islands - Northern and Central Red Sea	200.5	17	34.1	0.0	0.0	Not Protected
	Islands - Southern Red Sea	1,222.7	17	207.9	728.7	350.6	Well protected
	Islands - Western Arabian Sea	772.3	17	131.3	0.0	0.0	Not Protected
	Socotra Archipelago	3,882.8	17	660.1	2,808.1	425.4	Well protected
2. Coastal	Gulf Coastal Sabkha and Sabkha Matti	11,483.9	17	1,952.3	904.7	46.3	Poorly protected
	Northern Gulf Coastal Plain	66,165.4	17	11,248.1	388.8	3.5	Not Protected
	Oman Coastal Plain	13,860.0	17	2,356.2	192.4	8.2	Poorly protected
	Red Sea Coastal Plain and Sabkha	24,911.1	17	4,234.9	33.3	0.8	Not Protected
	Southern Coastal Plain	12,869.8	17	2,187.9	0.0	0.0	Not Protected
	Southern Gulf Coastal Plain	29,981.9	17	5,096.9	2,912.5	57.1	Moderately protected
	Tihamah Coastal Plain	24,079.6	17	4,093.5	110.7	2.7	Not Protected
3. Lowlands	Ad-Dibdibah / Kuwait Alluvial Plain	38,226.4	17	6,498.5	2,322.1	35.7	Poorly protected
	At-Taysiyah Limestone Plain	13,071.3	17	2,222.1	3,904.3	175.7	Well protected

Ecoregion	Habitat Name	Original Extent (km^2)	Protection Target %	Protection Target (km^2)	Protected Area (km^2)	Percentage of Protection target attained	Protection Level
	Central Limestone Plain and Low Cuesta	110,903.0	17	18,853.5	364.5	1.9	Not Protected
	Central Sand Plain	80,815.9	17	13,738.7	1,179.9	8.6	Poorly protected
	Central Yemen Plain	67,158.8	17	11,417.0	0.0	0.0	Not Protected
	Eastern Desert Plain	6,354.8	17	1,080.3	35.7	3.3	Not Protected
	Eastern Gravel Plain	46,091.2	17	7,835.5	267.3	3.4	Not Protected
	Huqf - Plain, Outcrop and Dune	7,241.6	17	1,231.1	1,370.8	111.4	Well protected
	Inland Sabkha	28,419.2	17	4,831.3	264.5	5.5	Poorly protected
	Najd Pediplain	249,469.0	17	42,409.7	8,707.5	20.5	Poorly protected
	Northern Sandstone Plain and Plateau	74,909.9	17	12,734.7	26,729.9	209.9	Well protected
	Western Sandstone Plain and Plateau	29,469.6	17	5,009.8	0.0	0.0	Not Protected
4. Deserts	Ad-Dahna Dune, Sand Sheet and Plain Mosaic	29,614.6	17	5,034.5	1,963.7	39.0	Poorly protected
	Al-Jafurah Sand Dune	31,822.7	17	5,409.9	53.4	1.0	Not Protected
	An-Nafud al-Kabir Sand Dune	66,454.0	17	11,297.2	1,060.1	9.4	Poorly protected
	Ar-Rub al-Khali Sand Dune	378,046.0	17	64,267.8	9,141.2	14.2	Poorly protected
	Ar-Rub al-Khali Sand Massif and Sabkha	95,578.2	17	16,248.3	9.1	0.1	Not Protected
	Central Nafuds Sand Dune	51,342.9	17	8,728.3	2,942.8	33.7	Poorly protected
	Eastern Sand Sheet and Dune	36,302.2	17	6,171.4	6,516.2	105.6	Well protected

Ecoregion	Habitat Name	Original Extent (km^2)	Protection Target %	Protection Target (km^2)	Protected Area (km^2)	Percentage of Protection target attained	Protection Level
	Wahiba Sand Dune	10,365.0	17	1,762.1	0.0	0.0	Not Protected
5. Uplands	As-Summan Limestone Plateau	79,266.2	17	13,475.3	517.4	3.8	Not Protected
	Central Volcanic Outcrop	69,646.2	17	11,839.9	196.7	1.7	Not Protected
	Dhofar Plateau	111,869.0	17	19,017.7	4,878.0	25.6	Poorly protected
	Hadramaut Plateau	202,427.0	17	34,412.6	0.0	0.0	Not Protected
	Hisma Plateau	8,803.0	17	1,496.5	601.2	40.2	Poorly protected
	Najd Pediplain - Granitic Outcrop	3,271.4	17	556.1	0.0	0.0	Not Protected
	Najd Pediplain - Pyroclastic Outcrop	42,034.4	17	7,145.9	1,646.8	23.0	Poorly protected
	Najran - Asir Plateau	53,363.8	17	9,071.9	0.0	0.0	Not Protected
	Northern Limestone Plateau	199,343.0	17	33,888.3	11,902.1	35.1	Poorly protected
	Northern Volcanic Outcrop	35,954.8	17	6,112.3	9,957.9	162.9	Well protected
	Yemen Precambrian Plateau	38,207.6	17	6,495.3	0.0	0.0	Not Protected
	Yemen Volcanic Outcrop	3,335.3	17	567.0	0.0	0.0	Not Protected
6. Mountains	Asir Mountains - Eastern Slope	26,351.1	17	4,479.7	100.3	2.2	Not Protected
	Asir Mountains - Juniper Woodland	281.1	17	47.8	60.7	127.1	Well protected
	Asir Mountains - 800m to 1500m	10,992.3	17	1,868.7	1,283.3	68.7	Moderately protected
	Asir Mountains - 1500m to 2000m	4,759.8	17	809.2	98.2	12.1	Poorly protected
	Asir Mountains - above 2000m	1,275.9	17	216.9	8.5	3.9	Not Protected
	Hajar Mountains - Jebel Hafit	202.8	17	34.5	0.0	0.0	Not Protected

Ecoregion	Habitat Name	Original Extent (km^2)	Protection Target %	Protection Target (km^2)	Protected Area (km^2)	Percentage of Protection target attained	Protection Level
	Hajar Mountains - below 500m	34,073.3	17	5,792.5	367.9	6.4	Poorly protected
	Hajar Mountains - Carbonate - below 500m	315.8	17	53.7	0.0	0.0	Not Protected
	Hajar Mountains - Eastern - 500m to 1000m	3,327.7	17	565.7	0.1	0.0	Not Protected
	Hajar Mountains - Eastern - above 1000m	685.1	17	116.5	0.0	0.0	Not Protected
	Hajar Mountains - Musandam - below 500m	1,486.1	17	252.6	0.0	0.0	Not Protected
	Hajar Mountains - Musandam - 500m to 1000m	633.0	17	107.6	0.0	0.0	Not Protected
	Hajar Mountains - Musandam - above 1000m	65.1	17	11.1	0.0	0.0	Not Protected
	Hajar Mountains - Western - 500m to 1000m	6,338.2	17	1,077.5	32.3	3.0	Not Protected
	Hajar Mountains - Western - 1000m to 2000m	1,339.0	17	227.6	103.9	45.6	Poorly protected
	Hajar Mountains - Western - above 2000m	51.0	17	8.7	0.0	0.0	Not Protected
	Hijaz Hills and Mountains - below 1500m	79,253.8	17	13,473.1	167.6	1.2	Not Protected
	Hijaz Hills and Mountains - above 1500m	850.0	17	144.5	0.0	0.0	Not Protected

Ecoregion	Habitat Name	Original Extent (km^2)	Protection Target %	Protection Target (km^2)	Protected Area (km^2)	Percentage of Protection target attained	Protection Level
	Jabal Shammar	8,079.9	17	1,373.6	0.0	0.0	Not Protected
	Jabal Tuwayq	46,974.5	17	7,985.7	4,786.1	59.9	Moderately protected
	Madyan Mountains - below 1000m	17,373.6	17	2,953.5	216.7	7.3	Poorly protected
	Madyan Mountains - above 1000m	689.7	17	117.2	0.0	0.0	Not Protected
	Monsoon-affected Vegetation - below 500m	13,096.4	17	2,226.4	393.7	17.7	Poorly protected
	Monsoon-affected Vegetation - 500m to 1000m	6,963.2	17	1,183.8	996.8	84.2	Moderately protected
	Monsoon-affected Vegetation - above 1000m	170.6	17	29.0	162.9	561.9	Well protected
	Tihamah Foothills - below 500m	52,352.4	17	8,899.9	4,633.8	52.1	Moderately protected
	Yemen Highlands - 500m to 1000m	14,916.2	17	2,535.8	27.6	1.1	Not Protected
	Yemen Highlands - 1000m to 2000m	22,444.8	17	3,815.6	45.4	1.2	Not Protected
	Yemen Highlands - above 2000m	6,781.4	17	1,152.8	0.0	0.0	Not Protected
7. Jordan	Acacia and Rocky Sudanian	3,699.4	17	628.9	407.1	64.7	Moderately protected
	Forest and Non-forest	6,536.8	17	1,111.3	183.5	16.5	Poorly protected
	Steppe	9,073.8	17	1,542.6	248.2	16.1	Poorly protected
Marine							
1. Arabian (Persian) Gulf	Algal Mats	193.2	17	32.8	25.4	77.2	Moderately protected
	Mangroves	208.1	80	166.5	17.8	10.7	Poorly protected

Ecoregion	Habitat Name	Original Extent (km^2)	Protection Target %	Protection Target (km^2)	Protected Area (km^2)	Percentage of Protection target attained	Protection Level
	Rocky Platforms	164.9	17	28.0	95.3	339.8	Well protected
	Saltmarsh	51.3	80	41.0	6.4	15.7	Poorly protected
	Tidal flats (no algal mats)	342.5	17	58.2	95.4	163.9	Well protected
	Coral Reef	762.9	80	610.4	88.9	14.6	Poorly protected
	Other Shallow Water	43,058.0	10	4,305.8	5,108.9	118.7	Well protected
	Seagrass / macro-algal beds	5,754.6	34	1 956.6	1,280.6	65.4	Moderately protected
	Deeper than 15m	89,013.1	10	8,901.3	798.6	9.0	Poorly protected
2. Gulf of Aden	Mangroves	0.1	100	0.1	0.0	23.7	Poorly protected
	Coral Reef	132.7	80	106.2	0.8	0.7	Not Protected
	Other Shallow Water	2,057.0	10	205.7	97.8	47.6	Poorly protected
	Seagrass / macro-algal beds	2,733.1	34	929.3	0.0	0.0	Not Protected
	Deeper than 15m	410,293.0	10	41,029.3	516.9	1.3	Not Protected
3. Gulf of Oman	Mangroves	3.1	100	3.1	1.1	33.9	Poorly protected
	Coral Reef	60.8	80	48.6	25.6	52.6	Moderately protected
	Other Shallow Water	1,530.8	10	153.1	27.9	18.2	Poorly protected
	Deeper than 15m	85,120.6	10	8,512.1	182.4	2.1	Not Protected
4. Northern and Central Red Sea	Mangroves	14.4	80	11.5	1.1	9.7	Poorly protected
	Coral Reef	2,082.2	80	1,665.8	3.0	0.2	Not Protected

Ecoregion	Habitat Name	Original Extent (km^2)	Protection Target %	Protection Target (km^2)	Protected Area (km^2)	Percentage of Protection target attained	Protection Level
	Other Shallow Water	3,870.8	10	387.1	3.3	0.9	Not Protected
	Seagrass / macro-algal beds	12,362.4	34	4,203.2	1.2	0.0	Not Protected
	Deeper than 15m	88,769.9	10	8,877.0	0.5	0.0	Not Protected
5. Southern Red Sea	Mangroves	35.8	80	28.7	5.2	18.2	Poorly protected
	Coral Reef	1,691.9	80	1,353.5	330.4	24.4	Poorly protected
	Other Shallow Water	12,997.7	10	1,299.8	2,070.4	159.3	Well protected
	Seagrass / macro-algal beds	9,161.6	34	3115.0	304.6	9.8	Poorly Protected
	Deeper than 15m	91,526.1	10	9,152.6	2,827.4	30.9	Poorly protected
6. Western Arabian Sea	Mangroves	0.2	100	0.2	0.1	75.1	Moderately protected
	Coral Reef	151.5	80	121.2	2.0	1.7	Not Protected
	Other Shallow Water	7,312.0	10	731.2	61.6	8.4	Poorly protected
	Deeper than 15m	542,165.0	10	54,216.5	142.7	0.3	Not Protected

5.4 Review of Protection Level and Threat Status by Ecoregion

5.4.1 Islands

Low lying islands are found both in the Red Sea and Arabian Gulf and support indigenous mammals, breeding seabirds and sooty falcon. Socotra is an isolated archipelago with high levels of endemism. As is shown in Table 5-10, no island habitat type is classified as 'Not Protected' that is currently identified as 'Threatened'. The sole island habitat type classified as 'Vulnerable' is that in the Arabian Gulf but this is classified as 'Well Protected'.

Hence, at a habitat level, conservation action for island habitats is not an urgent priority, though there may be critically urgent activities required for key species such as Sooty Falcon or Socotra Cormorants caused by increasing levels of disturbance and introduced alien predators such as cats and rats. In addition, the expert workshops highlighted that on islands such as Socotra, degradation through overgrazing is a critical issue but has not been mapped (i.e. was not in an existing datasets and hence was beyond the scope of the Project). This implies that the actual current threat to the Socotra Archipelago is underestimated by the current study.

Table 5-10: Summary of Islands Ecosystem Protection Level and Threat Status

Habitat Name	Protection Level	Ecosystem Threat Status
Islands - Gulf of Aden	Not Protected	Least Threatened
Islands - Northern and Central Red Sea	Not Protected	Least Threatened
Islands - Western Arabian Sea	Not Protected	Least Threatened
Islands - Arabian (Persian) Gulf	Well protected	Vulnerable
Islands - Gulf of Oman	Well protected	Least Threatened
Islands - Southern Red Sea	Well protected	Least Threatened
Socotra Archipelago	Well protected	Least Threatened

5.4.2 Coastal

Coastal habitats including coastal sabkhas support distinctive if species-poor plant and animal communities. As shown in the Table 5-11, coastal habitats generally receive low levels of protection within the Region and five of the seven types are also classified as 'Vulnerable' due to pressure from coastal developments particularly along the Red Sea coast, Oman coast and Arabian Gulf. These therefore appear to be a generally under-represented habitat type and a priority for targeted protection.

Table 5-11: Summary of Coastal Ecosystem Protection Level and Threat Status

Habitat Name	Protection Level	Ecosystem Threat Status
Northern Gulf Coastal Plain	Not Protected	Vulnerable
Red Sea Coastal Plain and Sabkha	Not Protected	Vulnerable
Tihamah Coastal Plain	Not Protected	Vulnerable
Southern Coastal Plain	Not Protected	Least Threatened
Gulf Coastal Sabkha and Sabkha Matti	Poorly protected	Vulnerable
Oman Coastal Plain	Poorly protected	Vulnerable
Southern Gulf Coastal Plain	Moderately protected	Least Threatened

5.4.3 Lowlands

Lowland habitats comprise of extensive sand and gravel plains and due to their large size and limited development potential are largely classified as 'Least Threatened', but are often 'Poorly Protected' or 'Not Protected' as shown in Table 5-12. Two priority ecosystems are the Eastern Desert Plain in Oman and the Central Sand Plain and are hence the two priority habitat types for protection within this category.

Table 5-12: Summary of Lowlands Ecosystem Protection Level and Threat Status

Habitat Name	Protection Level	Ecosystem Threat Status
Eastern Desert Plain	Not Protected	Vulnerable
Central Limestone Plain and Low Cuesta	Not Protected	Least Threatened
Central Yemen Plain	Not Protected	Least Threatened
Eastern Gravel Plain	Not Protected	Least Threatened
Western Sandstone Plain and Plateau	Not Protected	Least Threatened
Central Sand Plain	Poorly protected	Vulnerable
Ad-Dibdibah / Kuwait Alluvial Plain	Poorly protected	Least Threatened
Inland Sabkha	Poorly protected	Least Threatened
Najd Pediplain	Poorly protected	Least Threatened
At-Taysiyah Limestone Plain	Well protected	Least Threatened
Huqf - Plain, Outcrop and Dune	Well protected	Least Threatened
Northern Sandstone Plain and Plateau	Well protected	Least Threatened

5.4.4 Deserts

Desert habitats are geographically extensive habitats with very limited development potential and hence most desert ecosystems are 'Not Threatened' as demonstrated in Table 5-13. However, they have also tended to be ignored by Protected Area agencies and hence only one Desert type is Well Protected. Fortunately, the sole type that is 'Vulnerable', the Eastern Sand Sheets and Dune habitat type is well represented in Protected Areas and is classified as 'Well Protected'.

Table 5-13: Summary of Deserts Ecosystem Protection Level and Threat Status

Habitat Name	Protection Level	Ecosystem Threat Status
Al-Jafurah Sand Dune	Not Protected	Least Threatened
Ar-Rub al-Khali Sand Massif and Sabkha	Not Protected	Least Threatened
Wahiba Sand Dune	Not Protected	Least Threatened
Ad-Dahna Dune, Sand Sheet and Plain Mosaic	Poorly protected	Least Threatened
An-Nafud al-Kabir Sand Dune	Poorly protected	Least Threatened
Ar-Rub al-Khali Sand Dune	Poorly protected	Least Threatened
Central Nafuds Sand Dune	Poorly protected	Least Threatened
Eastern Sand Sheet and Dune	Well protected	Vulnerable

5.4.5 Uplands

The Upland habitats are extensive plateaus of limited development potential and are all 'Least Threatened'. As shown in Table 5-14, these habitats poorly represented in the Protected Area network, and only one Upland type is 'Well Protected'.

Table 5-14: Summary of Uplands Ecosystem Protection Level and Threat Status

Habitat Name	Protection Level	Ecosystem Threat Status
As-Summan Limestone Plateau	Not Protected	Least Threatened
Central Volcanic Outcrop	Not Protected	Least Threatened
Hadramaut Plateau	Not Protected	Least Threatened
Najd Pediplain - Granitic Outcrop	Not Protected	Least Threatened
Najran - Asir Plateau	Not Protected	Least Threatened
Yemen Precambrian Plateau	Not Protected	Least Threatened
Yemen Volcanic Outcrop	Not Protected	Least Threatened
Dhofar Plateau	Poorly protected	Least Threatened
Hisma Plateau	Poorly protected	Least Threatened
Najd Pediplain - Pyroclastic Outcrop	Poorly protected	Least Threatened
Northern Limestone Plateau	Poorly protected	Least Threatened
Northern Volcanic Outcrop	Well protected	Least Threatened

5.4.6 Mountains

Mountain habitats comprise some of the most species-rich and important habitats within the Arabian Peninsula notably in Saudi Arabia, Yemen, Oman and Northern UAE. Only two of the 29 habitat types are classified as 'Vulnerable' are shown in Table 5-15. These are both within the UAE and are clearly priorities for protection. Impacts of overgrazing and degradation are not well defined and hence this assessment for all mountain habitats should be viewed as provisional and further work especially on the extent and quality of native woodlands is urgently required to refine this assessment.

Table 5-15: Summary of Mountains Ecosystem Protection Level and Threat Status

Habitat Name	Protection Level	Ecosystem Threat Status
Hajar Mountains - Jebel Hafit	Not Protected	Vulnerable
Hajar Mountains - Carbonate - below 500m	Not Protected	Vulnerable
Asir Mountains - Eastern Slope	Not Protected	Least Threatened
Asir Mountains - above 2000m	Not Protected	Least Threatened
Hajar Mountains - Eastern - 500m to 1000m	Not Protected	Least Threatened
Hajar Mountains - Eastern - above 1000m	Not Protected	Least Threatened
Hajar Mountains - Musandam - below 500m	Not Protected	Least Threatened
Hajar Mountains - Musandam - 500m to 1000m	Not Protected	Least Threatened
Hajar Mountains - Musandam - above 1000m	Not Protected	Least Threatened
Hajar Mountains - Western - 500m to 1000m	Not Protected	Least Threatened
Hajar Mountains - Western - above 2000m	Not Protected	Least Threatened
Hijaz Hills and Mountains - below 1500m	Not Protected	Least Threatened

Habitat Name	Protection Level	Ecosystem Threat Status
Hijaz Hills and Mountains - above 1500m	Not Protected	Least Threatened
Jabal Shammar	Not Protected	Least Threatened
Madyan Mountains - above 1000m	Not Protected	Least Threatened
Yemen Highlands - 500m to 1000m	Not Protected	Least Threatened
Yemen Highlands - 1000m to 2000m	Not Protected	Least Threatened
Yemen Highlands - above 2000m	Not Protected	Least Threatened
Asir Mountains - 1500m to 2000m	Poorly protected	Least Threatened
Hajar Mountains - below 500m	Poorly protected	Least Threatened
Hajar Mountains - Western - 1000m to 2000m	Poorly protected	Least Threatened
Madyan Mountains - below 1000m	Poorly protected	Least Threatened
Monsoon-affected Vegetation - below 500m	Poorly protected	Least Threatened
Asir Mountains - 800m to 1500m	Moderately protected	Least Threatened
Jabal Tuwayq	Moderately protected	Least Threatened
Monsoon-affected Vegetation - 500m to 1000m	Moderately protected	Least Threatened
Tihamah Foothills - below 500m	Moderately protected	Least Threatened
Asir Mountains - Juniper Woodland	Well protected	Least Threatened
Monsoon-affected Vegetation - above 1000m	Well protected	Least Threatened

5.4.7 Jordan

The Jordan habitats were all classified as either 'Vulnerable' or 'Endangered', reflecting the high levels of transformation in the country. The Forest and Non-forest habitat type is 'Poorly Protected' and also highly threatened and represents a clear priority for urgent conservation action. Indeed all Jordan habitats are deserving of further protection measures as shown in Table 5-16.

Table 5-16: Summary of Jordan Ecosystems Protection Level and Threat Status

Habitat Name	Protection Level	Ecosystem Threat Status
Forest and Non-forest	Poorly protected	Endangered
Steppe	Poorly protected	Vulnerable
Acacia and Rocky Sudanian	Moderately protected	Vulnerable

5.4.8 Arabian (Persian) Gulf

Table 5-17 highlights how shallow water habitats of the Arabian Gulf contain highly threatened habitats including coral reefs, mangroves and sea-grass macro-algal beds. All three of these habitat types urgently require additional protection

Table 5-17: Summary of Arabian Gulf Ecosystems Protection Level and Threat Status

Habitat Name	Protection Level	Ecosystem Threat Status
Coral Reef	Poorly protected	Critically Endangered
Mangroves	Poorly protected	Endangered
Seagrass / macro-algal beds	Moderately protected	Endangered
Saltmarsh	Poorly protected	Vulnerable

Habitat Name	Protection Level	Ecosystem Threat Status
Deeper than 15m	Poorly protected	Vulnerable
Algal Mats	Moderately protected	Least Threatened
Other Shallow Water	Well protected	Vulnerable
Rocky Platforms	Well protected	Least Threatened
Tidal flats (no algal mats)	Well protected	Least Threatened

5.4.9 Gulf of Aden

All shallow water habitats within the Gulf of Aden are 'Critically Endangered' and hence under significant development pressure as shown in Table 5-18. As all the habitats are classified as either 'Not Protected' or 'Poorly Protected', there is a clear priority for conservation action in the Gulf of Aden.

Table 5-18: Summary of Gulf of Aden Ecosystems Protection Level and Threat Status

Habitat Name	Protection Level	Ecosystem Threat Status
Coral Reef	Not Protected	Critically Endangered
Seagrass / macro-algal beds	Not Protected	Critically Endangered
Deeper than 15m	Not Protected	Least Threatened
Mangroves	Poorly protected	Critically Endangered
Other Shallow Water	Poorly protected	Critically Endangered

5.4.10 Gulf of Oman

Table 5-19 indicates that all the shallow water habitats within the Gulf of Oman are classified as 'Critically Endangered' or 'Endangered' and hence under significant development pressure. None of these habitats are 'Well Protected' and hence are a clear priority for conservation action.

Table 5-19: Summary of Gulf of Oman Ecosystems Protection Level and Threat Status

Habitat Name	Protection Level	Ecosystem Threat Status
Deeper than 15m	Not Protected	Vulnerable
Other Shallow Water	Poorly protected	Critically Endangered
Mangroves	Poorly protected	Endangered
Coral Reef	Moderately protected	Critically Endangered

5.4.11 Northern and Central Red Sea

Shallow water habitats are generally significantly less threatened in the Northern and Central Red Sea than in the Gulfs of Aden or Oman with only Mangroves classified as 'Poorly Protected' as shown in Table 5-21. There is a need for further protection measures to be considered within these habitats.

Table 5-21: Summary of Northern and Central Red Sea Ecosystems Protection Level and Threat Status

Habitat Name	Protection Level	Ecosystem Threat Status
Deeper than 15m	Not Protected	Vulnerable
Coral Reef	Not Protected	Least Threatened
Other Shallow Water	Not Protected	Least Threatened
Seagrass / macro-algal beds	Not Protected	Least Threatened
Mangroves	Poorly protected	Vulnerable

5.4.12 Southern Red Sea

As shown in Table 5-22, the coastal habitats are classified as 'Vulnerable' or in the case of mangroves 'Endangered' and with the exception of other shallow water habitats are all 'Poorly Protected'. There is a clear need for further protection measures.

Table 5-22: Summary of Southern Red Sea Ecosystems Protection Level and Threat Status

Habitat Name	Protection Level	Ecosystem Threat Status
Seagrass / macro-algal beds	Poorly protected	Vulnerable
Mangroves	Poorly protected	Endangered
Coral Reef	Poorly protected	Vulnerable
Deeper than 15m	Poorly protected	Vulnerable
Other Shallow Water	Well protected	Vulnerable

5.4.13 Western Arabian Sea

Coastal habitats within the Western Arabian Sea are, with the exception of mangroves, 'Not Protected' but 'Least Threatened' as indicated in Table 5-23. Mangroves are 'Moderately Protected' and 'Vulnerable'. These habitats are not a high priority for immediate conservation action.

Table 5-23: Summary of Western Arabian Sea Ecosystems Protection Level and Threat Status

Habitat Name	Protection Level	Ecosystem Threat Status
Coral Reef	Not Protected	Least Threatened
Deeper than 15m	Not Protected	Least Threatened
Other Shallow Water	Poorly protected	Least Threatened
Mangroves	Moderately protected	Vulnerable

5.5 Spatial Prioritization Results

5.5.1 MARXAN Selection Frequency

As described in Section 4.6, the primary output of the MARXAN-based process described here is a selection frequency map. This map gives an idea of how important

each planning unit is for meeting targets, and summarizes the number of times (expressed as a percentage) that a planning unit is included in potential spatial configurations which meet the targets and minimize costs according to the parameters used in the MARXAN analysis. Figure 5-21 (and a larger version in Appendix C.3) shows the site selection map for Arabian Peninsula.

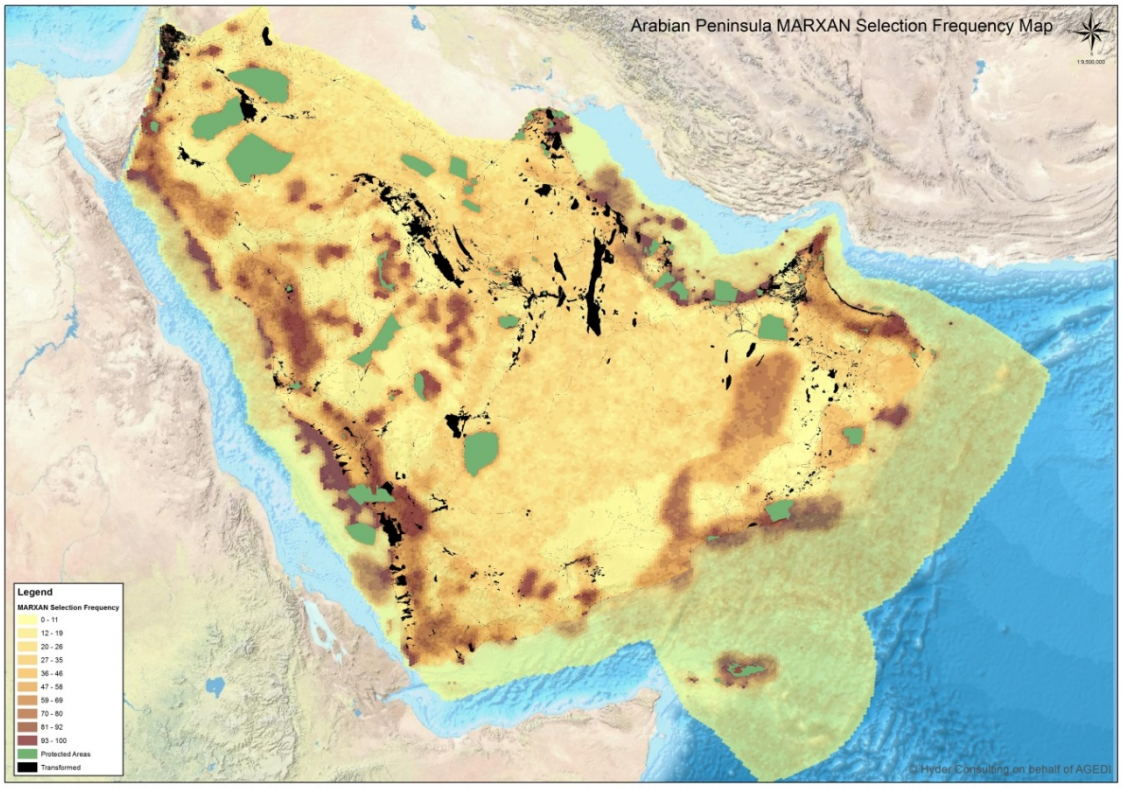


Figure 5-21: The MARXAN Site Selection Frequency for the Arabian Peninsula

5.5.2 Priority Focus Areas (PFAs)

Thirty Five Priority Focus Areas (PFAs) were identified (as defined in Section 4.6). The PFAs are shown in Figure 5-22 (and a larger version in Appendix C.4) overlaid on the selection frequency, and in a simplified form in Figure 5-23 (and a larger version in Appendix C.5).

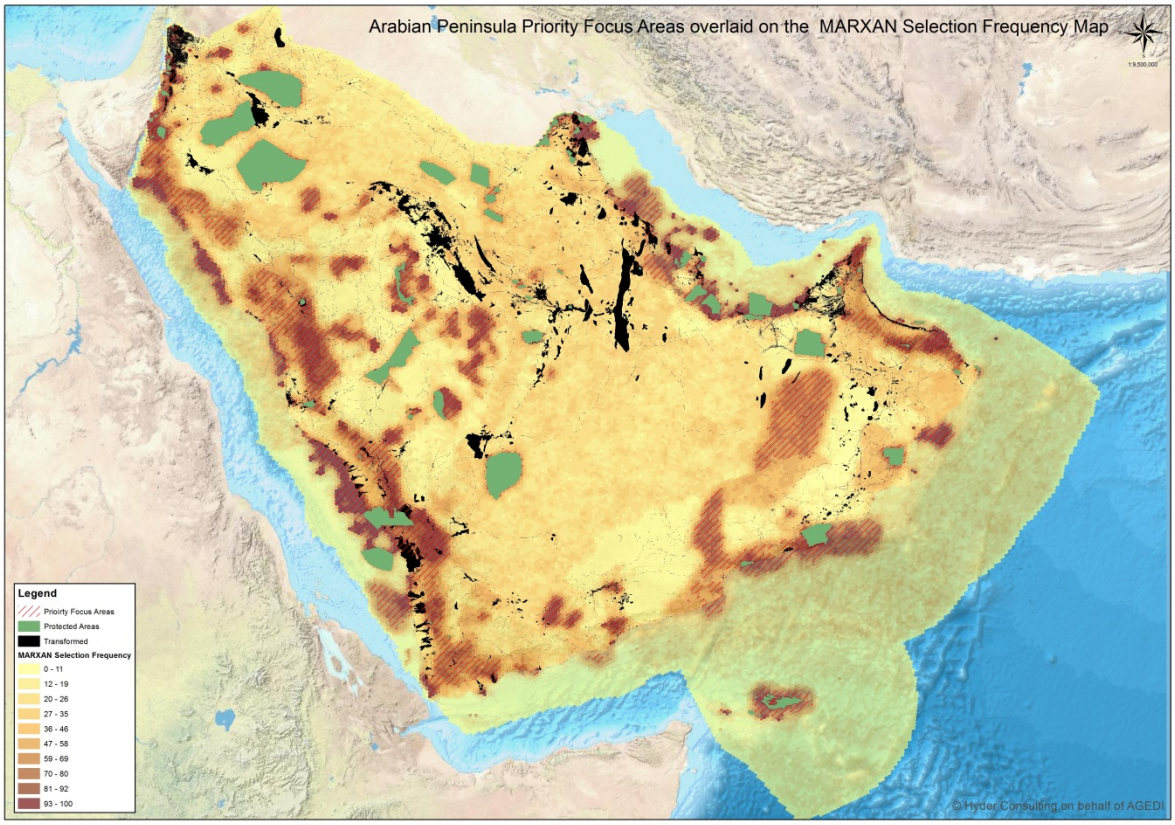


Figure 5-22: PFAs Overlaid on the MARXAN Selection Frequency Map for the Arabian Peninsula

The PFAs in Figure 5-23 include all areas that are required in at least 60% of iterations to meet targets. The PFAs were manually cleaned to remove major transformed areas and isolated sections.

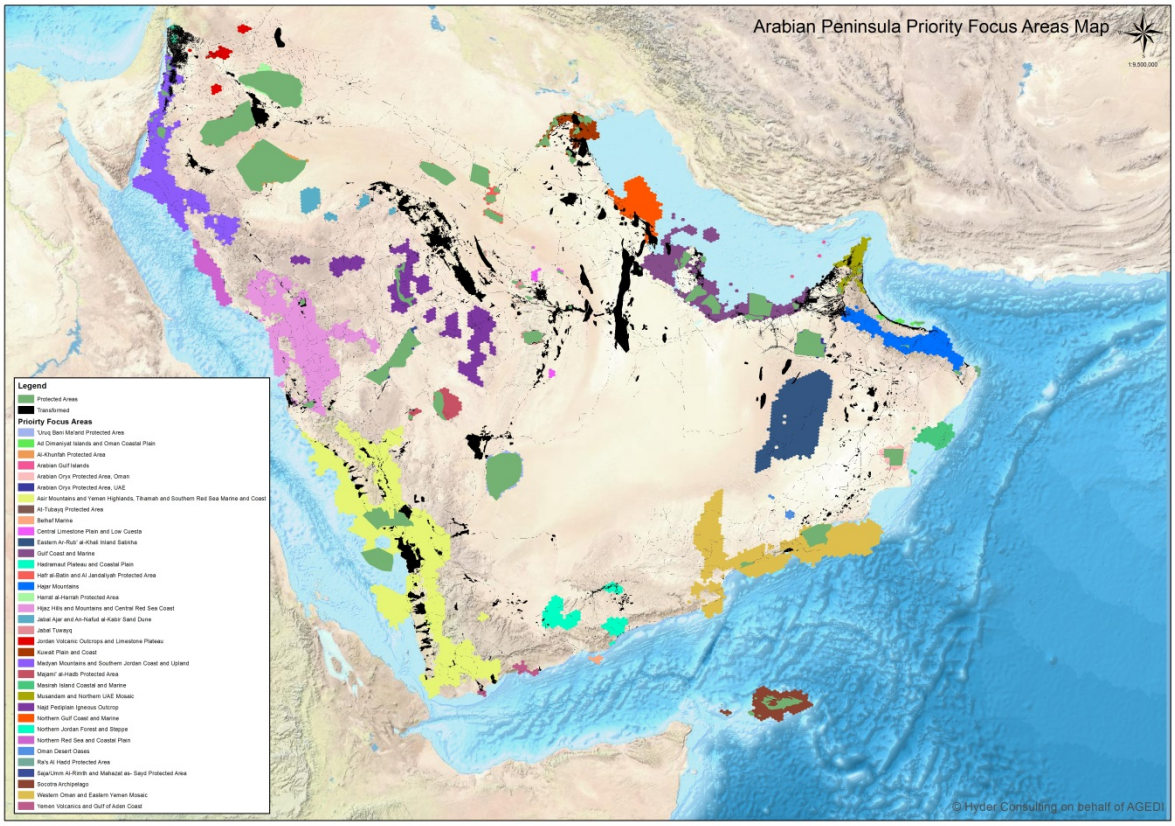


Figure 5-23: Identified PFAs for the Arabian Peninsula

The PFAs cover an area of 544, 135km^2 across the Arabian Peninsula, representing an area approximately 12.7% of the total land and sea area (or just over 4 times the current Protected Area network). These PFAs are:

- The areas within which Protected Area expansion would most efficiently meet Protected Areas targets (and hence improve the representiveness of the Protected Area network), while at the same time meeting targets for species. The prioritization identifies where conservation actions (including all place-based conservation activities, but particularly focussed on Protected Area expansion) should be prioritized in order to maximize gains and minimize potential future loss of biodiversity, while at the same time minimizing socio-economic impacts and conflict with other land uses. Protection of prioritized areas will improve ecosystem protection level (in particular, representiveness of the reserve network); will reduce inefficiencies (by avoiding unnecessary duplicates of areas sufficiently represented in the reserve network); and most importantly, will reduce the risk of worsening of ecosystem threat status of Arabian Peninsula habitat types; and efficiently prioritize areas required for the persistence of threatened and keystone species.

Importantly, the PFAs are not:

- Potential future Protected Area boundaries. Rather, they are areas within which targets can efficiently be met. In many cases, it is not necessary to protect the whole PFA. Detailed site level Protected Area expansion planning is necessary to refine the

potential boundaries of new or expanded Protected Areas. This planning should ideally incorporate finer level biodiversity data, as well as more detailed data on aspects such as socio-economic impacts and benefits.

- Designed to meet all targets for all habitat types. Note that the approach taken is to identify the highest priority areas where there is a combination of under-protected habitat and where areas are necessary for species or process conservation. The approach deliberately did not identify all areas necessary to meet habitat protection targets in areas with very high choice such as most deep water areas and extensive deserts of the south west. As shown in the MARXAN selection frequency map (Figure 5-21), some of these areas are required to meet targets, but in these areas where the whole of the habitat is available to meet targets and without additional biodiversity data, it is not useful to identify specific sites. As these areas generally are not subject to extensive transformation pressures, and hence consist of Least Threatened habitat types, Protected Area expansion is also far less urgent in these areas than elsewhere in the planning domain. Protected Area expansion in these habitats is necessary in the long term to ensure a fully representative Protected Area network, but should not be seen as part of the PFAs where implementation actions should be focussed in the short term.

5.5.3 Summary of PFA Features

Summary tables are included to assist in understanding the value of each PFA for inclusion within an expanded Protected Area network. Importantly, all of the areas are necessary and required to meet targets; all are of high priority, and each of the areas should be protected using appropriate conservation mechanisms.

Table 5-24 is a summary of the characteristics of each PFA in terms of their ecosystem threat status and protection level of habitats and the total number of biodiversity features included within the spatial prioritization. Table 5-25 ranks the PFAs by the number of features to provide an indication of their relative importance.

The results suggest that the top 15 most important PFAs in terms of conservation action include mountain areas in West Yemen, West KSA and West Jordan as well those in Oman and UAE. The monsoon-affected uplands of Dhofar and East Yemen are also important. Key coastal and marine areas include PFAs covering the Red Sea, Arabian Gulf, Gulf of Aden and Oman also score very highly.

As would be expected, there is a significant relationship between the size of the PFA and the number of biodiversity features (Figure 5-24). The most significant outlier is the Asir Mountains and Yemen Highlands, Tihamah and Southern Red Sea Marine and Coast PFA which is both very large (over 130,000km^2) and biodiverse (158 features). An area-adjusted analysis would therefore produce a revised list of PFAs rankings. However, there is clear relationship between both feature persistence and size and feature persistence and altitudinal range (given range shifts through climate change) so this PFA is clearly of the utmost importance at a regional scale. Further such PFA analysis is important but best achieved by the involvement of relevant experts.

Table 5-24: Summary of Key Characteristics of PFAs for the Arabian Peninsula

		Habitat Diversity	Ecosystem threat Status					Ecosystem Protection Level					Biodiversity Features		
Priority Focus Area	Area (km^2)	Total habitats	Critically Endangered	Endangered	Vulnerable	Least Threatened	Total Threatened Habitats	Not Protected	Poorly Protected	Moderately Protected	Well Protected	Very Underprotected Habitats	Maximum Number of Features Per Planning Unit	Mean Features Richness Per Planning Unit	Total Features For PFA
Ad Dimaniyat Islands and Oman Coastal Plain	1153	5	2		2	1	4	1	3	1		4	11	7.5	19
Al-Khunfah Protected Area	573	2				2	0		1		1	1	5	2.8	5
Arabian Gulf Islands	287	5	1	1	3		5		2	1	2	2	11	8.5	14
Arabian Oryx Protected Area, Oman	2286	3			1	2	1		2		1	2	13	9.0	17
Arabian Oryx Protected Area, UAE	395	3			1	2	1	1	1		1	2	7	5.3	8
Asir Mountains and Yemen Highlands, Tihamah and Southern Red Sea Marine and Coast	130901	41	3	1	11	26	15	25	10	2	4	35	34	13.1	158
At-Tubayq Protected Area	318	2				2	0		1		1	1	5	4.1	8
Belhaf Marine	800	1				1	0	1				1	8	2.4	2
Central Limestone Plain and Low Cuesta	1482	3				3	0	1	1	1		2	7	3.8	11
Eastern Ar-Rub' al-Khali Inland Sabkha	46100	5				5	0	2	3			5	9	5.1	10
Gulf Coast and Marine	32219	20	1	2	9	8	12	3	8	3	6	11	22	7.3	62
Hadramaut Plateau and Coastal Plain	13800	7	2			5	2	6	1			7	12	6.7	34
Hafr al-Batin and Al Jandaliyah Protected Area	1302	6				6	0	2	3		1	5	8	3.7	14
Hajar Mountains	21083	15	2	1	5	7	8	8	5	1	1	13	19	11.8	61
Harrat al-Harrah Protected Area	1431	3				3	0		2		1	2	7	4.0	10
Hijaz Hills and Mountains and Central Red Sea Coast	62420	21			4	17	4	13	5	2	1	18	21	5.8	70
Jabal Ajar and An-Nafud al-Kabir Sand Dune	6600	7			1	6	1	4	3			7	11	5.8	24
Jabal Tuwayq	956	3			1	2	1		2	1		2	9	4.9	16
Jordan Volcanic Outcrops and Limestone Plateau	3572	4			1	3	1		3		1	3	12	6.0	22
Kuwait Plain and Coast	7348	10	1	1	6	2	8	1	5	1	3	6	17	7.6	36
Madyan Mountains and Southern Jordan Coast and Upland	42165	21		1	6	14	7	12	6	1	2	18	21	9.2	82
Majami' al-Hadb Protected Area	5188	4				4	0	1	3			4	9	5.9	11
Masirah Island Coastal and Marine	7300	12			2	10	2	6	5		1	11	19	10.5	36
Musandam and Northern UAE Mosaic	7196	21	2	2	10	7	14	8	8		5	16	18	11.4	58
Najd Pediplain Igneous Outcrop	38774	8			1	7	1	3	5			8	11	4.0	29
Northern Gulf Coast and Marine	15796	11	1	2	7	1	10	2	5	1	3	7	16	5.5	36
Northern Jordan Forest and Steppe	1159	4		1	2	1	3		2	1	1	2	20	13.4	23
Northern Red Sea and Coastal Plain	8900	8			3	5	3	7	1			8	16	8.7	22
Oman Desert Oases	900	2				2	0	1	1			2	9	8.1	13
Ra's Al Hadd Protected Area	311	5	1		2	2	3	2	3			5	7	5.4	11
Saja/Umm Al-Rimth and Mahazat as- Sayd Protected Area	490	3				3	0		3			3	4	2.9	7
Socotra Archipelago	12658	4	2			2	2	1	2		1	3	19	4.9	28
'Uruq Bani Ma'arid Protected Area	1263	4			1	3	1	1	2	1		3	5	3.4	10
Western Oman and Eastern Yemen Mosaic	64610	16			2	14	2	7	6	2	1	13	35	7.0	68
Yemen Volcanics and Gulf of Aden Coast	2300	7	2		1	4	3	6	1			7	15	9.9	33

Note: This is the primary summary of biodiversity features per PFA.

Table 5-25: PFA Ranking by Habitat Summary Rankings and Biodiversity Features

		Habitat Summary Rankings			Biodiversity Feature Rankings			Overall Ranking
Priority Focus Area	Area (km^2)	Total Habitats Rank	Total Threatened Habitats Rank	Very Underprotected Habitats rank	Maximum Number of Features Per Planning Unit Rank	Mean Features Richness Per Planning Unit Rank	Total Features For PFA Rank	
Asir Mountains and Yemen Highlands, Tihamah and Southern Red Sea Marine and Coast	130901	1	1	1	2	2	1	1
Madyan Mountains and Southern Jordan Coast and Upland	42165	2	7	2	4	7	2	2
Musandam and Northern UAE Mosaic	7196	2	2	4	10	4	7	3
Hajar Mountains	21083	7	5	5	7	3	6	4
Gulf Coast and Marine	32219	5	3	7	3	14	5	5
Hijaz Hills and Mountains and Central Red Sea Coast	62420	2	9	2	4	19	3	6
Western Oman and Eastern Yemen Mosaic	64610	6	15	5	1	15	4	7
Masirah Island Coastal and Marine	7300	8	15	7	7	5	8	8
Kuwait Plain and Coast	7348	10	5	15	11	12	8	9
Northern Gulf Coast and Marine	15796	9	4	11	12	21	8	10
Yemen Volcanics and Gulf of Aden Coast	2300	13	11	11	14	6	12	11
Northern Red Sea and Coastal Plain	8900	11	11	9	12	9	17	12
Northern Jordan Forest and Steppe	1159	21	11	25	6	1	16	13
Hadramaut Plateau and Coastal Plain	13800	13	15	11	16	16	11	14
Ad Dimaniyat Islands and Oman Coastal Plain	1153	17	9	19	18	13	19	15
Jabal Ajar and An-Nafud al-Kabir Sand Dune	6600	13	19	11	18	20	15	16
Najd Pediplain Igneous Outcrop	38774	11	19	9	18	28	13	17
Arabian Gulf Islands	287	17	8	25	18	10	22	18
Socotra Archipelago	12658	21	15	21	7	26	14	19
Jordan Volcanic Outcrops and Limestone Plateau	3572	21	19	21	16	17	17	20
Arabian Oryx Protected Area, Oman	2286	26	19	25	15	8	20	21
Ra's Al Hadd Protected Area	311	17	11	16	28	22	25	22
Majami' al-Hadb Protected Area	5188	21	26	19	22	18	25	23
Eastern Ar-Rub' al-Khali Inland Sabkha	46100	17	26	16	22	24	28	24
Hafr al-Batin and Al Jandaliyah Protected Area	1302	16	26	16	26	31	22	25
Jabal Tuwayq	956	26	19	25	22	25	21	26
Oman Desert Oases	900	32	26	25	22	11	24	27
Arabian Oryx Protected Area, UAE	395	26	19	25	28	23	31	28
'Uruq Bani Ma'arid Protected Area	1263	21	19	21	32	32	28	29
Central Limestone Plain and Low Cuesta	1482	26	26	25	28	30	25	30
Harrat al-Harrah Protected Area	1431	26	26	25	28	29	28	31
Saja/Umm Al-Rimth and Mahazat as- Sayd Protected Area	490	26	26	21	35	33	33	32
At-Tubayq Protected Area	318	32	26	33	32	27	31	33
Belhaf Marine	800	32	26	33	26	35	35	34
Al-Khunfah Protected Area	573	32	26	33	32	34	34	35

Note: This individually ranks each PFA according to the number of habitat types, number of threatened habitats etc. The ranks were then combined to give an overall ranking for the PFA. These values are not area adjusted.

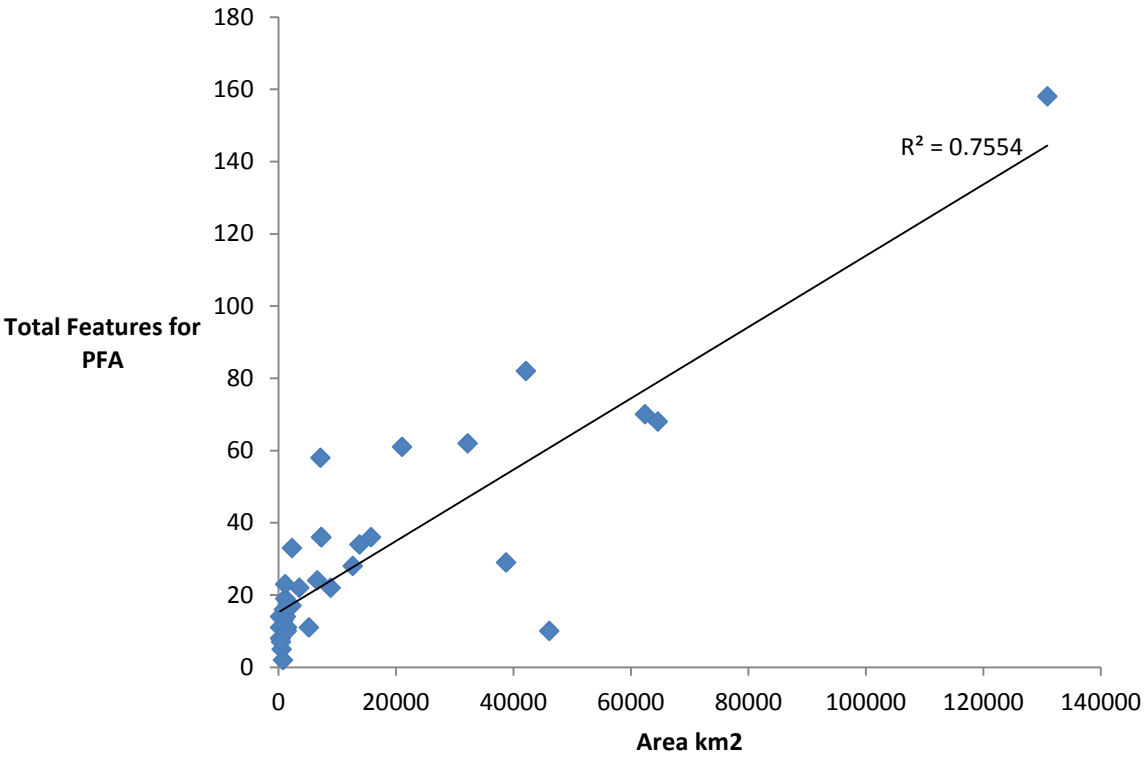


Figure 5-24: Relationship between the Size of PFAs and Number of Biodiversity Features

5.5.4 Expert Review of Priority Focus Areas

The identified PFAs were reviewed by biodiversity experts from across the region at the 14th Conservation Workshops in Sharjah held on the 3rd and 4th February 2013. This involved:

- Preliminary review of each PFA in terms of their biodiversity features and current pressures as well as suggested amendments to PFA names and potential divisions. In addition to this, an evaluation of PFAs was undertaken both in terms of any significant missing priorities at a regional scale, and also whether any identified PFAs had been included which the experts did not consider to be important.

- Prioritization of implementation of the PFAs in terms of which areas are particularly valuable from a biodiversity perspective and which areas are most urgent in terms of risk of short term loss of biodiversity or reduction in opportunity to effectively conserve these areas in the short term and their relative ease of implementation. The results of this workshop evaluation are shown in Appendix D.

5.6.3.1 Preliminary Review and Evaluation of PFAs

The results of this review are provided in Table 5-26. The set of PFAs were positively received by the experts, and no significant errors or omissions or unnecessary inclusions of areas were noted. However, at a finer scale (i.e. beyond the scope of the current project) when implementation of PFAs is being planned in detail; a number of activities need to be considered to facilitate implementation. These are discussed in the recommendations in Section 6.

Table 5-26: Summary of Preliminary Review of Arabian Peninsula Priority Focus Areas

PFA Name	Description comments	Proposed Amendments
Ad Dimaniyat Islands and Oman Coastal Plain	Important marine habitats including coral reefs, as well as turtle nesting beaches and important migratory stopover and wintering areas for wetland birds.	
Al-Khunfah Protected Area	An immense flat plain lying on the western edge of the Great Nafud Desert, Primarily steppe and sand desert, supporting small mammals, reptiles, and birds such as Houbara Bustard, lappet-Faced Vulture and sandgrouse species.	
Arabian Gulf Islands	Supports close to one third of the world population of dugong with extensive seagrass habitats and other marine species including turtles, dolphins, fish and elasmobranchs. The islands support important breeding seabird colonies but increasingly high levels of development and other forms of human disturbance.	
Arabian Oryx Protected Area, Oman	Important desert habitats supporting introduced Arabian Oryx. Under increasing pressure from overgrazing and competing land uses.	
Arabian Oryx Protected Area, UAE	Important desert habitats supporting introduced Arabian Oryx. Under increasing pressure from overgrazing and camel farming	
Asir Mountains and Yemen Highlands, Tihamah and Southern Red Sea Marine and Coast	A PFA with a broad range of highly diverse habitats. The southern coast contains rich coral reefs and important turtle nesting beaches of four species. The Asir Mountains and Yemen Highlands receive high levels of rainfall and are exceptionally rich in terms of flora and fauna with high levels of endemism. This is probably the richest PFA for species Western Oman and Eastern Yemen Mosaic and Northern Jordan Forest and Steppe. Key species include Arabian leopard, hyaena and wolf.	
At-Tubayq Protected Area	Extensive ancient sedimentary sandstones creating rugged habitats that support a core population of Nubian Ibex together with other important mammal and bird species.	
Belhaf Marine	Important turtle nesting beaches and coastal wetlands for birds.	
Central Limestone Plain and Low Cuesta	Limestone plains and low escarpments.	

PFA Name	Description comments	Proposed Amendments
Eastern Ar-Rub' al-Khali Inland Sabkha	Extensive wilderness of bare or species-poor sabkha.	
Gulf Coast and Marine	Important mangrove, coral reef and marine habitats supporting turtles and breeding and migratory seabirds.	
Hadramaut Plateau and Coastal Plain	Extensive open scrub habitats including uplands and deeply incised valleys. An important refuge for Nubian Ibex.	
Hafr al-Batin and Al Jandaliyah Protected Area	Mixed sand and gravel plains together dunes supporting migrant Houbara Bustard.	
Hajar Mountains	An area of upland and mountain habitats with unique ophiolite geology supporting a rich flora with high levels of endemism and important population of Arabian Tahr. This site is ecologically linked to the Musandam and Northern UAE Mosaic and these are proposed to be treated as one PFA.	Link to Musandam and Northern UAE Mosaic
Harrat al-Harrah Protected Area	Undulating basalt lava fields, gravel plains and sparsely vegetated wadis supporting a range of mammal species including Arabian Wolf, the Striped Hyena and Caracal. The area is also an Important Bird Area and supports resident and migratory Houbara bustard, rare raptors and desert species.	
Hijaz Hills and Mountains and Central Red Sea Coast	A large PFA with a broad spectrum of marine, coastal, upland and mountain habitats. Coastal habitats include species-rich coral reefs and mangroves (although not as rich as further north). The mountains include some key refugia for rare and important plant assemblages including areas of distinct volcanic habitats. The wadis are of significance as Important Plant and Bird Areas and a refuge for the Arabian Leopard and other threatened mammal species. .	
Jabal Ajar and An-Nafud al-Kabir Sand Dune	The uplands support important relict Mediterranean plant communities with a number of Important Plant Areas. Rare mammals including Nubian Ibex are present in good numbers. This PFA probably has the highest species diversity within the interior of the Arabian Peninsula.	
Jabal Tuwayq	The PFA includes biologically rich limestone escarpments with dramatic cuestas. This site has relatively high biodiversity for an interior PFA and is already reasonably well protected.	

PFA Name	Description comments	Proposed Amendments
Jordan Volcanic Outcrops and Limestone Plateau	This PFA includes areas of unique vegetation and the PFA is a high local priority for Protected Area designation.	
Kuwait Plain and Coast	Critically endangered habitats supporting important wetlands and coastal desert and sabkha habitats.	
Madyan Mountains and Southern Jordan Coast and Upland	This area is biologically rich and diverse with important Mediterranean habitats including three forest types and rich soils, with many similarities to North Jordan Forest and Steppe PFA. The area contains a number of Important Plant Areas and the summits act as important refugia for Mediterranean species.	
Majami' al-Hadb Protected Area	Habitats comprising smooth granite exfoliation domes and well-vegetated wadis, as well as dark volcanic mountains and sandy desert plains. It is a minor isolated mountain massif, and supports Acacia woodlands and an ephemeral freshwater wetland. The Arabian wolf and Ruppell's sand fox are present, and Houbara bustard is occasional. Dorcas, idmi, and reem gazelle species are reported to have been numerous in the recent past.	
Masirah Island Coastal and Marine	Important marine habitats including coral reefs, as well as turtle nesting beaches and important migratory stopover and wintering areas for wetland birds.	
Musandam and Northern UAE Mosaic	Ecologically, closely linked to the Hajar Mountains PFA and see description above. The area also supports an area of important carbonate habitats with distractive and important flora.	
Najd Pediplain Igneous Outcrop	Outcrops of granitic and pyroclastic rock formations with important hydrological characteristics with fringe areas supporting well vegetated and important plant communities contrasting with the highly xeromorphic species associated with the surrounding gravel plains.	
Northern Gulf Coast and Marine	A mosaic of important coastal and marine habitats including coral islands, with large numbers of breeding green turtle, and smaller numbers of hawksbill turtle, Important Socotra cormorant breeding colonies dependent on rich foraging areas, Also *Haloxlyon persicum* groves along the coast..	
Northern Jordan Forest and Steppe	This area is under intense development pressure and subject to a wide range of social issues, including significant opposition to a new Protected Area being established. There are also pressures to reduce the size of existing Protected Areas. Given the degree of threat and biological richness of the ecosystems in this area, it is a high priority for conservation action even though implementation will be most difficult.	

PFA Name	Description comments	Proposed Amendments
Northern Red Sea and Coastal Plain	Important range of coastal habitat including extensive mangroves, some of the most diverse and pristine coral reefs in the Red Sea and diverse marine communities.	
Oman Desert Oases	Small areas of oases supporting locally important mammals and bird species.	
Ra's Al Hadd Protected Area	Important marine habitats including mangroves and coral reefs as well as very important turtle nesting beaches..	
Saja/Umm Al-Rimth and Mahazat as- Sayd Protected Area	Extensive sand and gravel plains that support a range of local species including sand cat and migratory and resident Houbara bustard.	
Socotra Archipelago	Islands with high very high levels of global endemism. Very rich in endemic plants and over 30 endemic reptile species. The terrestrial habitats are well protected but even so are heavily degraded by high levels of overgrazing which remains the major threat to the biodiversity. Marine and coastal areas are also diverse with important turtle and other marine species.	
'Uruq Bani Ma'arid Protected Area	Located along the western edge of Ar-Rub‘ al-Khali, the largest sand desert on Earth. With the world’s largest longitudinal sand dunes, overlying a dissected limestone plateau, and the southern end of the Tuwayq Escarpment, this protected area contains greater biological diversity than any other part of the Empty Quarter, with vegetated wadis, gravel plains, and inter-dune corridors. A key location for introduced Arabian Oryx and recently extirpated gazelle species.	
Western Oman and Eastern Yemen Mosaic	The monsoon-affected vegetation is unique, species rich and with high levels of regional endemism. The monsoon forests are especially important for plants, reptiles and birds. The area ids probably the most important in the Arabian Peninsula for Arabian leopard and other mammals species such as Blandford’s Fox.	
Yemen Volcanics and Gulf of Aden Coast	Important turtle nesting beaches and coastal wetlands supporting important bird populations.	

5.6.3.2 *Prioritization of Implementation of the PFAs*

The assessment by the experts at the 14th Conservation Workshops in Sharjah was very useful in gaining an insight into the PFAs. This expert assessment is a valuable complement to the data-driven summary to evaluating and summarizing the PFAs given in Section 5.5.2.

The experts were divided into three groups (each with a project team facilitator) and were asked to allocate a numerical score to each PFAs (1= High, 2 = Moderate, 3 = Low) for the Biodiversity Value of each site, Ease of Implementation, and the Urgency of Implementation at each site.

Biodiversity scoring was based on:

- Importance/value of the biodiversity of each site.
- Uniqueness of biodiversity at each site.
- Threatened and under protected habitats.
- Threatened, rare, endemic species.
- Particularly good examples of functioning ecosystems.

Where a PFA was associated with an existing Protected Area, the evaluation was of the additional contribution of the PFA and excluded the existing Protected Area.

The ease of implementation of each site was based on:

- Whether the PFA had a core existing Protected Area to expand from (which generally aids implementation) compared to greenfield sites which are generally challenging to implement.
- Whether there are many competing activities and land uses which would make it harder to implement a Protected Area.
- Whether there are existing conservation initiatives (e.g. it is on an existing list of priority sites for a conservation agency or Non-Governmental Organisation, or where there are ongoing community-based conservation projects) which can be built on in the area.
- Whether the area is perceived to be a conservation priority at a political or decision-maker level.

The scoring of the Urgency of Implementation of each site was based on:

- Number of remaining opportunities, i.e. where few options exists and where they could be quickly lost.
- Area with current or imminent development threat.
- Species/populations which are at short term risk.

- Areas which are currently fairly intact but are rapidly becoming fragmented and hence where opportunities to create a substantial Protected Area may disappear soon.

- Areas which are experiencing ongoing or increasing degradation, rather than areas where impacts have occurred already and the sites are relatively stable.

The detailed scoring by each group as well as a summary of biodiversity value, ease of implementation and implementation urgency is given in Appendix D. These base values were then summarized (based on divisions discussed with the expert group) into three categories, namely High, Medium and Low Priority sites. The sites were then split into single country implementation sites and trans-boundary sites. This gives six categories which shown in Table 5-27.

Table 5-27: Summary of Expert Evaluation of the PFAs

High Priority	Medium Priority	Low Priority
Trans-boundary		
Asir Mountains and Yemen Highlands, Tihamah and Southern Red Sea Marine and Coast Gulf Coast and Marine Hajar Mountains Madyan Mountains and Southern Jordan Coast and Upland Western Oman and Eastern Yemen Mosaic	Northern Gulf Coast and Marine	Eastern Ar-Rub' al-Khali Inland Sabkha
Single Country		
Ad Dimaniyat Islands and Oman Coastal Plain Hijaz Hills and Mountains and Central Red Sea Coast Jabal Ajar and An-Nafud al-Kabir Sand Dune Masirah Island Coastal and Marine Northern Jordan Forest and Steppe Northern Red Sea and Coastal Plain Socotra Archipelago	Arabian Gulf Islands Hadramaut Plateau and Coastal Plain Kuwait Plain and Coast Majami' al-Hadb Protected Area Belhaf Marine Musandam and Northern UAE Mosaic Yemen Volcanics and Gulf of Aden Coast	Al-Khunfah Protected Area Arabian Oryx Protected Area, Oman Arabian Oryx Protected Area, UAE At-Tubayq Protected Area Central Limestone Plain and Low Cuesta Hafr al-Batin and Al Jandaliyah Protected Area Harrat al-Harrah Protected Area Jabal Tuwayq Jordan Volcanic Outcrops and Limestone Plateau Najd Pediplain Igneous Outcrop Oman Desert Oases Ra's Al Hadd Protected Area Saja/Umm Al-Rimth and Mahazat as-Sayd Protected Area 'Uruq Bani Ma'arid Protected Area

5.5.5 Protection Level Scenario Given Full Implementation of Priority Focus Areas

This section outlines the Protection Level scenario assuming that all PFAs are fully implemented. Table 5-28 details current and potential Protection Levels, while the current and post-implementation Protection Level maps are given in Figure 5-25 and Figure 5-26 (and in large format in Appendix C.2 and C.6, respectively).

Table 5-28: Current and Potential Protection Levels of Ecosystems Assuming Full Implementation of PFAs

Ecoregion	Habitat Name	Original Extent (km^2)	Protection Target %	Protection Target (km^2)	Protected Area (km^2)	Percentage of Protection target attained	Protection Level	Potential: Protected Area (km^2)	Potential: Percentage of Protection target attained	Potential: Protection Level
1. Islands	Islands - Arabian (Persian) Gulf	802.9	17	136.5	158.5	116.1	Well protected	728.8	533.9	Well protected
	Islands - Gulf of Aden	16.3	80	13.0	0.0	0.0	Not Protected	16.3	125.0	Well protected
	Islands - Gulf of Oman	0.2	100	0.2	0.2	100.0	Well protected	0.2	100.0	Well protected
	Islands - Northern and Central Red Sea	200.5	17	34.1	0.0	0.0	Not Protected	173.2	508.2	Well protected
	Islands - Southern Red Sea	1,222.7	17	207.9	728.7	350.6	Well protected	944.7	454.5	Well protected
	Islands - Western Arabian Sea	772.3	17	131.3	0.0	0.0	Not Protected	772.3	588.2	Well protected
	Socotra Archipelago	3,882.8	17	660.1	2,808.1	425.4	Well protected	3,859.8	584.8	Well protected
2. Coastal	Gulf Coastal Sabkha and Sabkha Matti	11,483.9	17	1,952.3	904.7	46.3	Poorly protected	3,816.4	195.5	Well protected
	Northern Gulf Coastal Plain	66,165.4	17	11,248.1	388.8	3.5	Not Protected	3,563.5	31.7	Poorly protected
	Oman Coastal Plain	13,860.0	17	2,356.2	192.4	8.2	Poorly protected	2,549.3	108.2	Well protected
	Red Sea Coastal Plain and Sabkha	24,911.1	17	4,234.9	33.3	0.8	Not Protected	9,093.9	214.7	Well protected
	Southern Coastal Plain	12,869.8	17	2,187.9	0.0	0.0	Not Protected	1,713.1	78.3	Moderately protected
	Southern Gulf Coastal Plain	29,981.9	17	5,096.9	2,912.5	57.1	Moderately protected	9,217.4	180.8	Well protected
	Tihamah Coastal Plain	24,079.6	17	4,093.5	110.7	2.7	Not Protected	9,255.5	226.1	Well protected
3. Lowlands	Ad-Dibdibah / Kuwait Alluvial Plain	38,226.4	17	6,498.5	2,322.1	35.7	Poorly protected	5,373.1	82.7	Moderately protected

Ecoregion	Habitat Name	Original Extent (km^2)	Protection Target %	Protection Target (km^2)	Protected Area (km^2)	Percentage of Protection target attained	Protection Level	Potential: Protected Area (km^2)	Potential: Percentage of Protection target attained	Potential: Protection Level
	At-Taysiyah Limestone Plain	13,071.3	17	2,222.1	3,904.3	175.7	Well protected	3,945.4	177.5	Well protected
	Central Limestone Plain and Low Cuesta	110,903.0	17	18,853.5	364.5	1.9	Not Protected	1,931.1	10.2	Poorly protected
	Central Sand Plain	80,815.9	17	13,738.7	1,179.9	8.6	Poorly protected	1,706.2	12.4	Poorly protected
	Central Yemen Plain	67,158.8	17	11,417.0	0.0	0.0	Not Protected	2,602.3	22.8	Poorly protected
	Eastern Desert Plain	6,354.8	17	1,080.3	35.7	3.3	Not Protected	1,605.4	148.6	Well protected
	Eastern Gravel Plain	46,091.2	17	7,835.5	267.3	3.4	Not Protected	1,364.9	17.4	Poorly protected
	Huqf - Plain, Outcrop and Dune	7,241.6	17	1,231.1	1,370.8	111.4	Well protected	2,415.7	196.2	Well protected
	Inland Sabkha	28,419.2	17	4,831.3	264.5	5.5	Poorly protected	15,838.1	327.8	Well protected
	Najd Pediplain	249,469.0	17	42,409.7	8,707.5	20.5	Poorly protected	27,296.3	64.4	Moderately protected
	Northern Sandstone Plain and Plateau	74,909.9	17	12,734.7	26,729.9	209.9	Well protected	27,210.9	213.7	Well protected
	Western Sandstone Plain and Plateau	29,469.6	17	5,009.8	0.0	0.0	Not Protected	1,167.6	23.3	Poorly protected
4. Deserts	Ad-Dahna Dune, Sand Sheet and Plain Mosaic	29,614.6	17	5,034.5	1,963.7	39.0	Poorly protected	2,402.0	47.7	Poorly protected
	Al-Jafurah Sand Dune	31,822.7	17	5,409.9	53.4	1.0	Not Protected	3,511.2	64.9	Moderately protected
	An-Nafud al-Kabir Sand Dune	66,454.0	17	11,297.2	1,060.1	9.4	Poorly protected	4,873.4	43.1	Poorly protected
	Ar-Rub al-Khali Sand Dune	378,046.0	17	64,267.8	9,141.2	14.2	Poorly protected	10,033.3	15.6	Poorly protected

Ecoregion	Habitat Name	Original Extent (km^2)	Protection Target %	Protection Target (km^2)	Protected Area (km^2)	Percentage of Protection target attained	Protection Level	Potential: Protected Area (km^2)	Potential: Percentage of Protection target attained	Potential: Protection Level
	Ar-Rub al-Khali Sand Massif and Sabkha	95,578.2	17	16,248.3	9.1	0.1	Not Protected	32,026.5	197.1	Well protected
	Central Nafuds Sand Dune	51,342.9	17	8,728.3	2,942.8	33.7	Poorly protected	3,963.3	45.4	Poorly protected
	Eastern Sand Sheet and Dune	36,302.2	17	6,171.4	6,516.2	105.6	Well protected	7,856.1	127.3	Well protected
	Wahiba Sand Dune	10,365.0	17	1,762.1	0.0	0.0	Not Protected	23.9	1.4	Not protected
5. Uplands	As-Summan Limestone Plateau	79,266.2	17	13,475.3	517.4	3.8	Not Protected	1,055.6	7.8	Poorly protected
	Central Volcanic Outcrop	69,646.2	17	11,839.9	196.7	1.7	Not Protected	18,964.2	160.2	Well protected
	Dhofar Plateau	111,869.0	17	19,017.7	4,878.0	25.6	Poorly protected	8,378.2	44.1	Poorly protected
	Hadramaut Plateau	202,427.0	17	34,412.6	0.0	0.0	Not Protected	31,322.0	91.0	Well protected
	Hisma Plateau	8,803.0	17	1,496.5	601.2	40.2	Poorly protected	3,224.0	215.4	Well protected
	Najd Pediplain - Granitic Outcrop	3,271.4	17	556.1	0.0	0.0	Not Protected	3,271.4	588.2	Well protected
	Najd Pediplain - Pyroclastic Outcrop	42,034.4	17	7,145.9	1,646.8	23.0	Poorly protected	31,009.2	433.9	Well protected
	Najran - Asir Plateau	53,363.8	17	9,071.9	0.0	0.0	Not Protected	6,780.5	74.7	Moderately protected
	Northern Limestone Plateau	199,343.0	17	33,888.3	11,902.1	35.1	Poorly protected	15,334.3	45.2	Poorly protected
	Northern Volcanic Outcrop	35,954.8	17	6,112.3	9,957.9	162.9	Well protected	14,295.2	233.9	Well protected
	Yemen Precambrian Plateau	38,207.6	17	6,495.3	0.0	0.0	Not Protected	4,081.8	62.8	Moderately protected

Ecoregion	Habitat Name	Original Extent (km^2)	Protection Target %	Protection Target (km^2)	Protected Area (km^2)	Percentage of Protection target attained	Protection Level	Potential: Protected Area (km^2)	Potential: Percentage of Protection target attained	Potential: Protection Level
	Yemen Volcanic Outcrop	3,335.3	17	567.0	0.0	0.0	Not Protected	1,030.9	181.8	Well protected
6. Mountains	Asir Mountains - Eastern Slope	26,351.1	17	4,479.7	100.3	2.2	Not Protected	15,346.9	342.6	Well protected
	Asir Mountains - Juniper Woodland	281.1	17	47.8	60.7	127.1	Well protected	281.1	588.2	Well protected
	Asir Mountains - 800m to 1500m	10,992.3	17	1,868.7	1,283.3	68.7	Moderately protected	8,337.0	446.1	Well protected
	Asir Mountains - 1500m to 2000m	4,759.8	17	809.2	98.2	12.1	Poorly protected	4,627.0	571.8	Well protected
	Asir Mountains - above 2000m	1,275.9	17	216.9	8.5	3.9	Not Protected	1,275.9	588.2	Well protected
	Hajar Mountains - Jebel Hafit	202.8	17	34.5	0.0	0.0	Not Protected	192.9	559.6	Well protected
	Hajar Mountains - below 500m	34,073.3	17	5,792.5	367.9	6.4	Poorly protected	10,517.1	181.6	Well protected
	Hajar Mountains - Carbonate - below 500m	315.8	17	53.7	0.0	0.0	Not Protected	311.1	579.5	Well protected
	Hajar Mountains - Eastern - 500m to 1000m	3,327.7	17	565.7	0.1	0.0	Not Protected	3,019.2	533.7	Well protected
	Hajar Mountains - Eastern - above 1000m	685.1	17	116.5	0.0	0.0	Not Protected	665.1	571.1	Well protected
	Hajar Mountains - Musandam - below 500m	1,486.1	17	252.6	0.0	0.0	Not Protected	1,339.2	530.1	Well protected
	Hajar Mountains - Musandam - 500m to 1000m	633.0	17	107.6	0.0	0.0	Not Protected	631.2	586.6	Well protected
	Hajar Mountains - Musandam - above 1000m	65.1	17	11.1	0.0	0.0	Not Protected	65.1	588.2	Well protected
	Hajar Mountains - Western - 500m to 1000m	6,338.2	17	1,077.5	32.3	3.0	Not Protected	4,596.2	426.6	Well protected
	Hajar Mountains - Western - 1000m to 2000m	1,339.0	17	227.6	103.9	45.6	Poorly protected	1,212.1	532.5	Well protected

Ecoregion	Habitat Name	Original Extent (km^2)	Protection Target %	Protection Target (km^2)	Protected Area (km^2)	Percentage of Protection target attained	Protection Level	Potential: Protected Area (km^2)	Potential: Percentage of Protection target attained	Potential: Protection Level
	Hajar Mountains - Western - above 2000m	51.0	17	8.7	0.0	0.0	Not Protected	37.5	433.2	Well protected
	Hijaz Hills and Mountains - below 1500m	79,253.8	17	13,473.1	167.6	1.2	Not Protected	32,343.3	240.1	Well protected
	Hijaz Hills and Mountains - above 1500m	850.0	17	144.5	0.0	0.0	Not Protected	817.1	565.5	Well protected
	Jabal Shammar	8,079.9	17	1,373.6	0.0	0.0	Not Protected	1,332.5	97.0	Well protected
	Jabal Tuwayq	46,974.5	17	7,985.7	4,786.1	59.9	Moderately protected	5,575.7	69.8	Moderately protected
	Madyan Mountains - below 1000m	17,373.6	17	2,953.5	216.7	7.3	Poorly protected	14,553.5	492.8	Well protected
	Madyan Mountains - above 1000m	689.7	17	117.2	0.0	0.0	Not Protected	675.4	576.1	Well protected
	Monsoon-affected Vegetation - below 500m	13,096.4	17	2,226.4	393.7	17.7	Poorly protected	8,590.3	385.8	Well protected
	Monsoon-affected Vegetation - 500m to 1000m	6,963.2	17	1,183.8	996.8	84.2	Moderately protected	5,758.1	486.4	Well protected
	Monsoon-affected Vegetation - above 1000m	170.6	17	29.0	162.9	561.9	Well protected	170.6	588.2	Well protected
	Tihamah Foothills - below 500m	52,352.4	17	8,899.9	4,633.8	52.1	Moderately protected	28,425.4	319.4	Well protected
	Yemen Highlands - 500m to 1000m	14,916.2	17	2,535.8	27.6	1.1	Not Protected	12,154.0	479.3	Well protected
	Yemen Highlands - 1000m to 2000m	22,444.8	17	3,815.6	45.4	1.2	Not Protected	7,731.4	202.6	Well protected
	Yemen Highlands - above 2000m	6,781.4	17	1,152.8	0.0	0.0	Not Protected	1,653.2	143.4	Well protected
7. Jordan	Acacia and Rocky Sudanian	3,699.4	17	628.9	407.1	64.7	Moderately protected	2,227.2	354.1	Well protected

Ecoregion	Habitat Name	Original Extent (km^2)	Protection Target %	Protection Target (km^2)	Protected Area (km^2)	Percentage of Protection target attained	Protection Level	Potential: Protected Area (km^2)	Potential: Percentage of Protection target attained	Potential: Protection Level
	Forest and Non-forest	6,536.8	17	1,111.3	183.5	16.5	Poorly protected	3,535.5	318.2	Well protected
	Steppe	9,073.8	17	1,542.6	248.2	16.1	Poorly protected	3,281.9	212.8	Well protected
1. Arabian (Persian) Gulf	Algal Mats	193.2	17	32.8	25.4	77.2	Moderately protected	193.1	588.1	Well protected
	Mangroves	208.1	80	166.5	17.8	10.7	Poorly protected	191.0	114.7	Well protected
	Rocky Platforms	164.9	17	28.0	95.3	339.8	Well protected	163.9	584.4	Well protected
	Saltmarsh	51.3	80	41.0	6.4	15.7	Poorly protected	50.6	123.3	Well protected
	Tidal flats (no algal mats)	342.5	17	58.2	95.4	163.9	Well protected	341.7	586.9	Well protected
	Coral Reef	762.9	80	610.4	88.9	14.6	Poorly protected	653.3	107.0	Well protected
	Other Shallow Water	43,058.0	10	4,305.8	5,108.9	118.7	Well protected	20,513.9	476.4	Well protected
	Seagrass / macro-algal beds	5,754.6	34	1,956.6	1,280.6	65.4	Moderately protected	4,532.5	231.7	Well protected
	Deeper than 15m	89,013.1	10	8,901.3	798.6	9.0	Poorly protected	17,197.5	193.2	Well protected
2. Gulf of Aden	Mangroves	0.1	100	0.1	0.0	23.7	Poorly protected	0.1	100.0	Well protected
	Coral Reef	132.7	80	106.2	0.8	0.7	Not Protected	122.5	115.4	Well protected
	Other Shallow Water	2,057.0	10	205.7	97.8	47.6	Poorly protected	846.1	411.3	Well protected
	Seagrass / macro-algal beds	2,733.1	34	929.3	0.0	0.0	Not Protected	1,399.5	150.6	Well protected
	Deeper than 15m	410,293.0	10	41,029.3	516.9	1.3	Not Protected	12,724.9	31.0	Poorly protected
3. Gulf of Oman	Mangroves	3.1	100	3.1	1.1	33.9	Poorly protected	2.0	65.5	Moderately protected

Ecoregion	Habitat Name	Original Extent (km^2)	Protection Target %	Protection Target (km^2)	Protected Area (km^2)	Percentage of Protection target attained	Protection Level	Potential: Protected Area (km^2)	Potential: Percentage of Protection target attained	Potential: Protection Level
	Coral Reef	60.8	80	48.6	25.6	52.6	Moderately protected	55.1	113.2	Well protected
	Other Shallow Water	1,530.8	10	153.1	27.9	18.2	Poorly protected	446.6	291.7	Well protected
	Deeper than 15m	85,120.6	10	8,512.1	182.4	2.1	Not Protected	1,970.3	23.1	Poorly protected
4. Northern and Central Red Sea	Mangroves	14.4	80	11.5	1.1	9.7	Poorly protected	13.0	112.4	Well protected
	Coral Reef	2,082.2	80	1,665.8	3.0	0.2	Not Protected	1,514.7	90.9	Well protected
	Other Shallow Water	3,870.8	10	387.1	3.3	0.9	Not Protected	2,704.6	698.7	Well protected
	Seagrass / macro-algal beds	12,362.4	34	4,203.2	1.2	0.0	Not Protected	6,186.5	147.2	Well protected
	Deeper than 15m	88,769.9	10	8,877.0	0.5	0.0	Not Protected	6,667.1	75.1	Moderately protected
5. Southern Red Sea	Mangroves	35.8	80	28.7	5.2	18.2	Poorly protected	32.4	112.9	Well protected
	Coral Reef	1,691.9	80	1,353.5	330.4	24.4	Poorly protected	1,346.9	99.5	Well protected
	Other Shallow Water	12,997.7	10	1,299.8	2,070.4	159.3	Well protected	7,856.8	604.5	Well protected
	Seagrass / macro-algal beds	9,161.6	34	3,115.0	304.6	9.8	Poorly protected	6,548.3	210.2	Well protected
	Deeper than 15m	91,526.1	10	9,152.6	2,827.4	30.9	Poorly protected	24,614.4	268.9	Well protected
6. Western Arabian Sea	Mangroves	0.2	100	0.2	0.1	75.1	Moderately protected	0.2	98.4	Well protected
	Coral Reef	151.5	80	121.2	2.0	1.7	Not Protected	140.9	116.2	Well protected
	Other Shallow Water	7,312.0	10	731.2	61.6	8.4	Poorly protected	3,210.1	439.0	Well protected
	Deeper than 15m	542,165.0	10	54,216.5	142.7	0.3	Not Protected	31,238.3	57.6	Moderately protected

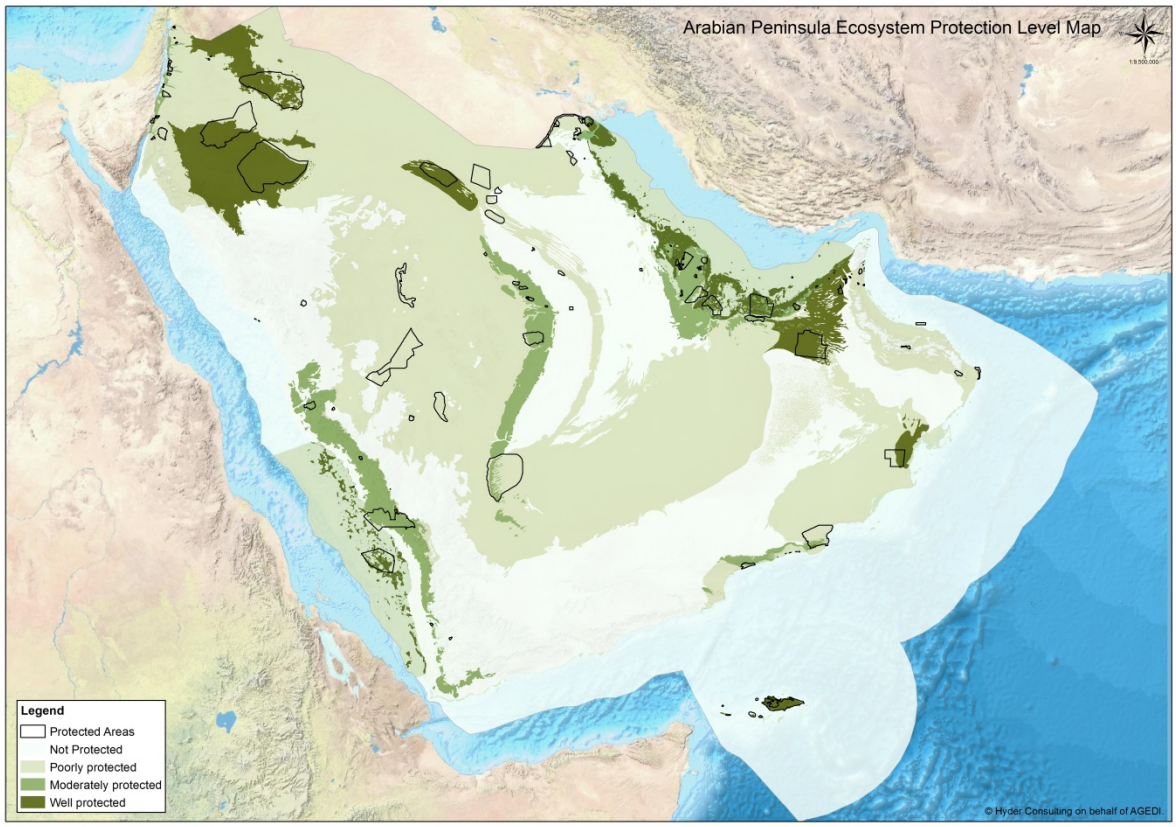


Figure 5-25: Current Ecosystem Protection Level for the Arabian Peninsula

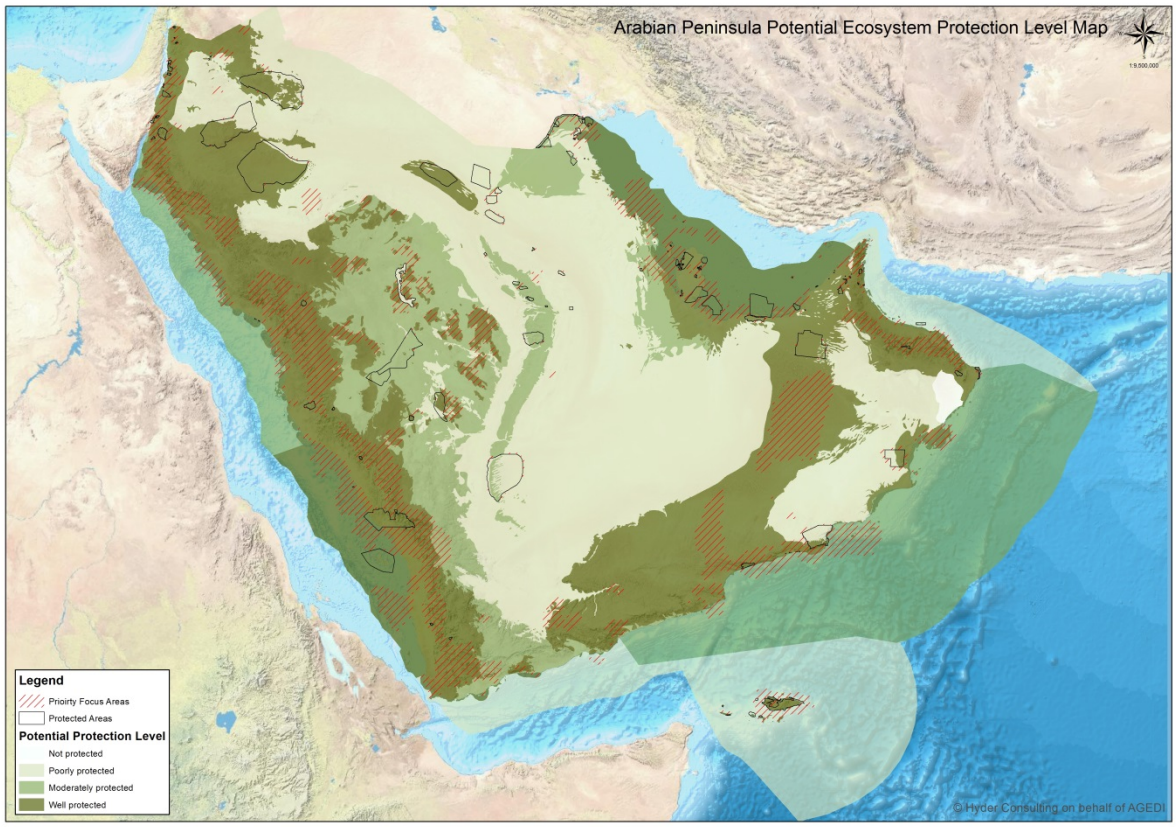


Figure 5-26: Potential Ecosystem Protection Level for the Arabian Peninsula Assuming Full Implementation of the PFAs

6 Recommendations

This Project has resulted in a valuable set of products and strong foundation for SCP to become an integral part of national and regional biodiversity planning and management programmes in the Arabian Peninsula. The following recommendations are provided which could be considered in future planning, initiatives and programmes.

6.1 Improving the Derived Layers

6.1.1 Habitat Map

The habitat map for the Arabian Peninsula is the first of its kind and has significant value for ecology and biodiversity science beyond the scope of this Project. There are a number of improvements to the terrestrial map advocated by Othman Llewellyn of the SWA that should be considered in the future and these include:

- Asir Mountains – Juniper Woodland. Improve the accuracy and extent of the Juniper Woodlands.
- Najran Highlands or North Yemen Highlands: these units should be added.
- The boundaries of the following units in eastern KSA: As-Summan, Ad-Dibdibah, the Northern Gulf Coastal Plain, and Al-Jafurah were difficult to define. The differences between these bioregions are rather subtle and require review, potentially filed validatio and further revision.

The marine map could be improved by access to the extensive mapping projects around the region especially in the Red Sea and the Arabian Gulf.

A unified and nested classification for terrestrial and marine habitats across the region would be important to develop alongside a revised habitat map for the region.

6.1.2 Condition Map

The condition map is as important a derived layer as the habitat map. The quality of the data for terrestrial transformation is generally good, although much was generated by mapping from satellite imagery and so first hand data directly from land use ministries or GIS centres for all countries would be valuable to improve this map. The two most difficult areas to map accurately are terrestrial degradation, especially the influence of overgrazing and woodland clearance as well as marine condition. Quantitative spatial data for both are difficult to obtain or derive from surrogate sources and this aspect requires significantly more time beyond this Project to obtain the best available data from government data providers, fill gaps through expert mapping processes or even commissioning basic research to provide the data.

6.1.3 Species Maps

The best available data were received from IUCN and BirdLife on threatened species distributions. The IUCN-Conservation International Global Assessment Unit was most helpful in providing draft data. Overall there is a lack of good quality atlas data for species. The Arabian Breeding Bird Atlas (Jennings, 2010) is a model project of good

quality using a 'citizen science' approach to collect data but its resolution was too coarse to be valuable for this project. Further analysis of the original data which was beyond the scope of this Project would be required to utilise this data and would provide useful range data especially in discrete habitat types such as high altitude woodlands and wetlands. Atlas work for other terrestrial taxa is a clear priority for the future.

6.2 Protected Area and Land Use Planning

SCP can provide a framework for strategic conservation and priority setting across the Arabian Peninsula as follows:

6.2.1 Protected Area Development

The Project outputs provide a list of draft PFAs and which may be regarded as priority areas within which Protected Areas should be investigated and implemented. The next steps would be to investigate these areas further to consider the many other factors such as socio-economic benefits, land ownership and local constraints and opportunities that influence Protected Area expansion scheduling. This scheduling should be explored in an iterative way with the appropriate bodies.

Detailed fine scale conservation planning at least at the national scale then needs to take place to support each new Protected Area and Protected Area expansion activity. At this finer scale (i.e. beyond the scope of the current project) when implementation of PFAs is being planned in detail, a number of issues need to be considered to facilitate implementation:

- The PFAs are areas within which targets for biodiversity features can be efficiently met. They are not designed to be used as Protected Area boundaries. In all cases it is recommended that detailed planning of Protected Areas takes place at a local scale.

- In most cases smaller areas within each PFA should be identified for Protected Area expansion, land use controls or other conservation activity. This will aid implementation.

- The boundaries of PFAs should be adjusted to take into account alignment with cultural and heritage issues. For example, boundaries of PFAs could be aligned with protected oases and cultural sites on potential World Heritage Site lists to gain mutual benefit and ease implementation.

- The PFAs have been identified through desk based information and ground truthing these areas would also be necessary to confirm their habitats, extent of transformation and degradation and boundaries.

The Project results also provide a range of outputs that may be included within current Protected Area management plans.

The outcomes of the SCP process provide an objective and repeatable method to continually identify further protection priorities.

6.2.2 Land Use Planning and Environmental Permitting

There is strong potential for inclusion of SCP outputs into transboundary and national level development planning and land use decision making and this should be explored.

SCP provides a robust informant to guide decision on development. It could also assist in site option appraisals and EIAs. SCP products have been successfully used as the basis for local and district level strategic land use planning, for example in providing the basis for Strategic Environmental Assessments, Environmental Management Frameworks and have inputted into zoning schemes. Its use in these contexts in South Africa is illustrated in Figure 6-27.

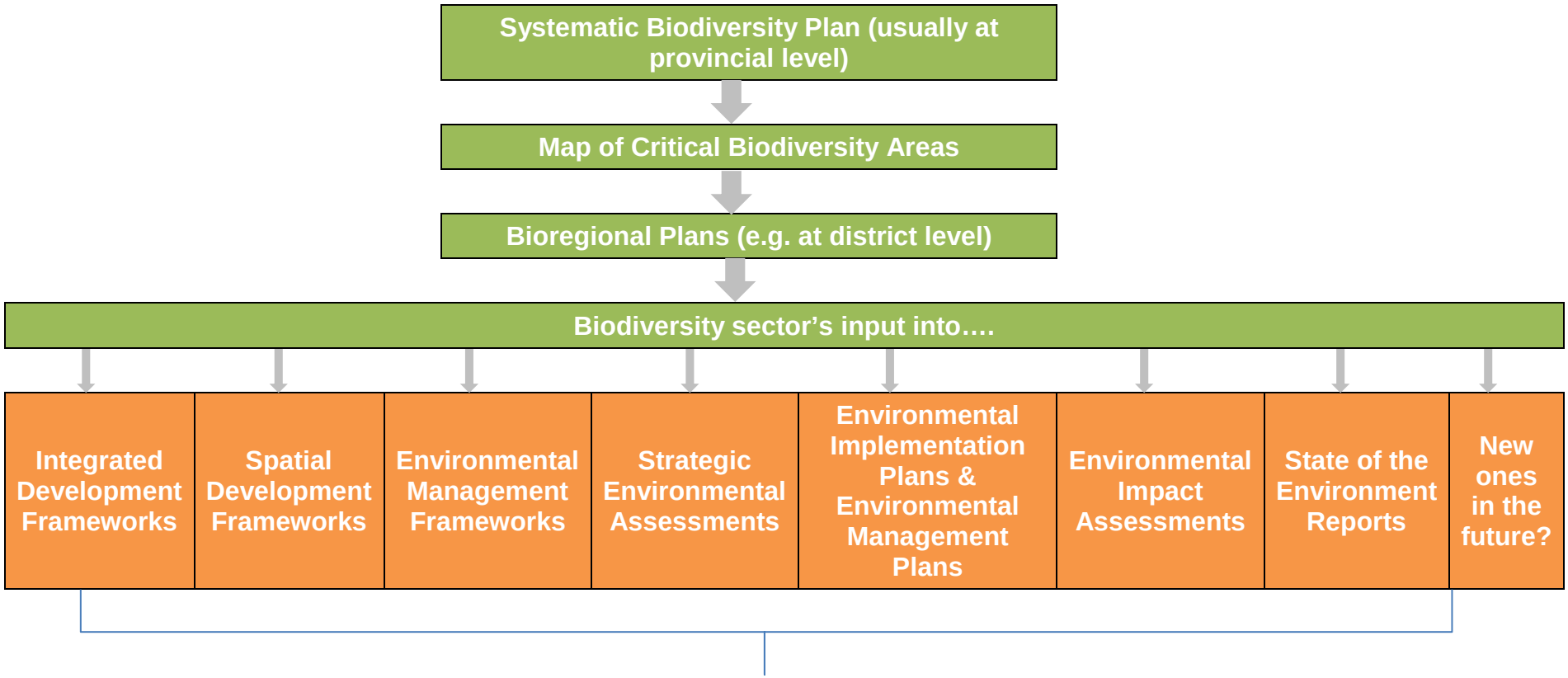


Figure 6-27: Uses of SCP in South Africa through multi-sectoral planning tools, frameworks and assessments.

6.2.3 Biodiversity Action Plans

The outputs from SCP can be used to assist with evaluating the CBD's Aichi strategic goals and targets. In particular the ecosystem threat status assessment which identified the threat status of habitat types in the Arabian Peninsula could be used as the basis for biodiversity action planning. Action plans for the most threatened habitats could be developed to aid recovery and allow progress reporting towards the reduction of biodiversity loss called for by the CBD.

The headline indicators of Ecosystem Threat Status and Protection Level can form the cornerstone of State of Environment reporting.

6.3 Data Sharing

Currently, data collected internally and externally for the Project has been collated into the Base Data Archive geodatabase. This includes data that was used to prepare the Derived Layers and data not used in the Derived Layers (Section 2.7.3). If AGEDI/EAD wish to circulate this data externally, they will need to seek permission from all the data providers (Section 3 of this report). However, the Derived Layers geodatabase contains processed geospatial data derived from the original data. This can therefore be made available (in various media) to external parties.

6.4 Capacity Building and Institutional Framework Strengthening

- Many stakeholders showed enthusiasm for the Project and made informal requests for training and capacity building which should be considered in any future SCP initiatives. The main stages of the Project where capacity building would be most valuable are: data collection, collation and review, preparation of derived ecological, threat and opportunity layers, threat status and protection level assessments and spatial prioritisation.

- Capacity building could involve a variety of delivery routes. Two options are proposed below:
  - A one-off intensive training session by external GIS and SCP specialists with appropriate country representatives which covers the whole systematic conservation planning process could be undertaken. This training could be undertaken on its own or as a precursor to more extensive training. The aim of this training would be to provide attendees with the right knowledge and tools to empower them to undertake their own SCP process for their country. It would guide individuals through the SCP stages and specify how they should carry it out for their country. This is a quicker and less expensive option and maybe more acceptable to countries which don't have the current capacity to carry out a national SCP. However it does not necessarily guarantee that countries would progress to delivery of their own enhanced national biodiversity assessment and would not allow for continued capacity building support.
  - A much longer, continued support level of training which would use external GIS and SCP specialists to guide each country through carrying out its own SCP process and produce refined and enhanced country specific outputs. This would involve a combination of in-country training at the crucial SCP stages with

ongoing technical review and assistance that aims to enable country representatives to conduct the stages themselves. This would promote enhanced regional data management standardisation and therefore data sharing. However this approach would require much more commitment, equipment and tools from countries over a much longer timescale.

- Regardless of what training method is progressed, it is recommended that an Institutional Training Charter is agreed with contributors beforehand. This would set out the purpose of the training, the format of the training, the desire outcomes, protocols and the individuals from each country who would undergo the training. By encouraging relevant organisations to sign this Charter would facilitate buy-in and cooperation from each country before training is initiated.

Given AGEDI's mandate and its current institutional relationships especially with UNEP and IUCN, it is in a good position to promote and establish the institutional framework required to deliver SCP and implement its findings successfully across the region. The key players have been identified as part of this Project as data focal points. Data sharing cooperation mechanisms such as a Memorandum of Understanding or data sharing agreements would need to be formalised with the data focal points. The development of delivery mechanisms such as a regional forum or working group specifically designed for SCP would also need to be established.

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An online, publicly accessible, bibliographic database, entitled *Systematic Conservation Planning - Arabian Peninsula*, currently comprising of over 500 biodiversity and SCP references has been established at www.mendeley.com. This has been used to generate the bibliography.

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8 Glossary

Adapted from (Driver et al., 2011)

Biodiversity Action Plan: a plan aimed at ensuring the long-term survival in nature of an indigenous species, a migratory species or an ecosystem. Norms and standards to guide the development of Biodiversity Action Plans should be developed.

Biodiversity stewardship: a model for expanding the protected area network in which conservation authorities enter into contract agreements with private and communal landowners to place land that is of high biodiversity value under formal protection.

Biodiversity target: the minimum proportion of each ecosystem type that needs to be kept in a natural or near-natural state in the long term in order to maintain viable representative samples of all ecosystem types and the majority of species associated with those ecosystem types.

Constraint area: an area where plans are for a land use that is not in sympathy with biodiversity conservation and therefore an area to be avoided in a spatial prioritization if at all possible.

Critically endangered ecosystem: an ecosystem type that has very little of its original extent (measured as area, length or volume) left in natural or near-natural condition. Most of the ecosystem type has been severely or moderately modified from its natural state. The ecosystem type is likely to have lost much of its natural structure and functioning, and species associated with the ecosystem may have been lost.

Degraded area: an area of a terrestrial ecosystem that is significantly degraded from its natural state by impacts such as overgrazing. Such impacts lead to a loss of plant species richness and a consequent reduction of faunal richness. Such impacts are generally reversible through restoration projects and targeted management actions. See also transformed areas.

Derived Layer: six types of spatial data organised within a GIS geodatabase that form the basis for the systematic conservation planning assessments. These include habitat, species, ecological processes, Protected Area, pressures and opportunity and constraints data.

Ecological processes: an area where the long term persistence of a species is enabled. Species are generally identified within discrete distributions but over time wider areas of habitat may be required for the persistence at times of extreme weather or longer term climate change impacts.

Ecosystem: an ecological unit of wide extent, characterised by complexes of plant communities and associated animal communities and ecosystems, and determined mainly by altitude, climatic factors, soil types and geology. An ecosystem may extend over large, more or less continuous expanses or land surface, or may exist in small discontinuous patches.

Ecosystem protection level: an indicator of the extent to which ecosystems are adequately protected or under-protected. Ecosystem types are categorised as well protected, moderately protected, poorly protected, or not protected, based on the proportion of the biodiversity target for each ecosystem type that is included within one or more protected areas. Unprotected, poorly protected or moderately protected ecosystem types are collectively referred to as under-protected ecosystems.

Ecosystem services: a measure of the benefits that people obtain from ecosystems, including provisioning services (such as food and water), regulating services (such as flood control), cultural services (such as recreational benefits), and supporting services (such as nutrient cycling, carbon storage) that maintain the conditions for life on Earth. Ecosystem services are the flows of value to human society that result from a healthy stock of ecological infrastructure. If ecological infrastructure is degraded or lost, the flow of ecosystem services will diminish.

Ecosystem threat status: an indicator of how threatened ecosystems are, in other words the degree to which ecosystems are still intact or alternatively losing vital aspects of their structure, function or composition. Ecosystem types are categorised as critically endangered, endangered, vulnerable or least threatened, based on the proportion of the original extent of each ecosystem type that remains in good ecological condition relative to a series of biodiversity thresholds. Critically endangered, endangered and vulnerable ecosystems are collectively referred to as threatened ecosystems.

Ecosystem type: an ecosystem unit that has been identified and delineated as part of a hierarchical classification system, based on biotic and/or abiotic factors. Factors used to map and classify ecosystems differ in different environments. Ecosystem types can be defined as, for example, vegetation types or marine or coastal habitat types. Ecosystems of the same type are likely to share broadly similar ecological characteristics and functioning. Also see National ecosystem classification system.

Endangered ecosystem: an ecosystem type that is close to becoming critically endangered.

Least threatened ecosystem: an ecosystem type that has experienced little or no loss of natural habitat or deterioration in condition.

Ecosystem classification system: a hierarchical system for mapping and classifying ecosystem types in the terrestrial and marine environment. A national ecosystem classification system provides an essential scientific foundation for ecosystem-level assessment, planning, monitoring and management.

Geodatabase: a spatial database that is optimized to store and query data that is related to objects in space, including points, lines and polygons.

GIS: Geographical Information System software for storing and manipulating geographical information on a computer.

Habitat condition: marine habitats are impacted to various degrees by a wide range of human impacts and most are difficult to evaluate and many are cumulative. Systematic conservation planning adopts are 3-tier classification of ‘good’, ‘fair’ and ‘poor’ condition based on a quantitative assessment of impacts and based on a degree grid. Terrestrial habitats are impacted through a more discrete set of factors. Hence these habitats are classified as transformed, degraded or natural. See Transformed, Degraded and Natural area descriptions.

Natural area: an area of terrestrial ecosystem that is not classified as degraded or transformed and is thus classified as being in a natural state. This classification implies the area supports the community of species.

Offshore benthic: relating to the bottom of the ocean or the seabed.

Offshore pelagic: relating to the water column in the ocean.

Opportunity area: an area managed in sympathy with biodiversity and therefore a priority to identify and include within the spatial prioritization.

Pressures: The spectrum of human impacts on terrestrial ecosystems normally classified as either degraded or transformed. See also habitat condition.

Priority Focus Areas: largest, intact and unfragmented areas of high biodiversity importance, suitable for the creation and expansion of large protected areas. They include features in the landscape or seascape that are important for conserving a representative sample of ecosystems and species, for maintaining ecological processes, or for the provision of ecosystem services.

Protected Area: an area of land or sea (normally a Marine Protected Area) that is legally protected through national legislation and hence formally announced and declared. Protection implies that there will be no significant transformation of habitats or deleterious impacts on species and any degradation or species impacts will be reversed by the implementation of a management plan.

Protected area target: a quantitative goal for how much of an ecosystem type should be included in the protected area network by a certain date. Protected area targets should be revised every five years.

Systematic conservation planning: a scientific method for identifying geographic areas of biodiversity importance. It involves: mapping biodiversity features (such as ecosystems, species, spatial components of ecological processes); mapping a range of information related to these biodiversity features and their ecological condition; setting quantitative targets for biodiversity features; analysing the information using software linked to GIS; and developing maps that show spatial biodiversity priorities. The configuration of priority areas is designed to be spatially efficient (i.e. to meet biodiversity targets in the smallest area possible) and to avoid conflict with other land and water resource uses where possible.

Threatened ecosystem: an ecosystem that has been classified as critically endangered, endangered or vulnerable based on an analysis of ecosystem threat status. A threatened ecosystem has lost or is losing vital aspects of its structure, function or composition.

Threatened species: a species that has been classified as Critically Endangered, Endangered or Vulnerable, based on a conservation assessment (Red List), using a standard set of criteria developed by the IUCN for determining the likelihood of a species becoming extinct. A threatened species faces a high risk of extinction in the near future.

Transformed area: an area of terrestrial ecosystem that has been permanently and irreversibly transformed by human development or other human use such that it no longer supports any of the biodiversity features normally associated with the ecosystem.

Vulnerable ecosystem: an ecosystem type that still has the majority of its original extent (measured as area, length or volume) left in natural or near-natural condition, but has experienced some loss of habitat or deterioration in condition. The ecosystem type is likely to have lost some of its structure and functioning, and will be further compromised if it continues to lose natural habitat or deteriorate in condition.

9 Technical Appendices

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Appendix A

Base Data Archive Summary

Table 1: UAE Base Data Archive

Feature Dataset	Source	Feature Class	Description
Habitat	EAD GISDB SDE database	UAE_GISDB_Habitats	Broad UAE habitat classification from Tatiana Atkinson.
	EAD GISDB SDE database	AD_GISDB_Beachline	General beachline within the Abu Dhabi Emirate.
	EAD GISDB SDE database	AD_GISDB_Coastline	General coastline within the Abu Dhabi Emirate.
	EAD GISDB SDE database	UAE_GISDB_Vegetation	Developed by MSD in 2002, classified into cropland, empty area, mangrove, orchard/plantation, trees, and orchard/palms.
	EAD CMRECS SDE database	AD_CMRECS_Shoreline	General shoreline position within the Abu Dhabi Emirate.
	EAD CMRECS SDE database	AD_CMRECS_Habitat	Fine scale land cover defined by geomorphology, substrate or sessile benthic community associations for the Emirate of Abu Dhabi.
	EAD CMRECS SDE database	AD_CMRECS_MacroHabitat	Moderate scale land cover defined by geomorphology, substrate or sessile benthic community associations for the Emirate of Abu Dhabi.
	EAD CMRECS SDE database	AD_CMRECS_Zone	Defines 6 marine zones (0-5,5-10,10-15,15-20 and >20) and intertidal zones.
	EAD CMRECS SDE database	AD_CMRECS_System	Defines the overall marine influence for the Emirate of Abu Dhabi such as terrestrial, transitional and marine.
	EAD CMRECS SDE database	AD_CMRECS_Land	Land areas within the Emirate of Abu Dhabi.
	GEBCO	AP_GEBCO_CMRECSZone	GEBCO bathymetric depth data to create polygon feature class indicating sea depth Classification the same as the CMRECS data.
	EAD EEBDB SDE database	AD_EEBDB_EcoRegion	Delineate EcoRegions across the Emirate of Abu Dhabi. The characterization features that inform the delineation of boundaries are mainly physical, above or below high water mark landform, elevation, soil characteristics, depth of water table, land use, salinity and marine water depth.
	EAD EEBDB SDE database	AD_EEBDB_EcoDistrict	Delineate EcoDistricts across the Emirate of Abu Dhabi. The characterization features that inform the delineation of boundaries are mainly physical, above or below high water mark landform, elevation, soil characteristics, depth of water table, land use, salinity and marine water depth.
	Tourism Development and Investment Company (TDIC)	AD_TDIC_MarineHabitats	Marine habitats of the following islands: Delma, Gasha, Jebel Dhanna, Kurkum Qasr Hamas Jabr, SBY islands.
	EAD CMRECS SDE database	AD_CMRECS_Geoform	Large to moderate scale geomorphological structures formed by solid substrates such as headlands, islands, beaches and lagoons.
	WWF	AP_WWF_meow_ecos	WWF marine ecoregions
	WWF	AP_WWF_terr_ecos	WWF terrestrial ecoregions
	WWF	AP_WWF_tnc_terr_ecoregions	WWF terrestrial ecoregions modified by The Nature Conservancy (TNC) to be used in its biodiversity planning (Ecoregional assessments).
	Environment Agency - Abu Dhabi	AD_EAD_Vegetation_AbuDhabi	Vegetation survey carried out at the same time as the Abu Dhabi Soil Survey.
	EAD GISDB SDE database	AD_GISDB_SoilMapUnitBoundaries500k	Soil survey carried out in the Emirate of Abu Dhabi.
	Abu Dhabi Urban Planning Council	AD_UPC_Habitat	Habitat data from UPC, localized only for Abu Dhabi Island and surrounding area.
	Derived Interim Layer	UAE_Terrestrial_Habitat	Terrestrial Habitat interim derived layer
	ADCO	AD_ADCO_EcologyHabitatClassification	Habitat classification for ADCO concession areas
	Environment Agency - Abu Dhabi	NorthernEmirates_EAD_SoilMapUnitBoundaries_SubGrp	Soil survey carried out in the Northern Emirates with assistance from EAD.
	Environment Agency - Abu Dhabi	NorthernEmirates_EAD_VegetationCommunity	Vegetation survey carried out at the same time as the Northern Emirates Soil Survey.
	Ajman Municipality and Planning Department	Ajman_AMPD_VegetationPoly	Vegetation coverage across Ajman Municipality
Species	EAD GISDB SDE database	AD_GISDB_TurtleNests	Turtle nest information collected in 2001.

Feature Dataset	Source	Feature Class	Description
	EAD GISDB SDE database	AD_GISDB_SpeciesRichness	This derived dataset depicts the density and variety of wildlife species observations, according to a 5 km grid. This was developed by the AGEDI team in May 2008 based on data provided by EAD Departments by that date to provide a picture of where surveys were yielding the greatest density and variety of observations, as a proxy for biodiversity.
	EAD GISDB SDE database	AD_GISDB_MarineSurvey2010	Marine siting's from 2010 for the Emirate of Abu Dhabi.
	EAD EEBDB SDE database	AD_EEBDB_SpeciesObservation	Species observations across the Abu Dhabi Emirate.
	EAD EEBDB SDE database	AD_EEBDB_BreedingArea	Sailfish Breeding Area
	EAD EEBDB SDE database	AD_EEBDB_BreedingSite	Breeding sites of Hawksbill Turtle
	EAD EEBDB SDE database	AD_EEBDB_SpeciesDistribution	Species distribution across the Abu Dhabi Emirate.
	Atlas of the Breeding Birds of Arabia	AP_ABBA_BreedingBirdsArabia	Data Digitized using: M Jennings, Atlas of the breeding birds of Arabia, Vol 25, 2010 Scanned images from book were georeferenced and then digitized. Only observations from 1984 and onwards were captured Only those birds that were within the IUCN list and were breeding birds "2" were digitized The comment field uses the description in ABBA to describe the observation type.
	Tourism Development and Investment Company (TDIC)	AD_TDIC_TurtleTrackActivity	Turtle tracking from 2010 on Saadiyat island
	Birdlife International	AP_Birdlife_SpeciesDistribution	Bird species distribution across the Arabian Peninsula.
	Birdlife International	AP_Birdlife_ThreatenedSpecies	Threatened bird species across the Arabian Peninsula.
	IUCN	AP_IUCN_AMPHIBIANS	IUCN Red List of Threatened Species
	IUCN	AP_IUCN_Angelfish	IUCN Red List of Threatened Species
	IUCN	AP_IUCN_Butterflyfish	IUCN Red List of Threatened Species
	IUCN	AP_IUCN_Groupers	IUCN Red List of Threatened Species
	IUCN	AP_IUCN_Mammal	IUCN Red List of Threatened Species
	IUCN	AP_IUCN_Parrotfish	IUCN Red List of Threatened Species
	IUCN	AP_IUCN_Reptiles	IUCN Red List of Threatened Species
	IUCN	AP_IUCN_Wrasses	IUCN Red List of Threatened Species
	Abu Dhabi Urban Planning Council	UAE_UPC_FlowerIntersect	Geographic range of over 500 wild flower types within the UAE.
	Breeding Centre for Endangered Arabian Wildlife	AP_BCEAW_HotspotsRevisited2004Lines	The biodiversity hotspots are regions known to hold especially high numbers of species found nowhere else, yet their remaining habitat combined covers a little more than two percent of Earth's land surface. According to the criteria developed by Myers et al (2000)
	Breeding Centre for Endangered Arabian Wildlife	AP_BCEAW_HotspotsRevisted2004Polygons	The biodiversity hotspots are regions known to hold especially high numbers of species found nowhere else, yet their remaining habitat combined covers a little more than two percent of Earth's land surface. According to the criteria developed by Myers et al (2000)
	Breeding Centre for Endangered Arabian Wildlife	AP_BCEAW_AllGMACarnivora	Carnivore distribution
	Breeding Centre for Endangered Arabian Wildlife	AP_BCEAW_ArabianOryx	Arabian Oryx distribution extent
	Breeding Centre for Endangered Arabian Wildlife	AP_BCEAW_ReptilesCompiled	Reptile information collected at Sharjah 2010 conference
	Breeding Centre for Endangered Arabian Wildlife	AP_BCEAW_SpeciesDataFromWorkshop	Species data collected from Sharjah 2010 conference
	Breeding Centre for Endangered Arabian Wildlife	AP_BCEAW_CarnivoresWgs84	Carnivore distribution
	Breeding Centre for Endangered Arabian Wildlife	AP_BCEAW_Felines	Feline distribution
	Breeding Centre for Endangered Arabian Wildlife	AP_BCEAW_Acanthobrama_hadiyahensis	Acanthobrama hadiyahensis distribution
	Breeding Centre for Endangered Arabian Wildlife	AP_BCEAW_Aphanius_sirhani	Aphanius sirhani distribution

Feature Dataset	Source	Feature Class	Description
	Breeding Centre for Endangered Arabian Wildlife	AP_BCEAW_Carasobarbus_exulatus	Carasobarbus exulatus distribution
	Breeding Centre for Endangered Arabian Wildlife	AP_BCEAW_Carasobarbus_exulatus_2	Carasobarbus exulatus_2 distribution
	Breeding Centre for Endangered Arabian Wildlife	AP_BCEAW_Garra_dunsirei	Garra dunsirei distribution
	Breeding Centre for Endangered Arabian Wildlife	AP_BCEAW_Garra_ghorensis	Garra ghorensis distribution
	Breeding Centre for Endangered Arabian Wildlife	AP_BCEAW_Garra_longipinnis	Garra longipinnis distribution
	ADCO	AD_ADCO_Birds	Bird monitoring sites used for coastal sensitivity atlas 2000.
	ADCO	AD_ADCO_EcologyWildlifeLocations	Species observations across the Abu Dhabi Emirate.
	ADCO	AD_ADCO_Mammals	Represents the entire collection of mammal records held by ERWDA
	ADCO	AD_ADCO_Reptiles	Representss (X, Y) location and distribution of different types of reptile species throughout the Emirate.
	ADCO	AD_ADCO_Turtles	Sea turtle surveys conducted in Spring and Summer of 2004.
	ADCO	AD_ADCO_HailBirdAreas	Bird Areas relating to Hail
	ADCO	AD_ADCO_ZirkuBirdsNestingSites	Bird nesting sites relating to Zirku
	ADCO	AD_ADCO_ZirkuTurtleNestingSites	Turtle nesting sites relating to Zirku
Ecological Processes	EAD GISDB SDE database	AD_GISDB_Mangroves	This layer depicts the location and extent of significant mangrove habitat along the coast of Abu Dhabi. This information was collected in 2000 as part of the Abu Dhabi Coastal Sensitivity Atlas to support oil spill contingency planning and response The information was extracted from 2000 Landsat satellite data with limited ground truthing.
	EAD GISDB SDE database	AD_GISDB_Sabkha	This layer depicts the location and extent of significant sabkha habitat along the coast of Abu Dhabi. This information was collected in 2000 as part of the Abu Dhabi Coastal Sensitivity Atlas to support oil spill contingency planning and response.
	EAD GISDB SDE database	AD_GISDB_Saltmarsh	This layer depicts the location and extent of significant salt marsh habitat along the coast of Abu Dhabi. This information was collected in 2000 as part of the Abu Dhabi Coastal Sensitivity Atlas to support oil spill contingency planning and response. The information was extracted from 2000 Landsat satellite data with limited ground truthing.
	EAD GISDB SDE database	UAE_GISDB_Coral	This dataset depicts the location and extent of live and dead coral reefs covering the offshore islands and near shore areas of Abu Dhabi Emirate and eastern Qatar. This study, referred to as Coral Reef Investigations In Abu Dhabi and Eastern Qatar, was conducted from 2005-2007, was sponsored by Dolphin Energy, managed by the Emirates Wildlife Society, and implemented by the Environment Agency Abu Dhabi and the Supreme Council for the Environment and Natural Reserves, with technical and training support from the National Coral Reef Institute (Florida, USA).
	EAD GISDB SDE database	AD_GISDB_Seagrasses	This layer depicts the location and extent of significant seagrass habitat along the coast of Abu Dhabi. This information was collected in 2000 as part of the Abu Dhabi Oil Spill Protection Priorities Atlas 2000 to support oil spill contingency planning and response. The information was extracted from 2000 Landsat satellite data with limited ground truthing.
	EAD GISDB SDE database	AD_GISDB_CoastalSoils	Soil boundaries were delineated from 775 GPS-surveyed sample points with 15 to 20-meter accuracy in 2003/2004 undertaken by EAD for the coastal strip of Abu Dhabi emirate. This dataset will be supplemented with results from the on-going soil survey.
	EAD GISDB SDE database	AD_GISDB_Wetlands	The boundaries of the protected areas in Abu Dhabi are depicted in this layer. These areas were declared as protected areas in 2001 and are managed by EAD. The protected areas are classified into marine and terrestrial. There are other protected areas in the emirate of Abu Dhabi managed by other authorities such as Private Departments, Emirates Heritage Club, etc. and these are not included in this layer. The purpose of the data layer is to be able to manage and monitor the designated protected areas.
	EAD GISDB SDE database	UAE_GISDB_Wells	This map service includes the location and basic characteristics of over 42,000 water wells within Abu Dhabi Emirate.
	EAD GISDB SDE database	UAE_GISDB_WLDecline2007	This data represents the amount of groundwater decline between (ADD YEAR/MONTH) and March 2007. Decline regimes (areas of average decline between isolines) are measured in meters. This information has been derived from data being collected by the EAD as part of a comprehensive groundwater monitoring program.

Feature Dataset	Source	Feature Class	Description
	EAD GISDB SDE database	AD_GISDB_WLDecline2008	Very limited geographical extent of groundwater decline in 2008
	EAD EEBDB SDE database	AD_EEBDB_WaterBody	Water bodies across the Emirate of Abu Dhabi
	EAD EEBDB SDE database	AD_EEBDB_WellLocations	Well locations across the Emirate of Abu Dhabi
	UNEP-WCMS	AP_WCMS_Arabian_Peninsula_USGS_Mangroves	Mangrove data across the Arabian Peninsula, compiled using recently available Global Land Survey (GLS) data and the Landsat archive
	UNEP-WCMS	AP_WCMS_Mangrove1997	Mangrove data across the Arabian Peninsula
	UNEP-WCMS	AP_WCMS_seagrass05pt	Seagrass point data across the Arabian Peninsula
	UNEP-WCMS	AP_WCMS_seagrass05py	Seagrass polygon data across the Arabian Peninsula
	UNEP-WCMS	AP_WCMS_CoralReef2010	Coral reef across the Arabian Peninsula
	University of New York - Abu Dhabi	UAE_NYU_DenseCoralPolygons	Coral reef across the UAE provided by John Burt at NYU Abu Dhabi.
	IUCN	AP_IUCN_CORAL	IUCN Red List of Threatened Species
	IUCN	AP_IUCN_Mangroves	IUCN Red List of Threatened Species
	IUCN	AP_IUCN_Seagrasses	IUCN Red List of Threatened Species
	Department of Municipal Affairs - Abu Dhabi	AD_DMA_Forest	Forests across the Emirate of Abu Dhabi
	Department of Municipal Affairs - Abu Dhabi	AD_DMA_Oasis	Oasis across the Emirate of Abu Dhabi
	Abu Dhabi Authority for Tourism and Culture	AlAin_ADACH_Wadi	Wadies in the Al Ain Region
	Abu Dhabi Authority for Tourism and Culture	AlAin_ADACH_Slope20PercentorHigher	Slopes 20% or higher in the Al Ain Region
	ADM	AD_ADM_ForestPlots	Forest plots across the Emirate of Abu Dhabi
	ADM	AD_ADM_SurfaceWaterBodies	Surface water bodies across the Emirate of Abu Dhabi
	CGIAR CSI Consortium for Spatial Information	NASA Shuttle Radar Topographic Mission (SRTM) 90m v4	90m Digital elevation model (global coverage) - Within BDA only AP extent
	GEBCO	EP_GEBCO_Masked_ AP	Bathymetric Raster Depth Data.
	Derived Layer	AP_GEBCO_Contour	Contour data derived from GEBCO data
	ADCO	UAE_ADCO_HighWaterLine	High water line for the UAE
	ADCO	UAE_ADCO_LoweWaterLine	Low water line for the UAE
	Fujairah Municipality	WadiUrayah_FujMunicipality_Catchment_Basin	Catchment basin of Wadi Urayah in Fujairah.
	Ajman Municipality and Planning Department	Ajman_AMPD_WaterPolyFeatures	Water bodies across the Emirate of Ajman
Pressures / Condition	EAD GISDB SDE database	UAE_GISDB_Roads	Road Network of UAE
	EAD GISDB SDE database	AD_GISDB_PowerStations	Power station locations across the Emirate of Abu Dhabi (points)
	EAD GISDB SDE database	AD_GISDB_CamelDistribution	Camel Distribution across UAE
	EAD GISDB SDE database	AD_GISDB_DumpArea	Dump areas across Abu Dhabi
	EAD GISDB SDE database	AD_GISDB_Goats2008	Goat Distribution across UAE
	EAD GISDB SDE database	UAE_GISDB_PoultryLocations	Poultry locations across UAE

Feature Dataset	Source	Feature Class	Description
	EAD GISDB SDE database	AD_GISDB_ReclaimedAnalysis	This feature class represents the analysis for reclaimed lands in Abu Dhabi Island, from 1963 to 2008.
	EAD GISDB SDE database	UAE_GISDB_WasteClassification	Waste classification across UAE
	EAD GISDB SDE database	AD_GISDB_WasteSitings	Dump locations in Liwa and Western Region
	EAD GISDB SDE database	AD_GISDB_DredgingChannel	This map service depicts the location and extent of dredged channels along the coast of Abu Dhabi. This information was collected in 2000 as part of the Abu Dhabi Coastal Sensitivity Atlas to support oil spill contingency planning and response. The information was extracted from 2000 Landsat satellite data with limited ground truthing and reference to British Admiralty charts at various scales.
	EAD CMRECS SDE database	AD_CMRECS_DredgedAreas	This dataset describes dredged areas within the Abu Dhabi Emirate as part of the web-based Coastal Resources Atlas (CRA).
	EAD EEBDB SDE database	AD_EEBDB_LandCover	Land cover across Abu Dhabi Emirate
	EAD EEBDB SDE database	AD_EEBDB_PermanentMadeSurfaces	Permanent made surfaces across Abu Dhabi Emirate
	EAD EEBDB SDE database	AD_EEBDB_IndustrialFacilities	Incomplete dataset, industrial facilities across the Emirate of Abu Dhabi
	EAD EEBDB SDE database	AD_EEBDB_CommIndustFacility	Identical to Industrial facilities feature class. Incomplete dataset, industrial facilities across the Emirate of Abu Dhabi.
	EAD EEBDB SDE database	AD_EEBDB_WasteFacility	Waste facilities across Abu Dhabi Emirate (point)
	EAD EEBDB SDE database	AD_EEBDB_Powerlines	Powerline across Abu Dhabi Emirate
	EAD EEBDB SDE database	AD_EEBDB_RoadSegment	Road network across Abu Dhabi Emirate
	EAD EEBDB SDE database	AD_EEBDB_DesalPlant	Desalination plants across Abu Dhabi Emirate
	EAD EEBDB SDE database	AD_EEBDB_WasteWaterPlant	Waste water plants across Abu Dhabi Emirate
	National Oceanic and Atmospheric Administration	UAE_NOOA_GasFlares	Gas Flares across UAE
	EAD EEBDB SDE database	AD_EEBDB_OceanOutfall	Ocean outfall points across Abu Dhabi Emirate
	EAD EEBDB SDE database	AD_EEBDB_LandUse	Land use across Abu Dhabi Emirate.
	Department of Municipal Affairs - Abu Dhabi	AD_DMA_Roadcentreline	Road network for Abu Dhabi Emirate
	Department of Municipal Affairs - Abu Dhabi	AD_DMA_RoadSurface	Road Surface across Abu Dhabi Emirate
	Department of Municipal Affairs - Abu Dhabi	AD_DMA_Plots	Plot boundaries across Abu Dhabi Emirate (land use)
	ADM	AD_ADM_Buildings	Building boundaries across Abu Dhabi Emirate
	ADM	AD_ADM_Plots_LandUse	Plot boundaries across Abu Dhabi Emirate (land use)
	ADM	AD_ADM_RoadCentreLines	Road centreline across Abu Dhabi Emirate
	EAD EEBDB SDE database	AD_EEBDB_LandingSites	Landing Sites for the Emirate of Abu Dhabi
	ADCO	AD_ADCO_Farms	Represents Farming areas across the Emirate of Abu Dhabi
	ADCO	AD_ADCO_Infrastructure	Depicts the location and extent of coastal built-up areas along the coast of Abu Dhabi. This information was collected in 2000 as part of the Abu Dhabi Coastal Sensitivity Atlas to support oil spill contingency planning and response. The information was extracted from 2000 Landsat satellite data using general, visual interpretation with limited ground truthing.
	ADCO	AD_ADCO_MainGasLineDasIsland	Main gas line for Das Island
	ADCO	AD_ADCO_PetroleumPort	Petroleum port for the Emirate of Abu Dhabi
	ADCO	AD_ADCO_TankerRoute	Tanker route aross the Emirate of Abu Dhabi

Feature Dataset	Source	Feature Class	Description
	ADCO	UAE_ADCO_OilGasPipeline	Oil and gas pineline for the UAE
	ADCO	UAE_ADCO_PlantationDates	Date plantations across UAE
	ADCO	UAE_ADCO_PlantationFruits	Fruit plantations across UAE
	ADCO	UAE_ADCO_PlantationTree	Tree plantations across UAE
	ADCO	UAE_ADCO_TankOilGas	Tank location for Oil and gas across the UAE
	ADCO	AD_ADCO_ZikuOilTanks	Oil tank locations around Zirku
	ADCO	AD_ADCO_ZirkuRoads	Road network of Zirku
	ADCO	AD_ADCO_ZirkuRunway	Airport runway on Zirku
	ADCO	AD_ADCO_ZirkuTempBuildings	Temporary buildings on Zirku
	ADCO	AD_ADCO_MainOilLineDasIsland	Main oil line for Das Island
	ADCO	UAE_ADCO_Powerlines	Powerlines across the UAE
	National Oceanic and Atmospheric Administration	UAE_NOOA_GasFlares	Gas Flares across UAE
	Environment Agency - Abu Dhabi	NorthernEmirates_EAD_Landuse	Land use for the Northern Emirates, created as part of the Northern Emirates soil survey
	Ajman Municipality and Planning Department	Ajman_AMPD_ParcelsLandUse	LandUse for the Emirate of Ajman
	Ajman Municipality and Planning Department	Ajman_AMPD_Roads	Roads for the Emirate of Ajman
	Ajman Municipality and Planning Department	Ajman_AMPD_FEWA_Electricity	Powerlines for the Emirate of Ajman
Protected Areas	EAD GISDB SDE database	AP_GISDB_ProtectedAreasArabPenuns	Protected areas across the Arabian Peninsula, Data collection from different sources on the Biodiversity conference Sharjah (2010).
	EAD CMRECS SDE database	AD_CMRECS_MarineProtectedAreas	Marine protected areas in Abu Dhabi (3)
	EAD EEBDB SDE database	AD_EEBDB_ProtectedArea	Various types of protected areas across the Emirate of Abu Dhabi.
	Abu Dhabi Urban Planning Council	AD_UPC_ProtectedAreas	Protected area from UPC
	Abu Dhabi Urban Planning Council	AD_UPC_NatureReserve	Nature Reserve from UPC
	Abu Dhabi Authority for Tourism and Culture	AD_ADACH_AlAinWHSBoundaries	World heritage site boundaries in Al Ain.
	EAD GISDB SDE database	AP_GISDB_ProtectedAreasArabPenuns	Protected areas across the Arabian Peninsula, Data collection from different sources on the Biodiversity conference Sharjah (2010).
	Breeding Centre for Endangered Arabian Wildlife	UAE_BCEAW_ProtectedAreas	Protected areas across the UAE.
	Fujairah Municipality	WadiUrayah_FujMunicipality_CoreZone	Wadi Urayah Core zone
	Breeding Centre for Endangered Arabian Wildlife	Dubai_BCEAW_DubaiConservationAreas	Dubai conservation areas
Opportunities / Constraints	EAD GISDB SDE database	UAE_GISDB_PearlDiving	The Pearl diving sites shown on this Dataset are based on the 'Map of Pearl Diving in the Arabian Gulf between the Arabic and the Iranian Coasts' by Sheikh Mani' Bin Sheikh Rashid Al Maktoum, which contains the following statement: this dataset has been compiled for the benefit of everyone working in the pearl business. The editor has compiled the map from old charts and from his own visits to the pearl diving sites between Ras Abu Ali (Saudi Arabia) and Ruus Al jibal (Mussandam Peninsula).
	EAD GISDB SDE database	AP_GISDB_CombinedImportantBirdArea	Data collection from different sources on the Biodiversity conference Sharjah. This dataset represents the distribution of different birds on the Arab Peninsula, classified by area name (290 areas).
	EAD GISDB SDE database	AD_GISDB_Bird	This map service illustrates the bird monitoring sites used for coastal sensitivity Atlas 2000. Of the 104 total documented sites, data has been collected at 85 sites. Monitoring began prior to 2000 and is on-going, however, monitoring occurs variably for each monitoring site, i.e. not all sites are monitored every month and the number of times a site gets monitored each month varies.

Feature Dataset	Source	Feature Class	Description
	EAD GISDB SDE database	UAE_GISDB_EIAFootprints	For new or pre-existing "Projects" or areas where new development is occurring or industrial facilities existed prior to EIA regulations, environmental impact assessments are conducted at some level. For each assessment, Project boundaries have been developed, as shown in this layer, which depicts location and extent of Projects. For each Project, there are various levels of environmental data available that can benefit baseline or monitoring data for various constituents.
	EAD GISDB SDE database	AD_GISDB_CoastalSensitiveAtlas	ADNOC approached EAD to participate in a major oil spill response exercise, Operation Ghazal, to be held in 1999. EAD was to provide timely environmental advice to the responding agencies on matters such as protection priorities and clean up. As such, EAD developed the Environmental Sensitivity Index (ESI) atlas for the coastline of Abu Dhabi in 2000.
	EAD GISDB SDE database	AD_GISDB_Archaeology	This layer depicts the location of archaeological, paleontological, and heritage points covering parts of Abu Dhabi Emirate, excluding Al Ain, as a density grid. The 5 km x 5 km grid protects the exact location of the archaeological sites, data originally collected by the Abu Dhabi Island Archaeological Survey (ADIAS) between the early '90's and the present, while demonstrating the distribution and density of these important, historic sites across the Emirate.
	EAD CMRECS SDE database	AD_CMRECS_Archaeology_Sites	This dataset describes coastal archaeology sites of the Abu Dhabi Emirate as part of the web-based Coastal Resources Atlas (CRA).
	EAD CMRECS SDE database	AD_CMRECS_FishingRightBoundaries	This dataset describes the boundaries of fishing rights areas within the Abu Dhabi Emirate as part of the web-based Coastal Resources Atlas (CRA).
	EAD EEBDB SDE database	AD_EEBDB_DevelopInfraProject	Development and infrastructure Project across the Emirate of Abu Dhabi.
	EAD EEBDB SDE database	AD_EEBDB_AvianArea	Avian areas across the Emirate of Abu Dhabi.
	EAD EEBDB SDE database	AD_EEBDB_BuhoorArea	Buhoor areas across the Emirate of Abu Dhabi.
	Environment Agency - Abu Dhabi	UAE_EAD_BirdWetlandLocations	Created from Salim Javed at EAD documents and coordinates to create wetland bird areas for UAE. Polygons need verifying as some of the coordinates did not appear to plot in the correct location. Only wetland sights with large bird populations were plotted.
	Umm Al Quwain Municipality	UQA_UQAM_PlannedDevelopment	Planned developments in Umm Al Quwain.
	Birdlife International	AP_BirdlifeInt_IBAPoly	Important bird area polygon
	Birdlife International	AP_BirdlifeInt_IBAPoint	Important bird area points
	Tourism Development and Investment Company (TDIC)	AD_TDIC_Saadiyat_Dune_Protection_Zone	Dune protection zone on Saadiyat Island, Abu Dhabi
	Department of Municipal Affairs - Abu Dhabi	AD_DMA_PlanGreenArea	Planned green areas for Abu Dhabi
	Department of Municipal Affairs - Abu Dhabi	AD_DMA_PlanPlots	Planned plots for Abu Dhabi
	Department of Municipal Affairs - Abu Dhabi	AD_DMA_Vegetation	Vegetated areas for Abu Dhabi
	Abu Dhabi Urban Planning Council	AD_UPC_DevProject	Development Project for Abu Dhabi
	Abu Dhabi Urban Planning Council	AD_UPC_CoastalStewartshipZone	Coastal Stewardship zone
	Abu Dhabi Urban Planning Council	AD_UPC_CoastalPark	Coastal park
	Abu Dhabi Urban Planning Council	AD_UPC_CoastalConservationZone	Coastal conservation zone
	Abu Dhabi Authority for Tourism and Culture	AD_ADACH_AlAinWHSBufferZones	Al Ain World heritage site buffer zones
	Abu Dhabi Authority for Tourism and Culture	AD_ADACH_Plan_AlAin2030_UrbanGrowthBoundary	Al Ain 2030 Urban growth boundary
	Abu Dhabi Authority for Tourism and Culture	AD_ADACH_CulturalFacilities	Cultural facilities across the Emirate of Abu Dhabi
	Abu Dhabi Authority for Tourism and Culture	AD_ADACH_archaeological_sites	Archaeological sites across the Emirate of Abu Dhabi
	Abu Dhabi Authority for Tourism and Culture	AD_ADACH_liwa_forts	Liwa fort locations
	Abu Dhabi Authority for Tourism and Culture	AD_ADACH_murawah	Murawah archaeological sites

Feature Dataset	Source	Feature Class	Description
	ADM	AD_ADM_GreenAreas	Green areas across Abu Dhabi
	ADCO	AD_ADCO_Archaeology_Buffer	Used for planning purposed Archaeology zoning
	ADCO	AD_ADCO_LandUseConcessionArea	ADCO Concession Area
	ADCO	AD_ADCO_LanUseOilfields	Oilfield locations across the Emirate of Abu Dhabi
	EAD GISDB SDE database	UAE_GISDB_Oilfields	This file depicts the locations of oil field locations as derived from the 1989 British Petroleum 1:500K topographic basemap.
	Fujairah Municipality	WadiUrayah_FujMunicipality_BufferZone	Wadi Urayah Buffer zone
	Fujairah Municipality	WadiUrayah_FujMunicipality_EcoTourismZone	Wadi Urayah Eco Tourism zone
Other Layers	Derived Layer	AD_Planning_Domain	Derived extent of planning units for MARXAN analysis
	Derived Layer	UAE_Planning_Units	Derived extent of planning domain for MARXAN analysis
	VLIZ Maritime Boundaries Geodatabase	AP_VLIZ_WorldEEZ_v6	Maritime boundaries of the world
	Derived Layer	UAE_Planning_Domain	Derived extent of planning units for MARXAN analysis

Table 2: AP Base Data Archive

Feature Dataset	Source	Feature Class	Description
Habitat	GEBCO	AP_GEBCO_CMRECSZone	GEBCO bathymetric depth data to create polygon feature class indicating sea depth Classification the same as the CMRECS data.
	WWF	AP_WWF_meow_ecos	WWF marine ecoregions
	WWF	AP_WWF_terr_ecos	WWF terrestrial ecoregions
	WWF	AP_WWF_tnc_terr_ecoregions	WWF terrestrial ecoregions modified by The Nature Conservancy (TNC) to be used in its biodiversity planning (Ecoregional assessments).
	Ministry of Planning and International Cooperation, Government of Yemen and International Food Policy Research Institute	Yemen_FoodSecurity_Soils	Polygon feature class that describes soil units from the FAO's new harmonized world soil database (2009)
	Breeding Centre for Endangered Arabian Wildlife	Jordan_BCEAW_VegetationTypesEisawi	Polygon feature class that describes the vegetation types of Jordan produced by Eisawi
	Breeding Centre for Endangered Arabian Wildlife	Jordan_BCEAW_Geology	Polygon feature class describing the geology of Jordan
	Breeding Centre for Endangered Arabian Wildlife	Jordan_BCEAW_BiogeographicalZones	Polygon feature class describing biogeographical zones in Jordan
	Ministry of Environment - Qatar	Qatar_MOE_Typology	Polygon feature class describing marine habitat in Qatar
	Ministry of Environment - Qatar	Qatar_MOE_SoilSubOrder	Polygon feature class describing soil type in Qatar
	FAO GeoNetwork	AP_FAO_DigitalSoilMapWorld	Polygon feature class describing soils across the Arabian Peninsula
	The Royal Society for the Conservation of Nature	Jordan_RSCN_Biogeographical_Zones	Polygon feature class describing biogeographical zones in Jordan
	The Royal Society for the Conservation of Nature	Jordan_RSCN_Vegetation_types_eisawi	Polygon feature class that describes the vegetation types of Jordan produced by Eisawi
	Orr and Associates	AP_OrrAndAssociates_USGS_Geology_of_Arabia	Polygon feature class describing geology across the Arabian Peninsula
	eMISK	Kuwait_eMISK_Vegetation	This layer represents the natural vegetation of Kuwait differentiated by name of species.
	Diva-GIS	Bahrain_Divagis_BHR_water_areas	Rivers, canals, and lakes. Area features. Digital Chart of the World
	Diva-GIS	Jordan_Divagis_JOR_water_areas	Rivers, canals, and lakes. Area features. Digital Chart of the World
	Diva-GIS	Kuwait_Divagis_KWT_water_areas	Rivers, canals, and lakes. Area features. Digital Chart of the World
	Diva-GIS	Oman_Divagis_OMN_water_areas	Rivers, canals, and lakes. Area features. Digital Chart of the World
	Diva-GIS	Qatar_Divagis_QAT_water_areas	Rivers, canals, and lakes. Area features. Digital Chart of the World
	Diva-GIS	Saudi_Divagis_SAU_water_areas	Rivers, canals, and lakes. Area features. Digital Chart of the World
	Diva-GIS	Yemen_Divagis_YEM_water_areas	Rivers, canals, and lakes. Area features. Digital Chart of the World
Species	EAD GISDB SDE database	AP_GISDB_SpeciesDataWorkshop	Polygon feature class describing species distribution across the Arabian Peninsula, collected at the Sharjah 2010 conference
	Atlas of the Breeding Birds of Arabia	AP_ABBA_BreedingBirdsArabia	Data Digitized using: M Jennings, Atlas of the breeding birds of Arabia, Vol 25, 2010 Scanned images from book were georeferenced and then digitized. Only observations from 1984 and onwards were captured Only those birds that were within the IUCN list and were breeding birds "2" were digitized The comment field uses the description in ABBA to describe the observation type.
	Birdlife International	AP_Birdlife_ThreatenedSpecies	Bird species distribution across the Arabian Peninsula.
	IUCN	AP_IUCN_AMPHIBIANS	IUCN Red List of Threatened Species
	IUCN	AP_IUCN_Angelfish	IUCN Red List of Threatened Species
	IUCN	AP_IUCN_Butterflyfish	IUCN Red List of Threatened Species
	IUCN	AP_IUCN_Groupers	IUCN Red List of Threatened Species

Feature Dataset	Source	Feature Class	Description
	IUCN	AP_IUCN_Mammal	IUCN Red List of Threatened Species
	IUCN	AP_IUCN_Parrotfish	IUCN Red List of Threatened Species
	IUCN	AP_IUCN_Reptiles	IUCN Red List of Threatened Species
	IUCN	AP_IUCN_Wrasses	IUCN Red List of Threatened Species
	Breeding Centre for Endangered Arabian Wildlife	AP_BCEAW_HotspotsRevisited2004Lines	The biodiversity hotspots are regions known to hold especially high numbers of species found nowhere else, yet their remaining habitat combined covers a little more than two percent of Earth's land surface. According to the criteria developed by Myers et al (2000)
	Breeding Centre for Endangered Arabian Wildlife	AP_BCEAW_HotspotsRevisted2004Polygons	The biodiversity hotspots are regions known to hold especially high numbers of species found nowhere else, yet their remaining habitat combined covers a little more than two percent of Earth's land surface. According to the criteria developed by Myers et al (2000)
	Breeding Centre for Endangered Arabian Wildlife	AP_BCEAW_AllGMACarnivora	Carnivore distribution
	Breeding Centre for Endangered Arabian Wildlife	AP_BCEAW_ArabianOryx	Arabian Oryx distribution extent
	Breeding Centre for Endangered Arabian Wildlife	OmanUAE_BCEAW_ArabianTahr	Arabian Tahr distribution extent across UAE and Oman
	Breeding Centre for Endangered Arabian Wildlife	AP_BCEAW_ReptilesCompiled	Reptile information collected at Sharjah 2010 conference
	Breeding Centre for Endangered Arabian Wildlife	AP_BCEAW_SpeciesDataFromWorkshop	Species data collected from Sharjah 2010 conference
	Breeding Centre for Endangered Arabian Wildlife	AP_BCEAW_CarnivoresWgs84	Carnivore distribution
	Breeding Centre for Endangered Arabian Wildlife	AP_BCEAW_Felines	Feline distribution
	Breeding Centre for Endangered Arabian Wildlife	KSA_BCEAW_Acanthobrama_hadiyahensis	Polygon feature class representing Acanthobrama hadiyahensis in Saudi Arabia
	Breeding Centre for Endangered Arabian Wildlife	Jordan_BCEAW_Aphanius_sirhani	Polygon feature class representing Aphanius sirhani in Jordan
	Breeding Centre for Endangered Arabian Wildlife	Yemen_BCEAW_Carasobarbus_exulatus	Polygon feature class representing Carasobarbus exulatus in Yemen
	Breeding Centre for Endangered Arabian Wildlife	Yemen_BCEAW_Carasobarbus_exulatus_2	Polygon feature class representing Carasobarbus exulatus in Yemen
	Breeding Centre for Endangered Arabian Wildlife	Oman_BCEAW_Garra_dunsirei	Polygon feature class representing Carasobarbus exulatus in Oman
	Breeding Centre for Endangered Arabian Wildlife	Jordan_BCEAW_Garra_ghorensis	Polygon feature class representing Garra ghorensis in Jordan
	Breeding Centre for Endangered Arabian Wildlife	Oman_BCEAW_Garra_longipinnis	Polygon feature class representing Garra longipinnis in Jordan
	Ministry of Environment - Qatar	Qatar_MOE_Dugongs	Dugong distribution across Qatar
	Ministry of Environment - Qatar	Qatar_MOE_Habitats	Species observation data in Qatar
	Drew Gardner	UAE_Oman_DGardner_OmanUAEReptiles	Oman and UAE ASG Herp data
	The Royal Society for the Conservation of Nature	Jordan_RSCN_Crocidura_suaveolens2_1	Crocidura suaveolens distribution in Jordan
	The Royal Society for the Conservation of Nature	Jordan_RSCN_Felis_chaus_1	Felis chaus distribution in Jordan
	The Royal Society for the Conservation of Nature	Jordan_RSCN_Herpestes_ichneumon	Herpestes ichneumon distribution in Jordan
	The Royal Society for the Conservation of Nature	Jordan_RSCN_Lutra_lutra	Lutra lutra distribution in Jordan
	The Royal Society for the Conservation of Nature	Jordan_RSCN_Martes_foina	Martes foina distribution in Jordan
	The Royal Society for the Conservation of Nature	Jordan_RSCN_Mellivora_capensis	Mellivora capensis distribution in Jordan
	The Royal Society for the Conservation of Nature	Jordan_RSCN_Microtus_guentheri	Microtus guentheri distribution in Jordan
	The Royal Society for the Conservation of Nature	Jordan_RSCN_Miniopterus_pallidus	Miniopterus pallidus distribution in Jordan
	The Royal Society for the Conservation of Nature	Jordan_RSCN_Myotis_emarginatus	Myotis emarginatus disttribution in Jordan

Feature Dataset	Source	Feature Class	Description
	The Royal Society for the Conservation of Nature	Jordan_RSCN_Rhinolophus_euryale	Rhinolophus euryale distribution in Jordan
	The Royal Society for the Conservation of Nature	Jordan_RSCN_Rhinolophus_ferrumequinum	Rhinolophus ferrumequinum distribution in Jordan
	The Royal Society for the Conservation of Nature	Jordan_RSCN_Suncus_etruscus_1	Suncus etruscus distribution in Jordan
	The Royal Society for the Conservation of Nature	Jordan_RSCN_Vormela_peregusna	Vormela peregusna distribution in Jordan
	Environmental Monitoring Information System of Kuwait (eMISK)	Kuwait_eMISK_TerrestrialBiotaObservations	This layer represents the locations where wildlife of the Terrestrial Environment have been observed or monitored.
	Environmental Monitoring Information System of Kuwait (eMISK)	Kuwait_eMISK_TerrestrialBiotaDistribution	This layer represents the different extent of Terrestrial wildlife Communities for specified periods of time.
	Environmental Monitoring Information System of Kuwait (eMISK)	Kuwait_eMISK_MarineBiotaObservations	This layer represents the locations where different Marine species are sighted / documented at different times.
	Environmental Monitoring Information System of Kuwait (eMISK)	Kuwait_eMISK_MarineBiotaDistribution	This layer represents the different extents of Marine Biota Communities for specified periods of time.
	EWS-WWF	AP_EWSWWF_Turtle2011	This layer represents turtle tracking data from 2011
	EWS-WWF	AP_EWSWWF_Turtle2010	This layer represents turtle tracking data from 2010
	IUCN - CI Global Assessment Team	AP_IUCNSSC_Freshwater_Crabs	Provisional IUCN Redlist Data
	IUCN - CI Global Assessment Team	AP_IUCNSSC_Freshwater_Molluscs	Provisional IUCN Redlist Data
	Agricultural Research Authority, Taiz	Yemen_ARATaiz_Endemic_Plants	Yemen endemic plants provided originally by Abdul Wali Al Khulaidi (Agricultural Reserach Authority). Originally provided as points but has now been buffered at 500 m (ie total daimeter of 1km)
	Birdlife International	AP_Birdlife_Species_Distribution	Bird species distribution across the Arabian Peninsula.
	EWS-WWF	AP_EWSWWF_TurtleTracking	This layer represents turtle tracking distribtuion across the Arabian Peninsula
	IUCN - CI Global Assessment Team	AP_IUCNSSC_Odonata	Provisional IUCN Redlist Data
	IUCN - CI Global Assessment Team	AP_IUCNSSC_Reptiles	Provisional IUCN Redlist Data
	IUCN - CI Global Assessment Team	AP_IUCNSSC_Plants	Provisional IUCN Redlist Data
	IUCN - CI Global Assessment Team	AP_IUCNSSC_Fish	Provisional IUCN Redlist Data
Ecological Processes	EAD GISDB SDE database	AP_GISDB_Basins	HydroSHEDS was to generate key data layers to support regional and global watershed analyses, hydrological modeling, and freshwater conservation planning at a quality, resolution and extent that had previously been unachievable.
	UNEP-WCMS	AP_WCMS_Arabian_Peninsula_USGS_Mangroves	Mangrove data across the Arabian Peninsula, compiled using recently available Global Land Survey (GLS) data and the Landsat archive
	UNEP-WCMS	AP_WCMS_Mangrove1997	Mangrove data across the Arabian Peninsula
	UNEP-WCMS	AP_WCMS_seagrass05pt	Seagrass point data across the Arabian Peninsula
	UNEP-WCMS	AP_WCMS_seagrass05py	Seagrass polygon data across the Arabian Peninsula
	UNEP-WCMS	AP_WCMS_CoralReef2010	Coral reef across the Arabian Peninsula
	Ministry of Planning and International Cooperation, Government of Yemen and International Food Policy Research Institute	Yemen_FoodSecurity_Wadies	Line feature class that describes wadies in Yemen
	IUCN	AP_IUCN_CORAL	IUCN Red List of Threatened Species
	IUCN	AP_IUCN_Mangroves	IUCN Red List of Threatened Species

Feature Dataset	Source	Feature Class	Description
	IUCN	AP_IUCN_Seagrasses	IUCN Red List of Threatened Species
	Derived Layer	AP_GEBCO_Contour	Contour data derived from GEBCO data
	The Royal Society for the Conservation of Nature	Jordan_RSCN_DesertDams	Point feature class describing the location of desert dams in Jordan
	The Royal Society for the Conservation of Nature	Jordan_RSCN_Streams	Line feature class describing streams in Jordan
	The Royal Society for the Conservation of Nature	Jordan_RSCN_SurfaceWaterBasins	Polygon feature class describing surface water basins in Jordan
	Environmental Monitoring Information System of Kuwait (eMISK)	Kuwait_eMISK_CoralReefs	This layer represents the Coral Reef boundaries covered in Arabian Gulf with in international boundaries Kuwait.
	Environmental Monitoring Information System of Kuwait (eMISK)	Kuwait_eMISK_WaterBodies	This layer represents the significant ponds, lakes, and bays in Kuwait.
	Environmental Monitoring Information System of Kuwait (eMISK)	Kuwait_eMISK_Wadis	This layer represents the lines passing through the centers of the Digital Elevation Model (DEM) cells on a drainage path.
	GEBCO	EP_GEBCO_Masked_AP	Bathymetric Raster Depth Data.
	CGIAR CSI Consortium for Spatial Information	EP_SRTM90m_AP_Masked	90m Digital elevation model (global coverage) - Within BDA only AP extent
Pressures / Condition	Ministry of Planning and International Cooperation, Government of Yemen and International Food Policy Research Institute	Yemen_FoodSecuirty_UrbanCenters	Polygon feature class that describes urban footprints within districts classified as urban (CSO population census 2004)
	Ministry of Planning and International Cooperation, Government of Yemen and International Food Policy Research Institute	Yemen_FoodSecurity_MainPorts	Point feature class that describes the main sea ports in Yemen
	Ministry of Planning and International Cooperation, Government of Yemen and International Food Policy Research Institute	Yemen_FoodSecuirty_Airports	Point feature class that describes the spatial distribution of main airports in Yemen
	Ministry of Planning and International Cooperation, Government of Yemen and International Food Policy Research Institute	Yemen_FoodSecurity_RoadNetwork	Line feature class that describes road infrastructure in Yemen
	National Oceanic and Atmospheric Administration	Oman_NOAA_GasFlares	Gas Flares across Oman
	National Oceanic and Atmospheric Administration	Qatar_NOAA_GasFlares	Gas Flares across Qatar
	National Oceanic and Atmospheric Administration	SaudiArabia_NOAA_GasFlares	Gas Flares across Saudi Arabia
	National Oceanic and Atmospheric Administration	Yemen_NOAA_GasFlares	Gas Flares across Yemen
	Breeding Centre for Endangered Arabian Wildlife	Jordan_BCEAW_VilliagesAndCities	Point feature class describing villages and cities in Jordan
	Breeding Centre for Endangered Arabian Wildlife	Jordan_BCEAW_ForestsAndUrbanAreas	Polygon feature class describing forest and urban areas in Jordan
	FAO GeoNetwork	AP_Geonetwork_Roads	Line feature class of roads across the Arabian Peninsula
	FAO GeoNetwork	AP_Geonetwork_Dams_MiddleEast	Point feature class of dams across the Arabian Peninsula
	FAO GeoNetwork	AP_Geonetwork_RWDBAirports	Point feature class of airports across the Arabian Peninsula
	FAO GeoNetwork	AP_Geonetwork_RWDBPort	Point feature class of ports across the Arabian Peninsula
	The Royal Society for the Conservation of Nature	Jordan_RSCN_SelectedLandUse_Geo	Polygon feature class describing landuse in Jordan
	Environmental Monitoring Information System of Kuwait (eMISK)	Kuwait_eMISK_WasteToEnergyPlants	This layer represents the plants responsible for creating energy in the form of electricity or heat from the incineration of waste source.

Feature Dataset	Source	Feature Class	Description
	Environmental Monitoring Information System of Kuwait (eMISK)	Kuwait_eMISK_LandfillSites	This layer represents landfill sites for the disposal of waste materials.
	Environmental Monitoring Information System of Kuwait (eMISK)	Kuwait_eMISK_HazardousWasteDisposal	This layer represents the designated sites for the hazardous waste disposal including the industrial wastes as well as other waste types (oil spills, contaminated soils, dredged materials, etc.).
	Environmental Monitoring Information System of Kuwait (eMISK)	Kuwait_eMISK_LandUse2010	This layer represents the land use in Kuwait (2010), further differentiating built-up areas into certain types. In contrast to the Land Cover feature class, which is addressing the natural environment, this layer is dealing with settlement areas.
	Ministry of Environment - Qatar	Qatar_MoE_PolicyPlanPlot	This layer represents development across Qatar both future and current developments.
	Ministry of Environment - Qatar	Qatar_MoE_RightOfWay	This layer represents rights of way across Qatar including current and future development.
	Public Commission for the Protection of Marine Resources, Environment & Wildlife	Bahrain_PCPMREW_OysterBeds	This layer represents Oyster Beds in Bahrain, captured as point feature class
	SeaAroundUs	PC_Seaaroundus_dem_d	Raster dataset describing demersal destructive
	SeaAroundUs	PC_Seaaroundus_dem_nd_hb	Raster dataset describing demersal non-destructive high bycatch
	SeaAroundUs	PC_Seaaroundus_dem_nd_lb	Raster dataset describing non-demersal destructive low bycatch
	SeaAroundUs	PC_Seaaroundus_pel_hb	Raster dataset describing pelagic high bycatch
	SeaAroundUs	PC_Seaaroundus_pel_lb	Raster dataset describing pelagic low bycatch
Protected Areas	EAD GISDB SDE database	AP_GISDB_ProtectedAreasArabPenuns	Polygon feature class describing protected areas across the Arabian Peninsula, collected at Sharjah 2010 conference.
	Ministry of Environment - Qatar	Qatar_MOE_ProtArea	Polygon feature class describing protected areas across Qatar
	The Royal Society for the Conservation of Nature	Jordan_RSCN_Established_and_Proposed_reserves	Polygon feature class describing established and proposed reserves in Jordan
	The World Database on Protected Areas (WDPA). UNEP-WCMC. Cambridge, UK. www.protectedplanet.net	Bahrain_ProtectedPlanet_BahrainPAs	Polygon feature class representing protected areas in Bahrain.
	The World Database on Protected Areas (WDPA). UNEP-WCMC. Cambridge, UK. www.protectedplanet.net	Jordan_ProtectedPlanet_JordanPAs	Polygon feature class representing protected areas in Jordan.
	The World Database on Protected Areas (WDPA). UNEP-WCMC. Cambridge, UK. www.protectedplanet.net	Kuwait_ProtectedPlanet_KuwaitPAs	Polygon feature class representing protected areas in Kuwait.
	The World Database on Protected Areas (WDPA). UNEP-WCMC. Cambridge, UK. www.protectedplanet.net	Oman_ProtectedPlanet_OmanPAs	Polygon feature class representing protected areas in Oman.
	The World Database on Protected Areas (WDPA). UNEP-WCMC. Cambridge, UK. www.protectedplanet.net	KSA_ProtectedPlanet_KSAPAs	Polygon feature class representing protected areas in KSA.
	The World Database on Protected Areas (WDPA). UNEP-WCMC. Cambridge, UK. www.protectedplanet.net	Yemen_ProtectedPlanet_YemenPAs	Polygon feature class representing protected areas in Yemen.
	Environmental Monitoring Information System of Kuwait (eMISK)	Kuwait_eMISK_TerrestrialProtectedAreas	This layer represents the boundaries of the areas designated to be Terrestrial conservations.

Feature Dataset	Source	Feature Class	Description
	Environmental Monitoring Information System of Kuwait (eMISK)	Kuwait_eMISK_MarineProtectedAreas	This layer represents the boundaries of the Marine Protected Areas designated for Biodiversity conservation.
	The Royal Society for the Conservation of Nature	Jordan_RSCN_SCAinJordan	This layer represents Special Conservation Areas in Jordan
	Environment Society of Oman	Oman_ESO_JebelAkdharReserve	This layer represents Jebel Akhdar protected area in Oman.
	Public Commission for the Protection of Marine Resources, Environment & Wildlife	Bahrain_PCPMREW_BulthamaPA	This layer represents Bulthama protected area in Bahrain.
	David Insall	Oman_DavidInsall_JebelAkhdar	This layer represents Jebel Akhdar protected area in Oman.
	Saudi Wildlife Authority	KSA_SWA_Uraq_Bani_Ma_arid_correct_boundaries	This layer represents Uraq Bani Ma'arid protected area in KSA.
	Saudi Wildlife Authority	KSA_SWA_AlGhat_Nat_park	This layer represents Al Ghat National Park in KSA.
	Saudi Wildlife Authority	KSA_SWA_Existing_PAs_Other_Agencies	This layer represents existing protected areas managed by other authorities other than Saudi Wildlife Authority.
	Saudi Wildlife Authority	KSA_SWA_Existing_PAs_SWC	This layer represents existing protected areas managed by Saudi Wildlife Authority.
	EAD GISDB SDE database	AP_GISDB_CombinedImportantBirdArea	Identify the Important Bird Areas within the Arabian Peninsula for use within a rapid conservation assessment, collected from different sources at Sharjah 2010 conference.
	Birdlife Middle East	YEMEN_BirdlifeME_BirdWetlandAreas	Created from Richard Porters documents and coordinates to create wetland bird areas for Yemen.
	Birdlife International	AP_BirdlifeInt_IBAPoly	Important bird area polygon
	Birdlife International	AP_BirdlifeInt_IBAPoint	Important bird area points
	Breeding Centre for Endangered Arabian Wildlife	Jordan_BCEAW_EstablishedAndProposedReservesGeo	Polygon feature class describing established and proposed reserves in Jordan
	Breeding Centre for Endangered Arabian Wildlife	Jordan_BCEAW_ImportantBirdAreas	Polygon feature class describing important bird areas in Jordan
	Breeding Centre for Endangered Arabian Wildlife	AP_BCEAW_OtherIdentifiedPriorityAreas	Polygon feature class describing priority areas across the Arabian Peninsula, collected at Sharjah 2010 conference
	The Royal Society for the Conservation of Nature	Jordan_RSCN_Important_Bird_Areas	Polygon feature class describing important bird areas in Jordan
	The Royal Society for the Conservation of Nature	Jordan_RSCN_Special_Conservation_Areas	This layer represents Special Conservation Areas in Jordan
Opportunities / Constraints	Environmental Monitoring Information System of Kuwait (eMISK)	Kuwait_eMISK_FerryTerminals	This layer represents the ports/harbors as point features.
	Environmental Monitoring Information System of Kuwait (eMISK)	Kuwait_eMISK_Greenery	This layer represents the green areas inside urban areas (such as planting trees alongside and in the islands of major roads, parks, gardens), greenery projects, irrigation management, maintenance and so on.
	Environmental Monitoring Information System of Kuwait (eMISK)	Kuwait_eMISK_MasterPlanAreas2005	This layer represents the area features of Kuwait master plan 2005.
	M. Hall, P. Scholte, A. W. Al-Khulaidi, A. G. Miller, A. H. Al-Qadasi, A. Al-Farhan and T. M. Al-Abbasi (2009). ARABIA'S LAST FORESTS UNDER THREAT II: REMAINING FRAGMENTS OF UNIQUE VALLEY FOREST IN SOUTHWEST ARABIA. Edinburgh Journal of Botany, 66, pp 263-281. doi:10.1017/S0960428609005460.	Yemen_MHall_ImptPlantAreas	This layer represents important plant areas in Yemen as discussed in ARABIA'S LAST FORESTS UNDER THREAT II: REMAINING FRAGMENTS OF UNIQUE VALLEY FOREST IN SOUTHWEST ARABIA
	Birdlife International	AP_BirdlifeInternational_MarineIBA	This layer represents marine important bird areas across the Arabian Peninsula.
	Agricultural Research Authority, Taiz	Yemen_ARATaiz_Location_Map	This layer represents protected areas and proposed protected areas across Yemen.

Feature Dataset	Source	Feature Class	Description
	The Royal Society for the Conservation of Nature	Jordan_RSCN_Reserves_Buffer_Zone	This layer represents buffer zones for nature reserves in Jordan
	Saudi Wildlife Authority	KSA_SWA_Propsed_PAs_Other_Agencies	This layer represents proposed protected areas managed by other agencies
	Saudi Wildlife Authority	KSA_SWA_Propsed_PAs_SWC	This layer represents proposed protected areas managed by Saudi Wildlife Authority
	Rebecca Klaus - Independent	AP_RebeccaKlaus_MPA_Site_Locations	This layer represents in points proposed and protected areas across the Arabian Peninsula
Other Layers	Derived Layer	AP_Planning_Domain	Derived extent of planning domain for MARXAN analysis
	Derived Layer	AP_Planning_Units	Derived extent of planning units for MARXAN analysis
	VLIZ Maritime Boundaries Geodatabase	AP_VLIZ_WorldEEZ_v6	Maritime boundaries of the world

Appendix B.1

Arabian Peninsula Habitat Map

Arabian Peninsula Ecological Habitat Map

The habitat classification is derived from Othman Llewellyn's (Saudi Wildlife Authority) draft, bioregional classification of Saudi Arabia.
It has been used as a model to extend across the Arabian Peninsula.

Data Sources: USGS, SRTM, ICARDA, EAD, Qatar MoE, eMISK, GEBCO, UNEP-WCMC, Diva-GIS.org and El-Eisawi (1996).

Legend

1. Islands.Islands - Arabian (Persian) Gulf
2. Islands.Islands - Gulf of Aden
3. Islands.Islands - Gulf of Oman
4. Islands.Islands - Northern and Central Red Sea
5. Islands.Islands - Southern Red Sea
6. Islands.Islands - Western Arabian Sea
7. Islands.Socotra Archipelago
8. Coastal.Oman Coastal Plain
9. Coastal.Gulf Coastal Sabkha and Sabkha Matti
10. Coastal.Northern Gulf Coastal Plain
11. Coastal.Red Sea Coastal Plain and Sabkha
12. Coastal.Southern Coastal Plain
13. Coastal.Southern Gulf Coastal Plain
14. Coastal.Tihamah Coastal Plain
15. Inland Plains and Sabkha.Ad-Dibdibah / Kuwait Alluvial Plain
16. Inland Plains and Sabkha.At-Taysiyah Limestone Plain
17. Inland Plains and Sabkha.Central Limestone Plain and Low Cuesta
18. Inland Plains and Sabkha.Central Sand Plain
19. Inland Plains and Sabkha.Central Yemen Plain
20. Inland Plains and Sabkha.Eastern Desert Plain
21. Inland Plains and Sabkha.Eastern Gravel Plain
22. Inland Plains and Sabkha.Huqf - Plain, Outcrop and Dune
23. Inland Plains and Sabkha.Inland Sabkha
24. Inland Plains and Sabkha.Najd Pediplain
25. Inland Plains and Sabkha.Northern Sandstone Plain and Plateau
26. Inland Plains and Sabkha.Western Sandstone Plain and Plateau
27. Sand Sheets and Dunes.Ad-Dahna Dune, Sand Sheet and Plain Mosaic
28. Sand Sheets and Dunes.Al-Jafurah Sand Dune
29. Sand Sheets and Dunes.An-Nafud al-Kabir Sand Dune
30. Sand Sheets and Dunes.Ar-Rub al-Khali Sand Dune
31. Sand Sheets and Dunes.Ar-Rub al-Khali Sand Massif and Sabkha
32. Sand Sheets and Dunes.Central Nafuds Sand Dune
33. Sand Sheets and Dunes.Eastern Sand Sheet and Dune
34. Sand Sheets and Dunes.Wahiba Sand Dune
35. Plateaus.As-Summan Limestone Plateau
36. Plateaus.Dhofar Plateau
37. Plateaus.Hadramaut Plateau
38. Plateaus.Hisma Plateau
39. Plateaus.Najran - Asir Plateau
40. Plateaus.Northern Limestone Plateau
41. Plateaus.Yemen Precambrian Plateau
42. Igneous.Central Volcanic Outcrop
43. Igneous.Najd Pediplain - Granitic Outcrop
44. Igneous.Najd Pediplain - Pyroclastic Outcrop
45. Igneous.Northern Volcanic Outcrop
46. Igneous.Yemen Volcanic Outcrop
47. Mountains and Hills.Asir Mountains - above 2000m
48. Mountains and Hills.Asir Mountains - Juniper Woodland
49. Mountains and Hills.Asir Mountains - 1500m to 2000m
50. Mountains and Hills.Asir Mountains - 800m to 1500m
51. Mountains and Hills.Asir Mountains - Eastern Slope
52. Mountains and Hills.Monsoon-affected Vegetation - above 1000m
53. Mountains and Hills.Monsoon-affected Vegetation - 500m to 1000m
54. Mountains and Hills.Monsoon-affected Vegetation - below 500m
55. Mountains and Hills.Hajar Mountains - Carbonate - below 500m
56. Mountains and Hills.Hajar Mountains - Jebel Hafit
57. Mountains and Hills.Hajar Mountains - Musandam - above 1000m
58. Mountains and Hills.Hajar Mountains - Musandam - 500m to 1000m
59. Mountains and Hills.Hajar Mountains - Musandam - below 500m
60. Mountains and Hills.Hajar Mountains - Eastern - above 1000m
61. Mountains and Hills.Hajar Mountains - Eastern - 500m to 1000m
62. Mountains and Hills.Hajar Mountains - Western - above 2000m
63. Mountains and Hills.Hajar Mountains - Western - 1000m to 2000m
64. Mountains and Hills.Hajar Mountains - Western - 500m to 1000m
65. Mountains and Hills.Hajar Mountains - below 500m
66. Mountains and Hills.Hijaz Hills and Mountains - above 1500m
67. Mountains and Hills.Hijaz Hills and Mountains - below 1500m
68. Mountains and Hills.Jabal Shammar
69. Mountains and Hills.Jabal Tuwayq
70. Mountains and Hills.Madyan Mountains - above 1000m
71. Mountains and Hills.Madyan Mountains - below 1000m
72. Mountains and Hills.Tihamah Foothills - below 500m
73. Mountains and Hills.Yemen Highlands - above 2000m
74. Mountains and Hills.Yemen Highlands - 1000m to 2000m
75. Mountains and Hills.Yemen Highlands - 500m to 1000m
76. Jordan.Forest and Non-forest
77. Jordan.Steppe
78. Jordan.Acacia and Rocky Sudanian
79. Arabian (Persian) Gulf,Algal Mats
80. Arabian (Persian) Gulf,Coral Reef
81. Arabian (Persian) Gulf,Deeper than 15m
82. Arabian (Persian) Gulf,Mangroves
83. Arabian (Persian) Gulf,Other Shallow Water
84. Arabian (Persian) Gulf,Rocky Platforms
85. Arabian (Persian) Gulf,Saltmarsh
86. Arabian (Persian) Gulf,Seagrass / macro-algal beds
87. Arabian (Persian) Gulf,Tidal flats (no algal mats)
88. Gulf of Aden,Coral Reef
89. Gulf of Aden,Deeper than 15m
90. Gulf of Aden,Mangroves
91. Gulf of Aden,Other Shallow Water
92. Gulf of Aden,Seagrass / macro-algal beds
93. Gulf of Oman,Coral Reef
94. Gulf of Oman,Deeper than 15m
95. Gulf of Oman,Mangroves
96. Gulf of Oman,Other Shallow Water
97. Northern and Central Red Sea,Coral Reef
98. Northern and Central Red Sea,Deeper than 15m
99. Northern and Central Red Sea,Mangroves
100. Northern and Central Red Sea,Other Shallow Water
101. Northern and Central Red Sea,Seagrass / macro-algal beds
102. Southern Red Sea,Coral Reef
103. Southern Red Sea,Deeper than 15m
104. Southern Red Sea,Mangroves
105. Southern Red Sea,Other Shallow Water
106. Southern Red Sea,Seagrass / macro-algal beds
107. Western Arabian Sea,Coral Reef
108. Western Arabian Sea,Deeper than 15m
109. Western Arabian Sea,Mangroves
110. Western Arabian Sea,Other Shallow Water

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Appendix B. 2

Arabian Peninsula Habitat Condition Map

Arabian Peninsula Habitat Condition Map

1:9,500,000

Legend

Terrestrial

- Natural
- Degraded
- Transformed

Marine

- Good
- Fair
- Poor

Data Sources: EAD, Qatar MoE, eMISK, Protected, RSCN, Food Security Council, Google Earth desktop data capture,
UAE derived habitat condition layer, Qatar Petroleum, Middle East Geospatial Forum and Library of Congress (American Memory website).

Appendix B.3

Arabian Peninsula Protected Areas Map

Arabian Peninsula Protected Areas Map

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Data Sources for PA Layer: EAD, Qatar MoE, eMISK, Protected Planet, RSCN, BCEAW, Fujairah Municipality, David Insall, Bahrain PCPMREW, SWA, Sana University and ARA, Taiz.

Appendix B.4

Arabian Peninsula Opportunities and Constraints Summary

Summary of Arabian Peninsula Opportunities and Constraints Data and Values

Type	Capture Source	Value	Description
Constraint	Confirmed by Abdulqauder Khamis during the AP LNR Workshop Nov2012	-3	Reclaimed and dredged areas locations given by Abdul Qauder Khamis at the Regional Technical Workshop.
Constraint	(Bahrain 0-2) Constraints data (degraded coral reef) marked up on map PA5 during Regional Technical Workshop	-3	Degraded coral locations identified at the Regional Technical Workshop.
Constraint	(OM-CM1) Confirmed by Robert Baldwin during AP LNR Workshop Nov2012	-3	Airport under construction identified at Regional Technical Workshop.
Constraint	(OM-CM1) Confirmed by Robert Baldwin during the AP LNR Workshop Nov2012	-3	Large coastal development identified at the Regional Technical Workshop
Constraint	(OM-CM1) Confirmed by Robert Baldwin during the AP Workshop Nov2012	-3	Coastal road construction identified at the Regional Technical Workshop
Constraint	AD_ADACH_Plan_AlAin2030_UrbanGrowthBoundary	-3	Boundary of planned future development in Al Ain as specified in Al Ain 2030 Plan.
Constraint	AD_ADCO_LandUseConcessionArea	-3	Boundary of ADCO's concession area (land only).
Constraint	AD_ADCO_LanUseOilfields	-3	Location of ADCO's oil fields (land).
Constraint	AD_DMA_PlanPlots	-3	Planned development plots within the Municipality of Abu Dhabi.
Constraint	AD_EEBDB_DevelopInfraProject	-3	Location of development sites in Abu Dhabi where environmental permit applications have been submitted to EAD - some are completed, some construction and some are proposed.
Constraint	AD_UPC_AD2030Boundary	-3	Location of future development sites as given in 2030 plan provided by UPC.
Constraint	AD_UPC_DevProject	-3	Location of development sites in Abu Dhabi which have been submitted to UPC - some are completed, some construction and some are proposed.
Constraint	Data Capture from Google Earth, Sept 2012. Future Developments	-3	Location of future developments captured using Google Earth.
Constraint	Data Supplied by UPC, Al Gharbia 2030 Plan	-3	Boundary of planned future development in Al Gharbia as provided by UPC.
Constraint	Digitized based on Bahrain National Planning Dev Strategies (Phase 2:2010-2020)	-3	Location of Bahrain National Planning Development Strategies.
Constraint	Dubai_DubaiCentreGIS_Dubai2020_MajorProjects	-3	Boundary of planned future development in Dubai as specified in Major Projects Plan.
Constraint	eMISK Masteplan Areas 2005	-3	Location of Master Plan sites across Kuwait.
Constraint	Etihad Railway proposed line, taken from website 29/08/2012	-3	Location of proposed Etihad Railway line across the UAE.
Constraint	Qatar MoE Policy Plan Plot	-3	Planned development across Qatar provided by the Qatar Ministry of Environment.
Constraint	UAE_GISDB_EIAFootprints	-3	Locations of development sites where EIAs have been received by EAD - includes Abu Dhabi and the Abu Dhabi to Fujairah pipeline.
Constraint	UAE_GISDB_Oilfields	-3	Locations of oilfields in the UAE.
Constraint	UAE_GoogleCapture_NEFutureDevelopments	-3	Future developments in the Northern Emirates of the UAE captured using Google Earth.
Constraint	UQA_UQAM_PlannedDevelopment	-3	Location of planned development sites within the Emirate of Um al Quwain.
Opportunity	AD_ADACH_CulturalFacilities	1	Location of Cultural facilities across the Emirate of Abu Dhabi.
Opportunity	AD_GISDB_Bird	1	Location (points) of bird monitoring sites in Abu Dhabi.
Opportunity	AD & UAE Species Workshop	2	Important species locations identified at UAE and AD Workshop.
Opportunity	AD_ADACH_archaeological_sites	2	Archaeological important sites in Abu Dhabi.
Opportunity	AD_ADACH_liwa_forts	2	Archaeological structures of importance in Liwa in Abu Dhabi.
Opportunity	AD_ADACH_murawah	2	Archaeological important sites on Murawah Island in Abu Dhabi.
Opportunity	AD_ADCO_Archaeology_Buffer	2	Buffer zones around archaeological important sites within ADCO's concession area.
Opportunity	AD_CMRECS_Archaeology_Sites	2	Location of archaeological important sites within the Emirate of Abu Dhabi.
Opportunity	AD_GISDB_Archaeology	2	Location of archaeological important sites within the Emirate of Abu Dhabi.
Opportunity	No Commercial Fishing Area in Kuwait Marine, Captured from drawing Kuwait P-01	2	Location of restricted fishing areas in Kuwait.
Opportunity	UAE_UAQM_Archaeology	2	Location of archaeological important sites within the Emirate of Um al Quwain.
Opportunity	AD & UAE Species Workshop	3	Important species locations identified at UAE and AD Workshop.
Opportunity	AD_ADACH_AlAinWHSBoundaries	3	Location of World Heritage Sites in Al Ain.
Opportunity	AD_ADACH_AlAinWHSBufferZones	3	Buffer zones around World Heritage Sites in Al Ain.
Opportunity	AD_CMRECS_FishingRightBoundaries	3	Location (polygons) of private traditional fishing areas i.e. where commercial fishing is not allowed (mainly around the Abu Dhabi islands).
Opportunity	AD_EEBDB_BuhoorArea	3	Location (points) of private traditional fishing areas i.e. where commercial fishing is not allowed (mainly around the Abu Dhabi islands).
Opportunity	AD_TDIC_Saadiyat_Dune_Protection_Zone	3	Location of one dune protection zone on Saadiyat Island in Abu Dhabi.
Opportunity	AD_UPC_CoastalConservationZone	3	Location of UPC proposed coastal conservation zones in Emirate of Abu Dhabi.
Opportunity	AD_UPC_CoastalPark	3	Location of UPC proposed coastal park in Emirate of Abu Dhabi.
Opportunity	AD_UPC_CoastalStewartshipZone	3	Location of UPC proposed coastal stewardship zone in Emirate of Abu Dhabi.
Opportunity	AD_UPC_NatureReserve	3	Locations of proposed nature reserves in the Emirate of Abu Dhabi.
Opportunity	AD_UPC_ProtectedAreas	3	Locations of proposed Protected Areas in the Emirate of Abu Dhabi.
Opportunity	BCEAW Established and Proposed Reserves	3	Locations of proposed Protected Areas across the Arabian Peninsula.
Opportunity	BCEAW Other Identified Priority Areas	3	Locations of priority areas identified at Sharjah 2010 workshop.
Opportunity	Birdlife International IBAs	3	Location of Important Bird Areas across the Arabian Peninsula.
Opportunity	Birdlife International Marine IBA	3	Location of Marine Important Bird Areas across the Arabian Peninsula.
Opportunity	Confirmed by Ehab Eid (RSCN) APWorkshop Nov2012	3	Location of Shoubak Proposed Protected Area identified at Regional Technical Workshop.
Opportunity	Confirmed by Othman Llewelyn APWorkshop Nov2012	3	Location of Al-Jandaliyah identified at Regional Technical Workshop.
Opportunity	Digitized (Nov 2012) using M. Hall et.al, CMEP	3	Important Wadis for biodiversity identified by M Hall et al.
Opportunity	Dubai_BCEAW_DubaiConservationAreas	3	Proposed conservation areas in Dubai as provided by Breeding Centre for Endangered Arabian Wildlife.
Opportunity	eMISK Kuwait Masterplan 2005	3	Master plan locations across Kuwait supplied by eMISK
Opportunity	eMISK Marine Proposed Protected Area	3	Location of marine proposed Protected Areas in Kuwait supplied by eMISK.
Opportunity	eMISK Terrestrial Proposed Protected Area	3	Location of terrestrial proposed Protected Areas in Kuwait supplied by eMISK.
Opportunity	Fareed Krupp from Qatar Natural History Museum	3	Location of important opportunity sites across the Arabian Peninsula identified by Fareed Krupp at the Regional Technical Workshop.

Summary of Arabian Peninsula Opportunities and Constraints Data and Values

Type	Capture Source	Value	Description
Opportunity	KMZ file provided by David Insall via email post workshop	3	Location of wadi Al Sareen Nature Reserve given by David Insall.
Opportunity	Qatar MoE	3	Al Sheehaniya supplied by Qatar Ministry of Environment.
Opportunity	Richard Porter from Birdlife Middle East	3	Important wetland sites supplied by Richard Porter.
Opportunity	RSCN Special Conservation Areas	3	Special Conversation Areas in Jordan supplied by Nathalia Boulad of RSCN.
Opportunity	Saudi Wildlife Authority & Environmental Balance Establishment	3	Identification of important sites across the Arabian Peninsula identified at the Regional Technical Workshop.
Opportunity	Shapefile provided by Abdul Wali Al Khulaidi via email post workshop	3	Important Dugong, BAPCO special management site and Green Belt identified by Abdul Wali Al Khuladi.
Opportunity	Shapefile provided by RSCN on 19/12/2012.	3	Buffer zones around established and proposed Protected Areas in Jordan supplied by RSCN.
Opportunity	Shapefile provided by SWA via Dropbox post workshop on 19/12/2012	3	Proposed Protected Areas managed by other Authorities across Saudi Arabia supplied by Saudi Wildlife Authority.
Opportunity	SWA OL Bioregional Classification	3	Important habitat site in Najran Highlands identified by Othman at Regional Technical Workshop.
Opportunity	UAE_BCEAW_ProtectedAreas	3	Proposed conservation areas in UAE as provided by Breeding Centre for Endangered Arabian Wildlife.
Opportunity	UAE_EAD_BirdWetlandLocations	3	Locations of proposed bird wetland areas in the UAE.
Opportunity	UAE_GISDB_PearlDiving	3	Locations of pearl diving sites (i.e. oyster beds) in UAE.
Opportunity	WadiUrayah_FujMunicipality_BufferZone	3	Location of buffer zone around Wadi Urayah Protected Area in Fujairah.
Opportunity	WadiUrayah_FujMunicipality_EcoTourismZone	3	Location of proposed ecotourism zone around Wadi Urayah Protected Area in Fujairah.
Opportunity	Proposed_MPA_Prioirty_Coral_Reefs	3	Location of proposed marine Protected Areas and priority coral reef sites around te Arabian Peninsula supplied by ROPME.

Appendix B.5

Arabian Peninsula Planning Unit Cost Map

Arabian Peninsula Planning Unit Costs Map

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Legend

- Lowest cost
- Highest Cost
- Protected Areas
- World Physical Map

Appendix C.1

Arabian Peninsula Ecosystem Threat Status Map

Arabian Peninsula Ecosystem Threat Status Map

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Legend

- Critically Endangered
- Endangered
- Vulnerable
- Least Threatened

Appendix C.2

Arabian Peninsula Ecosystem Protection Level Map

Arabian Peninsula Ecosystem Protection Level Map

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Legend

- Protected Areas
- Not Protected
- Poorly protected
- Moderately protected
- Well protected

Appendix C.3

Arabian Peninsula MARXAN Site Selection Frequency Map

Arabian Peninsula MARXAN Selection Frequency Map

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Legend

MARXAN Selection Frequency

- 0 - 11
- 12 - 19
- 20 - 26
- 27 - 35
- 36 - 46
- 47 - 58
- 59 - 69
- 70 - 80
- 81 - 92
- 93 - 100
- Protected Areas
- Transformed

Appendix C.4

Arabian Peninsula PFAs Overlaid on the MARXAN Selection Frequency Map

Arabian Peninsula Priority Focus Areas overlaid on the MARXAN Selection Frequency Map

1:9,500,000

Legend

- Prioirty Focus Areas
- Protected Areas
- Transformed

MARXAN Selection Frequency

- 0 - 11
- 12 - 19
- 20 - 26
- 27 - 35
- 36 - 46
- 47 - 58
- 59 - 69
- 70 - 80
- 81 - 92
- 93 - 100

Appendix C.5

Arabian Peninsula Priority Areas Map

Arabian Peninsula Priority Focus Areas Map

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Legend

- Protected Areas
- Transformed

Priority Focus Areas

- 'Uruq Bani Ma'arid Protected Area
- Ad Dimaniyat Islands and Oman Coastal Plain
- Al-Khunfah Protected Area
- Arabian Gulf Islands
- Arabian Oryx Protected Area, Oman
- Arabian Oryx Protected Area, UAE
- Asir Mountains and Yemen Highlands, Tihamah and Southern Red Sea Marine and Coast
- At-Tubayq Protected Area
- Belhaf Marine
- Central Limestone Plain and Low Cuesta
- Eastern Ar-Rub' al-Khali Inland Sabkha
- Gulf Coast and Marine
- Hadramaut Plateau and Coastal Plain
- Hafr al-Batin and Al Jandaliyah Protected Area
- Hajar Mountains
- Harrat al-Harrah Protected Area
- Hijaz Hills and Mountains and Central Red Sea Coast
- Jabal Ajar and An-Nafud al-Kabir Sand Dune
- Jabal Tuwayq
- Jordan Volcanic Outcrops and Limestone Plateau
- Kuwait Plain and Coast
- Madyan Mountains and Southern Jordan Coast and Upland
- Majami' al-Hadb Protected Area
- Masirah Island Coastal and Marine
- Musandam and Northern UAE Mosaic
- Najd Pediplain Igneous Outcrop
- Northern Gulf Coast and Marine
- Northern Jordan Forest and Steppe
- Northern Red Sea and Coastal Plain
- Oman Desert Oases
- Ra's Al Hadd Protected Area
- Saja/Umm Al-Rimth and Mahazat as- Sayd Protected Area
- Socotra Archipelago
- Western Oman and Eastern Yemen Mosaic
- Yemen Volcanics and Gulf of Aden Coast

Appendix C.6

Arabian Peninsula Potential Ecosystem Protection Level Map

Arabian Peninsula Potential Ecosystem Protection Level Map

N
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1:9,500,000

Legend

- Prioirty Focus Areas
- Protected Areas

Potential Protection Level

- Not protected
- Poorly protected
- Moderately protected
- Well protected

Appendix D

Summary of PFAs Expert Evaluation

Summary of Expert Evaluation of Arabian Peninsula Priority Focus Areas

		Biodiversity Value			BV combined	Urgency of Implementation			Urgency combined	Ease of Implementation			Ease combined	All Combined	Group Ranking	Transboundary
Priority Area	**Amended Name**	**Gr1**	**Gr2**	**Gr3**		**Gr1**	**Gr2**	**Gr3**		**Gr1**	**Gr2**	**Gr3**				
Madyan Mountains and Southern Jordan Coast and Upland		1	1	1	1.0	1	1	1	1.0	1	1	2	1.3	1.11	Highest	Transboundary
Masirah Island Coastal and Marine		1	1	1	1.0	2	1	1	1.3	1	2	1	1.3	1.22	Highest	
Gulf Coast and Marine		1	1	1	1.0	1	1	1	1.0	2	1	2	1.7	1.22	Highest	Transboundary
Hajar Mountains		1	1	1	1.0	1	1	1	1.0	2	2	2	2.0	1.33	Highest	Transboundary
Hijaz Hills and Mountains and Central Red Sea Coast		1	1	2	1.3	1	1	1	1.0	2	1	2	1.7	1.33	Highest	
Northern Jordan Forest and Steppe		1	1	1	1.0	1	1	1	1.0	1	3	2	2.0	1.33	Highest	
Northern Red Sea and Coastal Plain		1	1	1	1.0	1	2	2	1.7	1	1	2	1.3	1.33	Highest	
Asir Mountains and Yemen Highlands, Tihamah and Southern Red Sea Marine and Coast		1	1	1	1.0	1	1	2	1.3	1	3	2	2.0	1.44	Highest	Transboundary
Ad Dimaniyat Islands and Oman Coastal Plain		2	2	1	1.7	2	1	2	1.7	1	1	1	1.0	1.44	Highest	
Jabal Shammar and An-Nafud al-Kabir Sand Dune	Jabal Ajar and An-Nafud al-Kabir Sand Dune	1	2	2	1.7	1	2	2	1.7	1	1	1	1.0	1.44	Highest	
Socotra Archipelago		1	1	1	1.0	1	2	1	1.3	2	3	2	2.3	1.56	Highest	
Western Oman and Eastern Yemen Mosaic		1	1	1	1.0	1	2	1	1.3	2	2	3	2.3	1.56	Highest	Transboundary
Arabian Gulf Islands		2	1	2	1.7	2	1	1	1.3	2	1	3	2.0	1.67	Medium	
Majami' al-Hadb Protected Area		1	2	2	1.7	2	1	2	1.7	2	1	2	1.7	1.67	Medium	
Northern Gulf Coast and Marine		1	2	1	1.3	1	1	2	1.3	2	3	2	2.3	1.67	Medium	Transboundary
Mijdahah Marine	Belhaf Marine	1	2	1	1.3	1	1	1	1.0	3	3	3	3.0	1.78	Medium	
Kuwait Plain and Coast		2	3	2	2.3	2	1	1	1.3	2	1	2	1.7	1.78	Medium	
Hadramaut Plateau and Coastal Plain		2	2	2	2.0	1	1	1	1.0	2	3	3	2.7	1.89	Medium	
Musandam and Northern UAE Mosaic		2	1	2	1.7	2	1	1	1.3	2	3	3	2.7	1.89	Medium	
Yemen Volcanics and Gulf of Aden Coast		2	1	2	1.7	2	1	2	1.7	3	2	3	2.7	2.00	Medium	
Arabian Oryx Protected Area, Oman		2	2	2	2.0	2	1	1	1.3	3	3	3	3.0	2.11	Low	
Harrat al-Harrah Protected Area		3	3	3	3.0	2	2	2	2.0	1	1	2	1.3	2.11	Low	
Saja/Umm Al-Rimth and Mahazat as- Sayd Protected Area		3	3	2	2.7	2	3	3	2.7	1	1	1	1.0	2.11	Low	
At-Tubayq Protected Area		3	3	3	3.0	3	2	3	2.7	1	1	1	1.0	2.22	Low	
Jabal Tuwayq		2	3	3	2.7	3	2	3	2.7	2	1	1	1.3	2.22	Low	
Ra's Al Hadd Protected Area		3	3	3	3.0	2	3	3	2.7	1	1	1	1.0	2.22	Low	
Al-Khunfah Protected Area		3	3	3	3.0	3	3	2	2.7	2	1	1	1.3	2.33	Low	
Jordan Volcanic Outcrops and Limestone Plateau		2	2	2	2.0	2	3	2	2.3	3	3	2	2.7	2.33	Low	
Najd Pediplain Igneous Outcrop		2	2	3	2.3	3	2	3	2.7	2	2	2	2.0	2.33	Low	
'Uruq Bani Ma'arid Protected Area		3	3	2	2.7	3	3	3	3.0	1	2	1	1.3	2.33	Low	
Oman Desert Oases		3	2	3	2.7	2	2	2	2.0	3	2	3	2.7	2.44	Low	
Arabian Oryx Protected Area, UAE		2	3	3	2.7	2	1	2	1.7	3	3	3	3.0	2.44	Low	
Eastern Ar-Rub' al-Khali Inland Sabkha		3	2	3	2.7	3	1	3	2.3	3	3	2	2.7	2.56	Low	Transboundary
Central Limestone Plain and Low Cuesta		3	3	3	3.0	3	2	2	2.3	3	2	2	2.3	2.56	Low	
Oman Deep Marine		2	3	3	2.7	3	3	2	2.7	3	3	3	3.0	2.78	Low	
Hafr al-Batin and Al Jandaliyah Protected Area		3	3	3	3.0	3	3	3	3.0	3	3	3	3.0	3.00	Low	