IPA Habitat Mapping

Centre for Middle Eastern Plants
PART OF THE ROYAL BOTANIC GARDEN EDINBURGH

Habitat Mapping in the south and east Mediterranean region

A brief situation analysis

IUCN

Plantlife

MAVA
FONDATION POUR LA NATURE

Summary

A variety of sources of information were researched to ascertain what information is currently available about habitat and vegetation classification and mapping in Algeria, Lebanon and Morocco, and whether these sources of information could be used in habitat classification and mapping appropriate at the scale of Important Plant Areas (IPAs) across the south and east Mediterranean region.

Sources of information came from published floras and scientific articles, online databases and website contents including spatial resources, and contact with a selection of colleagues as to unpublished sources or data not in the public domain. Species occurrence data availability was also assessed.

In general, despite some detailed local studies, this exercise revealed little published and comparable data that could be currently used in any sort of formal or comparative analyses at a national, regional or IPA scale. In contrast, the potential to use freely available data sources to compile Potential Natural Vegetation maps was judged to be an appropriate and relevant first step. Additional floristic and habitat data alongside expert opinion at the IPA scale can be used to capture habitats not defined using global spatial environmental and bioclimatic data. Additional data would be available to assist in planning, prioritisation and management zoning in identified IPAs. These data and methods may also be useful in refining current IPA selections at the national level.

Introduction: approaches to habitat definition

Experience in a range of collaborative programmes has revealed that while habitat mapping is often cited as a useful pre-requisite for management planning and zoning, it is rare for individual programmes to describe and identify what is meant by the term 'habitat'. The term can encompass highly specific environmental systems relevant to single taxa, through to combinations of biotic and abiotic features distinguished from each other by formal or informal discontinuities.

Important Plant Areas were first conceived, and their criteria and designation developed and implemented, in the context of the European systems of habitat and vegetation mapping. An excellent review of vegetation classification and habitat mapping is given in Terrestrial Habitat Mapping in Europe: an overview (Joint MNHN-EEA Technical Report 1/2014) which gives a range of examples of pan-European and country level programmes. For many parts of the world, however, such a detailed classification has never been developed at a national or regional scale.

It is important to remember that any classification developed and used should be at an appropriate scale for practical use in IPAs. Concepts such a Global Ecoregions (see Figure 1) are too broad to be relevant at IPA scale (although it could be argued that Ecoregions should be represented in IPAs as part of Protected Area systems regionally and nationally.

Regional approaches

At the IPA scale and the criteria used for designation, it is stated that "Threatened habitats or vegetation taken from a regionally recognised list" should form the basis of habitat conservation. To our knowledge, no such detailed lists exist for each of the countries included, or regionally across the South and East Mediterranean. This lack of an accepted habitat classification and list was a topic of much discussion in two highly relevant programmes: the Abu Dhabi Global Environmental Data Initiative (AGEDI), and workshops held under the auspices of the Arabian Plant Specialist Group (APSG) as

part of their Arabian IPA programme. Recently, the Standardized Terrestrial Ecosystem Map of Africa has been published, and a range of terrestrial mapping programmes have been undertaken in Europe including those encompassing Mediterranean habitats.

The AGEDI project (AGEDI 2013) involved 149 institutions and 270 experts over 15 months, whereby a range of open access spatial data was used to identify 78 terrestrial zones that were the subject of extensive discussion and expert opinion. Open access species occurrence data was not suitable to enable more formal and detailed analyses, and descriptions were imposed upon the defined broad categories by expert opinion and through discussion. Such an approach can be difficult to compare among diverse countries with diverse individuals involved. Where more detailed classifications have been proposed – for example in Yemen – these have been based upon relatively dense field survey data across the varied habitats in the area concerned. The comparison between the AGEDI and the Yemen maps reveals that the latter contains 32 habitats in 8 broad categories. The former study was based upon substrate and altitude data and is far broader, identifying fewer habitats, and not defined directly by the occurrence of particular species. The AGEDI programme identified the island of Socotra as a single habitat type, whereas in fact it contains four major and as many as 28 distinct vegetation components, further illustrating the course nature of the AGEDI assessment. However, the exercise was primarily designed to develop a Rapid Biodiversity Survey protocol involving minimal fieldwork, rather than define fine-scale vegetation units No formal scale comparison between the AGEDI programme and the Arabian IPA programme was undertaken.

The APSG Arabian IPA programme resulted in a publication of IPA criteria specific to the region (Al-Abbasi *et al.* 2010). The criteria for assessing threatened habitats in this publication was the result of extensive workshop discussions, that resulted in the opinion that no formal habitat classification could be established based upon existing published works, and that any habitat criteria used in IPA selection would be based upon expert opinion at that stage. This differed from existing IPA criteria developed in Europe, as the lack of systematic data collection and mapping precluded a less prescriptive approach. As Al-Abbasi *et al.* (2010) stated:

"This is potentially a very important criterion [Criterion C Globally or Regionally Threatened Habitat Type] for IPA selection in the region. Its implementation requires both the standardisation of habitat classifications and the listing of threatened habitats in the Arabian region. Compilation of this list will require extensive field surveys of potentially threatened habitats as well as research into the drivers of plant habitat degradation".

At the broader scale, the Standardized Terrestrial Ecosystem Map of Africa (Figure 2: Sayre *et al.* 2013) defines 126 'macrogroups' across the entire continent that are defined hierarchical suite of environmental variables including bioclimate, surface lithology, landform, elevation and land cover. The 'macrogroups', the finest vegetation units delineated in this mapping effort, are defined by diagnostic plant species and growth forms that reflect biogeographic differences in the variables listed above (Sayre *et al.* 2013). Such an approach could be repeated in the project region or globally.

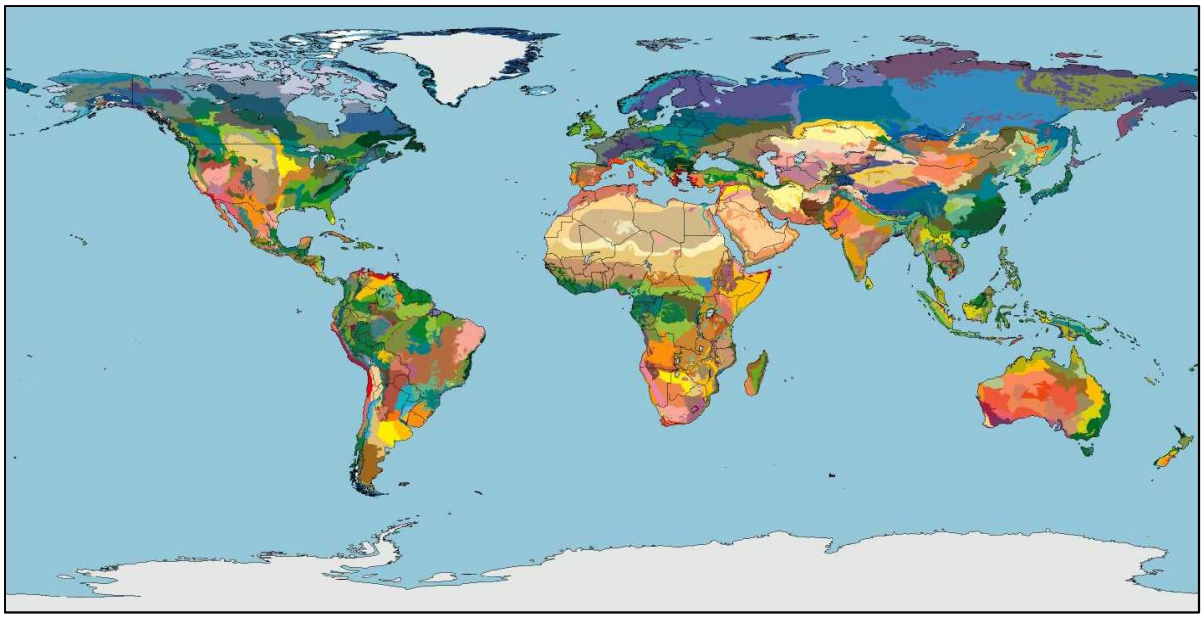

Figure 1. Global map of >200 ecoregions (http://wwf.panda.org/about_our_earth/ecoregions/maps/). While conserving these is an important component of global conservation goals, it is not an appropriate scale to use within IPAs or in zoning management plans.

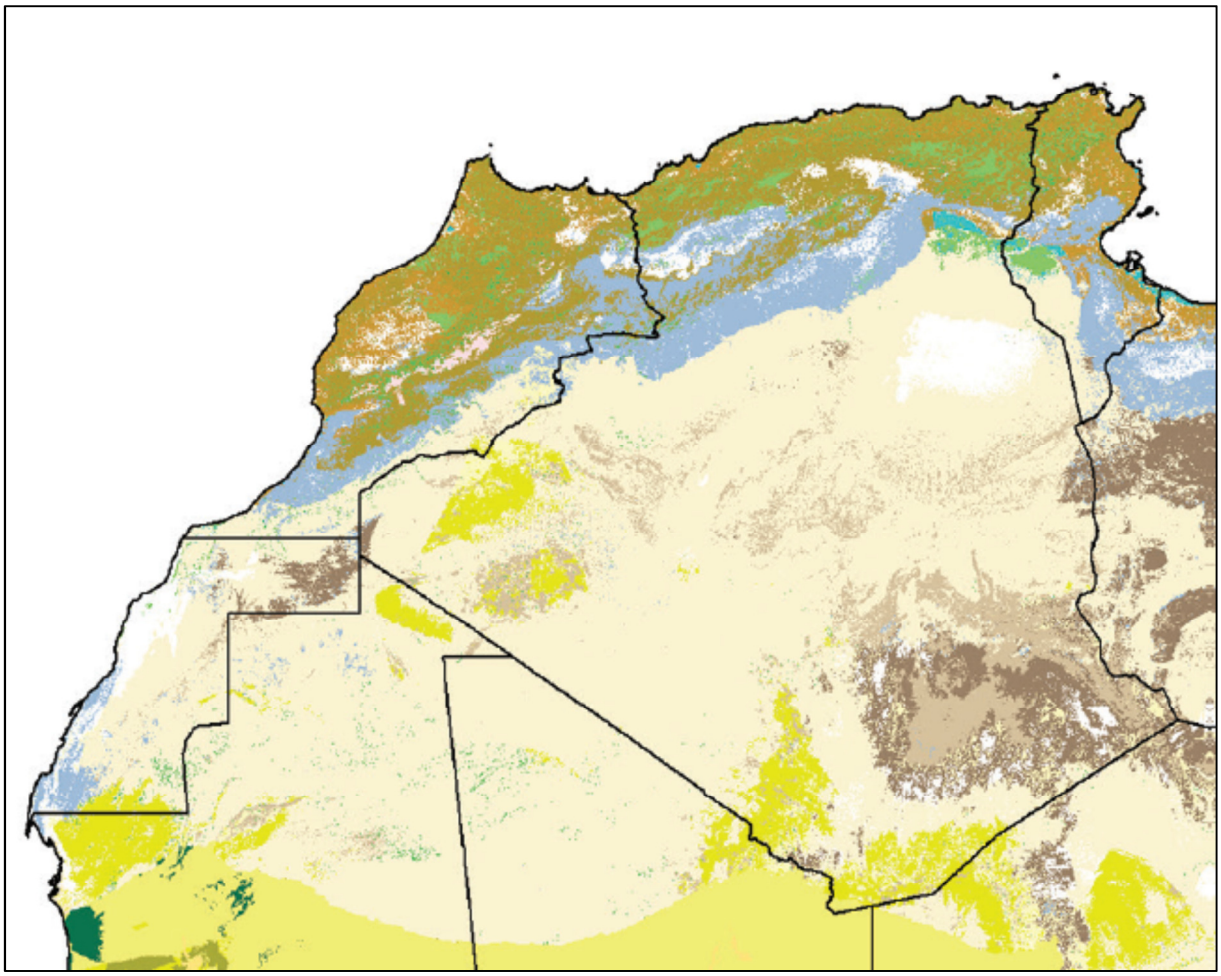

Figure 2. Map of north west Africa including Algeria and Morocco, showing the extent of terrestrial ecosystems defined in the Standardized Terrestrial Ecosystem Map of Africa. Country boundaries are as published in Sayre *et al.* (2013). While more detailed than global ecoregions, the ecosystems identified are still relatively broad, and designed to capture major systems rather than finely distinct habitats or vegetation types. Conserving these ecosystems within IPAs would not allow appropriate zoning based upon distinct habitat classes at the IPA scale.

National approaches

The following sections briefly describe the potential resources available for habitat and vegetation mapping in each country.

Algeria

Published floras often contain detailed descriptions and/or maps of vegetation and habitats. The floras of Battandier (1888, 1895) and Maire's Flore d'Afrique du Nord contain little or no habitat information. The Carte de la vegetation de l'Algerie contains a number of individual maps showing a range of vegetation types: however, these are not widely available, not in a comparable format, and not in digital form. Figure 3 shows the map of Ghardaia, with the legend containing 31 associations, and Figure 4 shows the area of Guelt es Stel Djelfa as a comparison.

There are several local studies within Algeria that have identified vegetation types using a variety of techniques. Examples include the studies of Benhouhou (2001), Benhouhou *et al.* (2003) and Khaznader *et al.* (2009) which describe phytosociological associations at a local scale based normally on extensive fieldwork. Several local and detailed articles have described the flora, but have not gone on to determine the vegetation series or habitats of which they form a constituent part. The species occurrence records they contain are generally not available on global databases.

The Global Index of Vegetation Plot Databases (GIVD) lists a single entry with relevance to Algeria. The Mediterranean Ammophiletea database covers a range of Mediterranean countries, and provides data on a single vegetation association. Such data would be informative in a formal analysis to determine the exact distribution of this single vegetation type, and any threats to this habitat assessed through field or remotely sensed data.

The 4th CBD National Report from Algeria contains a broad habitat map, based mostly on altitude zones (see Figure 5). The source of this map is not known, nor the methods used to produce it.

Colleagues provided us with a map of the Gouraya National Park (see Figure 6). Again, the methodology used to produce this map is not clear, but given the constituent land use classes it seems to represent contemporary land use rather than potential or actual vegetation types.

The flora of Algeria contains approximately 4000 species, of which 387 are national endemics, the majority occurring in the Mediterranean region. Species occurrence data from Algeria available on the Global Biodiversity Information Facility (GBIF) currently amounts to a total of 7886 geo-referenced data points representing a minority of Algerian species and a minority of data on endemic taxa. While these may be useful in locating which species occur in distinct IPAs, they were not collected in such a fashion as to be useful in the determination of habitats or vegetation types: the data are too sparse and not physically linked in any systematic way.

The IUCN Red List of Threatened Taxa shows that 286 species occurring in Algeria have been assessed using the Red List Criteria. Of these, 16 are threatened. The vast majority of taxa assessed are not endemic to Algeria, and represent widespread species with global assessments which occur in Algerian territory.

Algeria has designated 21 IPAs. A list of five main vegetation types is given for the Mediterranean part of the country, and the statement that all these are represented in the IPA series. No details of how such habitats were classified or assessed for inclusion was given in either Radford *et al.* (2011) or Yahi *et al.* (2012).

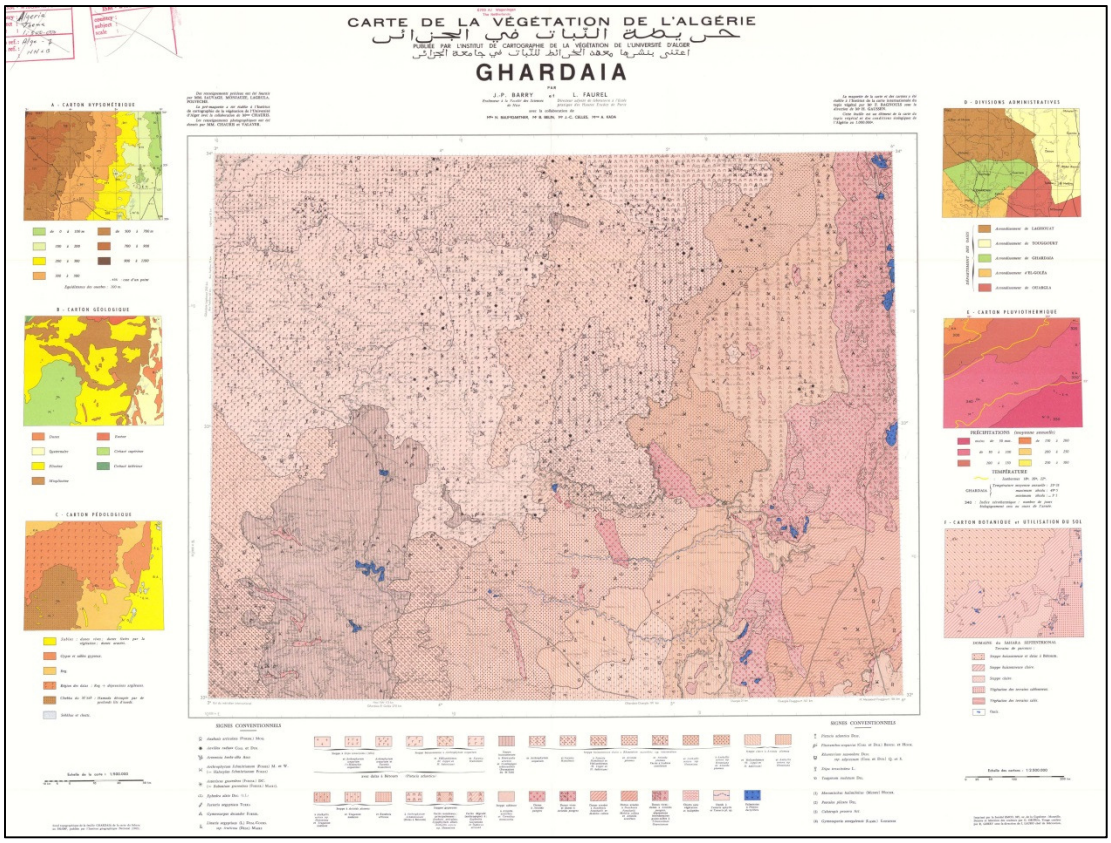

Figure 3. Individual sheet of the "Carte de la Vegetation de l'Algerie", showing the Ghardaia region. A total of 31 vegetation types are listed and mapped.

http://esdac.jrc.ec.europa.eu/content/carte-de-la-v%C3%A9g%C3%A9tation-de-lalg%C3%A9rie-ghardaia-et-6-cartons-echelle-1-2500000

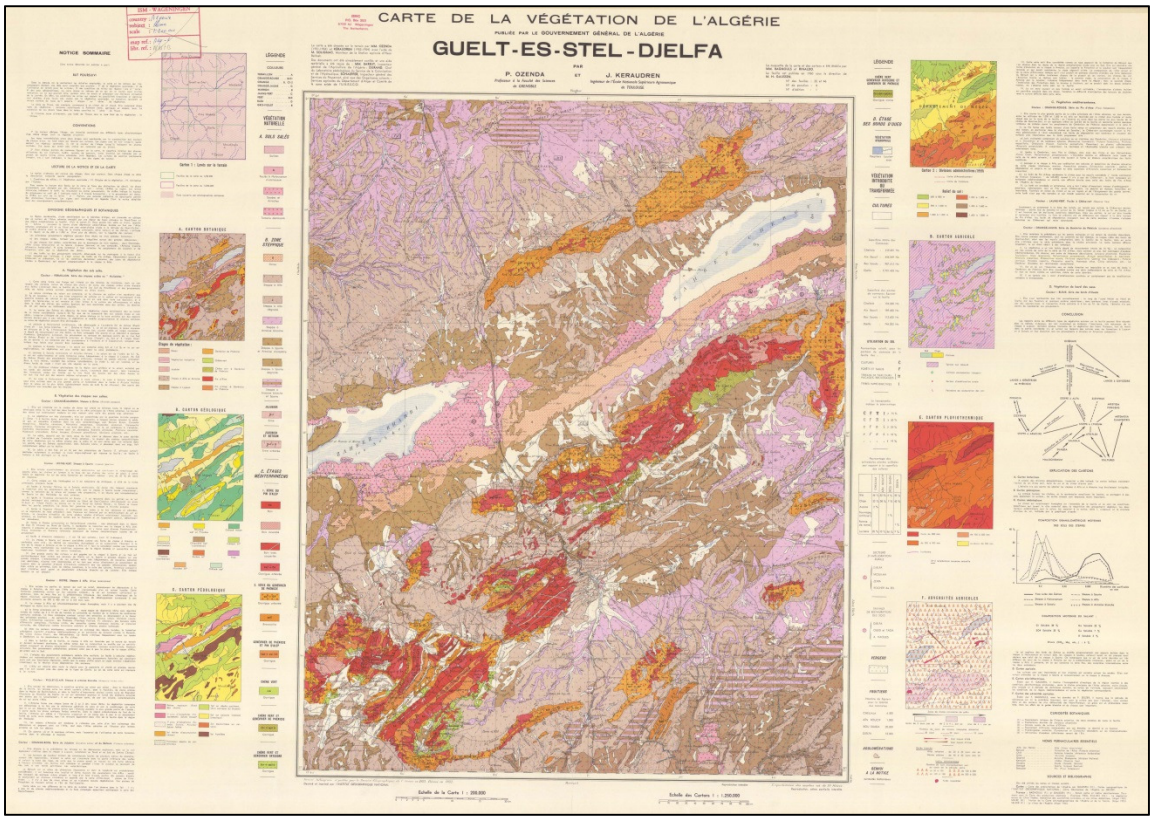

Figure 4. Individual sheet of the Carte de la Vegetation de l'Algerie, showing the Guelt es Stel Djelfa region. A total of 23 vegetation types are listed and mapped.

http://esdac.jrc.ec.europa.eu/content/carte-de-la-v%C3%A9g%C3%A9tation-de-lalg%C3%A9rie-guelt-es-stel-djelfa-et-6-cartons-echelle-1-1250000

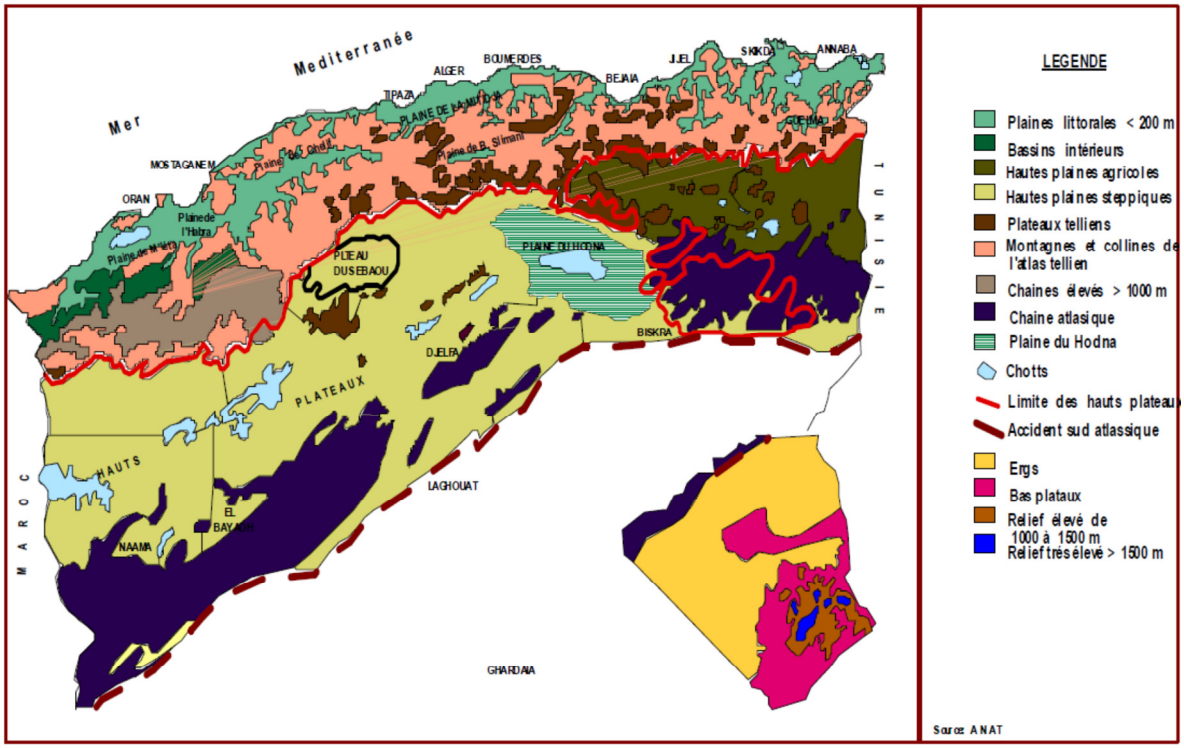

Figure 5. Broad ecosystem map of Algeria presented in the 4th Report to CBD.
https://www.cbd.int/doc/world/dz/dz-nr-04-fr.pdf

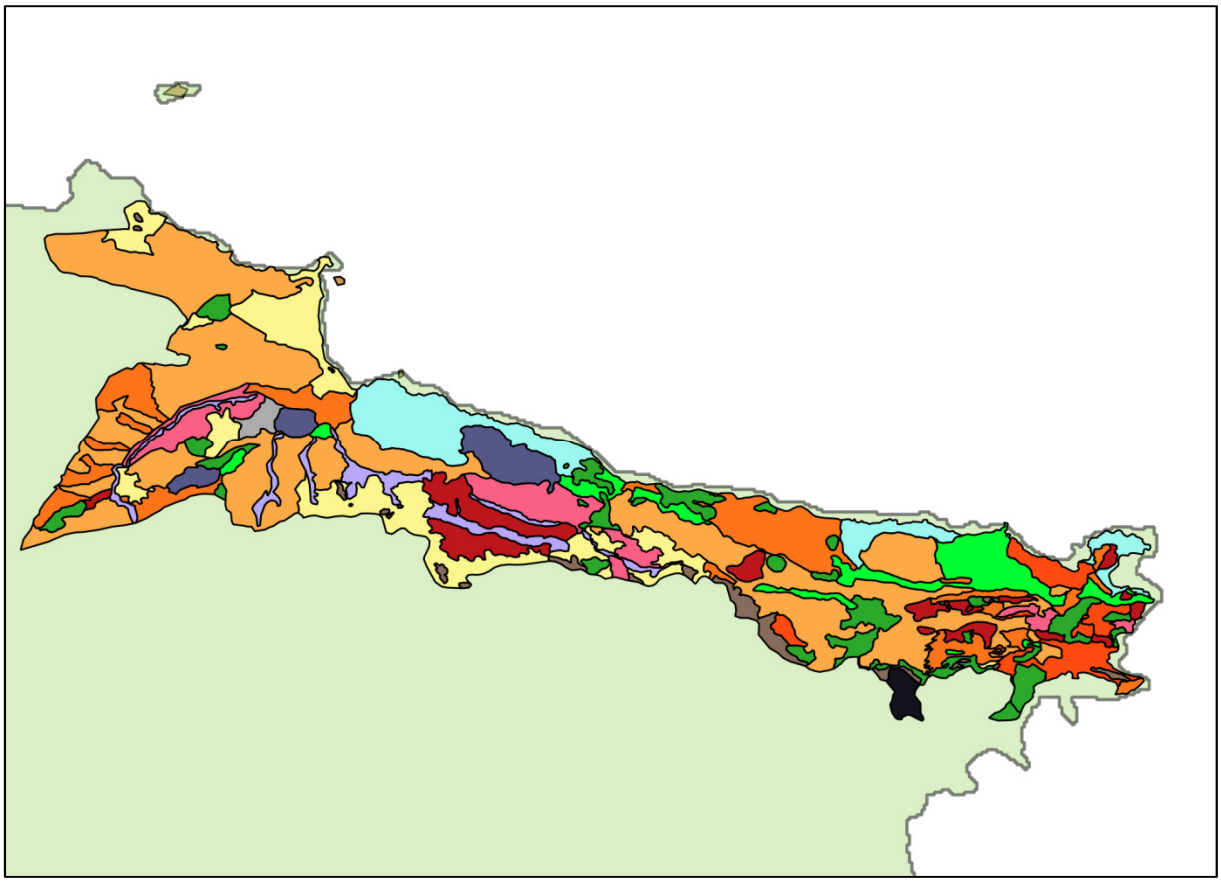

Figure 6. Land use map of Gouraya National Park.

Lebanon

Talhouk *et al.* (2005) state that vegetation and habitat mapping and understanding is still based upon historical work in Lebanon, with no systematic approach yet undertaken. Much of this work is located in floristic publications such as those as Mouterde and Post, but details are scanty. However, some work has been done but often is unpublished in theses or reports. It has not been possible to access this information for assessment.

The Global Index of Vegetation Plot Databases (GIVD) lists a single entry with relevance to Lebanon. The Mediterranean Ammophiletea database covers a range of Mediterranean countries, and provides data on a single vegetation association. Such data would be informative in a formal analysis to determine the exact distribution of this single vegetation type, and any threats to this habitat assessed through field or remotely sensed data.

The 4th National Report to CBD from Lebanon contains a map of phyto-associations which can be interpreted as broad vegetation zones (see Figure 7). These do not identify or classify at a suitable scale for mapping or zoning at the IPA scale. A detailed map of current land use is also available (see Figure 8), but does not specifically identify habitats or vegetation types. Such maps could be valuable for comparisons with habitat maps to ascertain threats to habitats or to assess habitat quality and extent compared to PNV (Potential Natural Vegetation) maps generated through spatial bioclimatic data.

The flora of Lebanon contains approximately 2600 species, of which 103 are national endemics. Species occurrence data from Lebanon available on GBIF amounts to a total of 2317 geo-referenced data points representing a minority of these species and a minority of data on endemic taxa. While these may be useful in locating which species occur in distinct IPAs, they were not collected in such a fashion as to be useful in the determination of habitats or vegetation types: the data are too sparse and not physically linked in any systematic way.

Lebanon has designated 20 IPAs. Eight vegetation types in two “floristic ensembles” were reported. No details are given of how these vegetation types were assessed or compiled, or any maps produced locating their potential or actual areas.

The IUCN Red List of Threatened Taxa shows that 171 species occurring in Lebanon have been assessed using the Red List Criteria. Of these, four are threatened. The vast majority of taxa assessed are not endemic to Lebanon, and represent widespread species with global assessments which occur in Lebanese territory. An ongoing programme funded by Critical Ecosystem Partnership Fund CEPF is seeking to Red List a majority of Lebanese endemic plant species, and as such occurrence data should become available for them in the relatively near future.

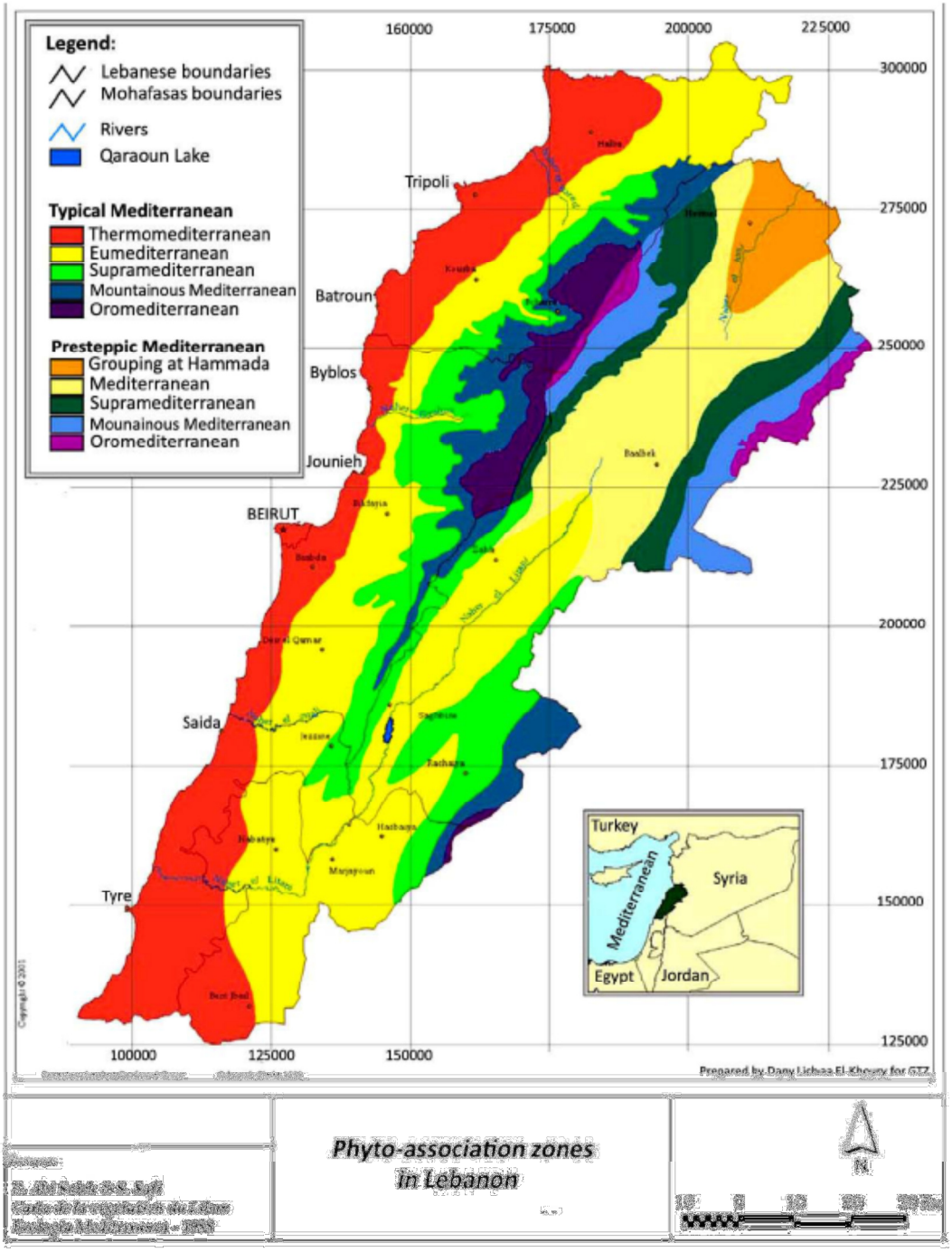

Figure 7. Map of phytoassociation zones in Lebanon presented in the 4th Report to CBD. https://www.cbd.int/doc/world/lb/lb-nr-04-en.pdf

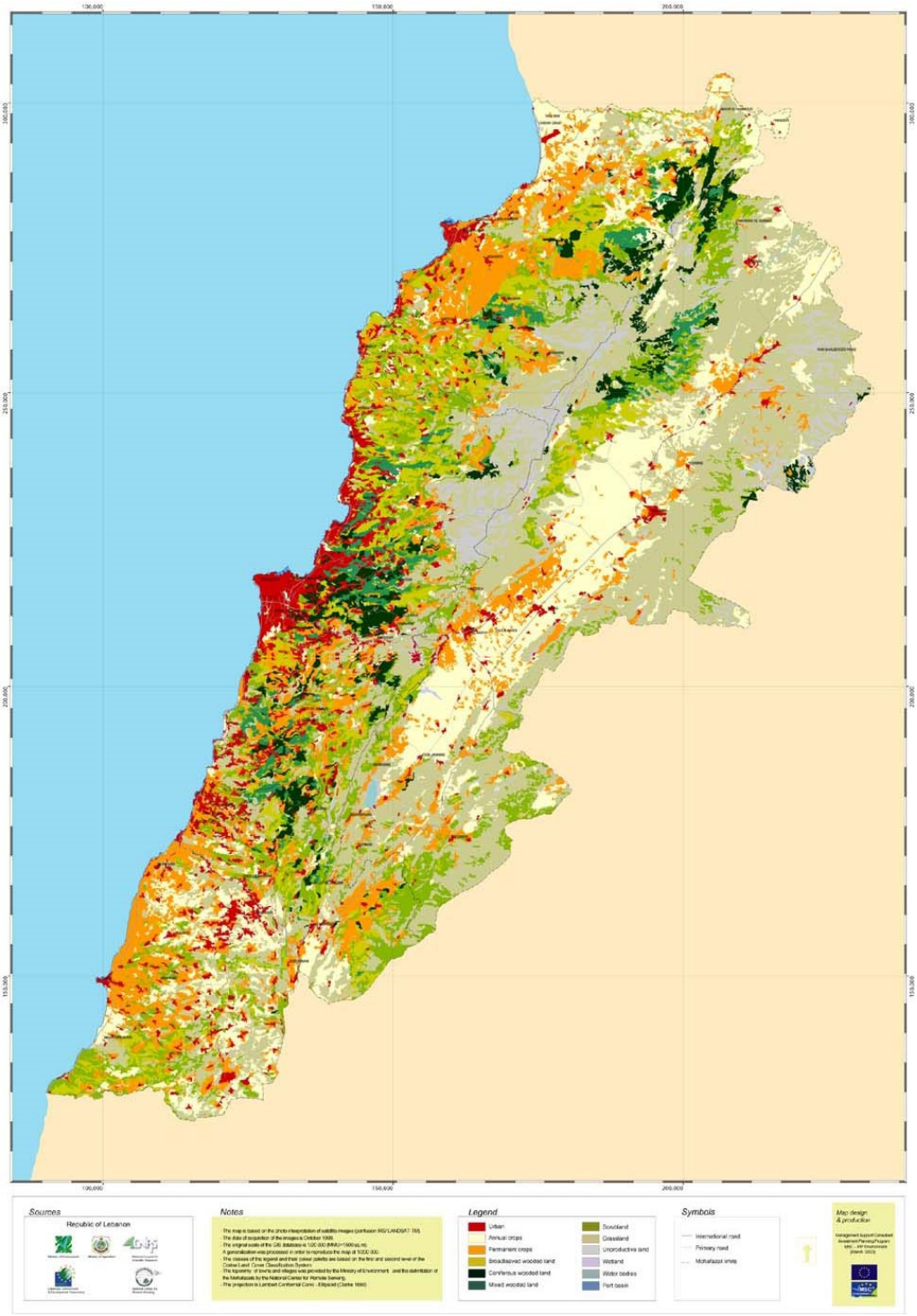

Figure 8. Land Use Cover map. Ministry of Environment Prepared by MSC-IPP Environment. http://www.comap.ca/kmland/display.php?ID=534

Morocco

Several floras are available for Morocco, but none that give detailed habitat or vegetation descriptions. Numerous scientific articles on vegetation and habitats have been published, and these use a wide array of survey and descriptive techniques: many can also be found on websites, with little information as to the methods used or data available for formal analyses. Most are relatively out of date, and the data held within them is inaccessible for formal analyses.

Published and available vegetation data available through the Global Index of Vegetation Plot Databases amounts to three data sets. The first covers some 35 permanent plots in southern Morocco which identify a wide range of vegetation types. The second is the Mediterranean Ammophiletea database covering a range of Mediterranean countries, providing data on a single vegetation association. The third is FLOPTROP which has accessed existing plot data for a large number of vegetation plots across north Africa. Plots in Morocco constitute 0.8% of plots included. Given the topographical and climatic diversity of Morocco, each of these data sets would not allow a national assessment of habitat types. As no maps or digital data is available related to these plots in terms of habitat or vegetation associations, there is no possibility to use these data for verification of Potential Natural Vegetation mapping at the national scale without extensive digitization, research and analyses.

While the 5th Report to CBD for Morocco contains a habitat map (see Figure 9), this was produced largely from remotely sensed data and the habitat classification applied is very broad.

The flora of Morocco contains approximately 4500 species, of which 951 are national endemics, many occurring in the Mediterranean region. Species occurrence data from Morocco available on GBIF amounts to a total of 45970 geo-referenced data points representing a minority of these species and a minority of data on endemic taxa. These data are still quite sparse at the IPA scale. While inappropriate for habitat or vegetation mapping, useful data for species-level zoning may be extracted and used.

The IUCN Red List of Threatened Taxa shows that 332 species occurring in Morocco have been assessed using the Red List Criteria. Of these, 34 are threatened. The vast majority of taxa assessed are not endemic to Morocco, and represent widespread species with global assessments which occur in Moroccan territory.

Morocco has already identified 160 sites of biological and ecological importance. 57 of these were considered as potential IPAs, and 19 were selected from this list. It is not clear whether any formal or informal habitat or vegetation classification was used in any of these selections, although informal descriptions of some vegetation types are given in Radford *et al.* (2011).

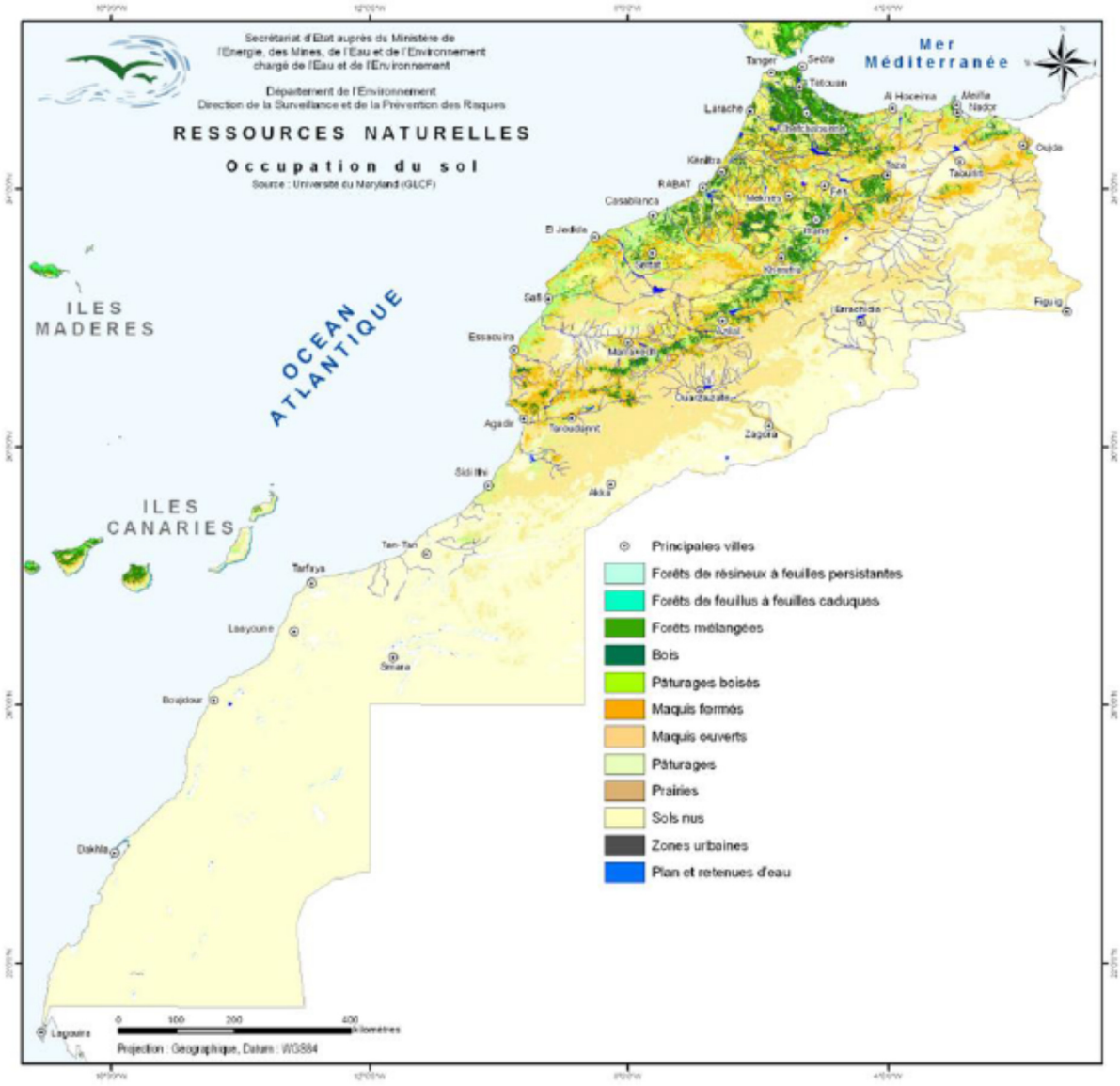

Figure 9. Map of natural resources and land use of Morocco, presented in 5th Report to CBD. https://www.cbd.int/doc/world/ma/ma-nr-05-fr.pdf

Conclusion

In summary, global and continental scale initiatives have outlined potential data sources and methodology that can be combined to generate simple spatial analyses to identify broad habitat types in the selected countries of the south and east Mediterranean region. Mobilization of existing data that is otherwise not open access has the potential to improve the resolution of habitat classification at the country and IPA scale, but whether these can form the basis for comparative mapping regionally must await more formal analyses.

In the absence of any formal or comprehensive habitat or vegetation classification nationally or regionally, there are two alternate approaches that can be used combined or in isolation. Firstly, satellite imagery and expert knowledge can be used and captured digitally in GIS software, allowing managers to highlight areas of existing habitat and vegetation as compared to degraded areas. Such methods would not generate comparative habitat mapping regionally, but would allow site by site identification of habitat zones, and allow the incorporation of species-level data into spatial planning.

Secondly, the use of bioclimate, lithology and elevation data in a GIS system would allow the prediction of Potential Natural Vegetation (PNV) using a method that could be comparable regionally. Although there are no existing vegetation data against which to validate such a methodology for the countries concerned, there are vegetation data available from other Mediterranean regions (for example, Andalucía) that can be used to verify the methodology proposed. This methodology would be based upon different combinations of bioclimate and environmental data that correspond to known vegetation types, and then using the same combinations to predict vegetation types in other areas. As the vegetation types would depend upon the variables used, they would generate types associated with environmental conditions locally rather than duplicating types from Andalucía (the region used for verification of the method).

Generating PNV maps or mapping existing habitat types through expert knowledge would allow comparison with current land use knowledge to prioritise and zone areas for conservation. Any gaps in knowledge of habitat quality or land use can be checked via field survey, or through satellite imagery.

References

AGEDI (2013) Systematic Conservation Planning Assessments and Spatial Prioritizations for the Emirate of Abu Dhabi, the United Arab Emirates and the Arabian Peninsula. Abu Dhabi.

https://agedi.org/?portfolio=local-national-regional-biodiversity-rapid-assessment

Al-Abbasi TM, Al Farhan A, Al Khulaidi AW, Hall M, Llewellyn OA, Miller AG & Patzelt A (2010) Important Plant Areas in the Arabian Peninsula. *Edinburgh J Bot* 67, 25-35.

Algeria Fourth National Report to CBD (2009)

https://www.cbd.int/doc/world/dz/dz-nr-04-fr.pdf

Benhouhou SS (2001) Vegetation associations in the Great Western erg and the Saoura valley, Algeria. *Phytocoenologia* 31, 311-324.

Benhouhou SS, Dragie TCD & Gilbert OI (2003). Vegetation associations in the Ougarta Mountains and dayas of the Guir Hamada, Algerian Sahara. *J Arid Env* 54, 739-753.

Carte de la Végétation de L'Algérie

http://esdac.jrc.ec.europa.eu/search/node/Carte%20de%20la%20V%C3%A9g%C3%A9tation%20de%20L'Alg%C3%A9rie

Khaznader M, Vogiatzakis IN & Griffiths GH (2009) Land degradation and vegetation distribution in Chott El Beida wetland, Algeria. *J Arid Env* 73, 369-377.

Lebanon Fourth National Report to CBD (2009)

https://www.cbd.int/doc/world/lb/lb-nr-04-en.pdf

Morocco Fifth National Report to CBD (2014)

https://www.cbd.int/doc/world/ma/ma-nr-05-fr.pdf

Radford, E.A., Catullo, G. and Montmollin, B. de. (eds.) (2011). Important Plant Areas of the south and east Mediterranean region: priority sites for conservation. IUCN, Gland, Switzerland and Malaga, Spain. Gland, Switzerland and Malaga, Spain: IUCN. VIII + 108 pp.

https://portals.iucn.org/library/efiles/edocs/2011-014.pdf

Sayre, R., P. Comer, J. Hak, C. Josse, J. Bow, H. Warner, M. Larwanou, E. Kelbessa, T. Bekele, H. Kehl, R. Amena, R. Andriamasimanana, T. Ba, L. Benson, T. Boucher, M. Brown, J. Cress, O. Dassering, B. Friesen, F. Gachathi, S. Houcine, M. Keita, E. Khamala, D. Marangu, F. Mokua, B. Morou, L. Mucina, S. Mugisha, E. Mwavu, M. Rutherford, P. Sanou, S. Syampungani, B. Tomor, A. Vall, J. Vande Weghe, E. Wangui, and L. Waruingi (2013) A New Map of Standardized Terrestrial Ecosystems of Africa. Washington, DC: Association of American Geographers. 24 pages.

http://www.aag.org/cs/publications/special/map_african_ecosystems

Talhouk SN, Dardas M, Dagher M, Clubbe C, Jury S, Zurayk R & Maunder M (2005) Patterns of floristic diversity in semi-natural coastal vegetation of Lebanon and implications for conservation. *Biodiversity & Conservation* 14, 903-915.

WWF Terrestrial Ecoregions Map (1999-2000)

http://wwf.panda.org/about_our_earth/ecoregions/maps/

Yahi N, Vela E, Benhouhou S, De Belair G & Gharzouli R (2012). Identifying Important Plant Areas (Key Biodiversity Areas for Plants) in northern Algeria. *JoTT Communication* 4, 2753-2765.