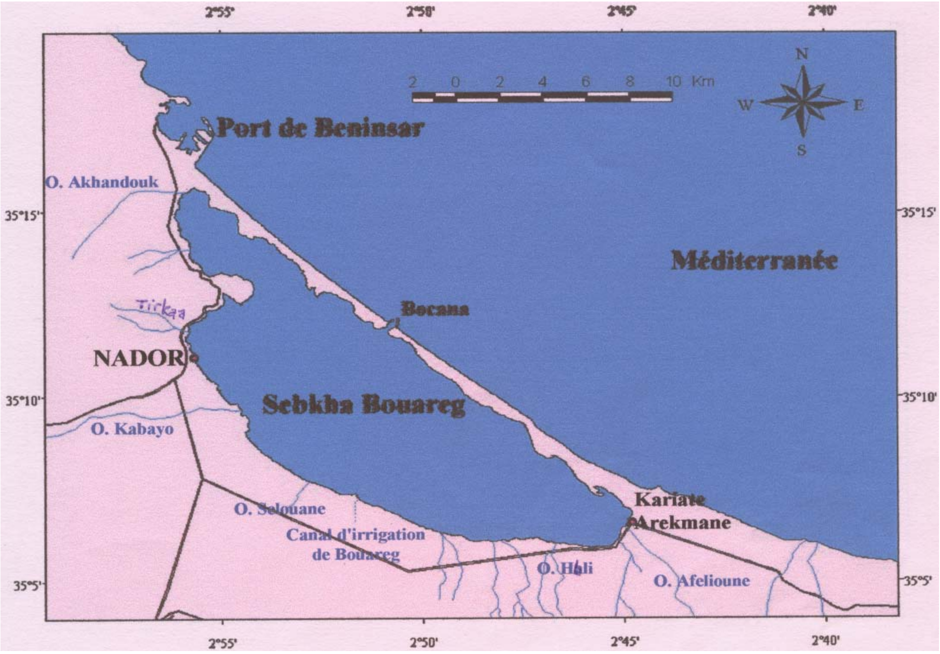
Scenery and Bathing Area Registration and Evaluation of selected beaches along the coastal Province of Nador



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1. INTRODUCTION

The overall goal of the umbrella SMAP III project is to promote sustainable development in the coastal area, province of Nador, Morocco, through the establishment of an integrated coastal zone management plan of action with civil society participation. To this aim the project wants to contribute to resolving conflicts between different actors and developing to the largest possible extent 'win win' situations for the following forms of land use: ports, fishing harbour, aquaculture farms, traditional fishing activities around Nador lagoon – a Ramsar site, and also sea, urbanisation developments, tourism activities (beach and nature), intensive agriculture, industry and biodiversity conservation. This report covers investigations of scenic evaluations in the area with a view to selecting future potential tourist sites, together with the application of the Bathing Area Registration and Evaluation technique (BARE) for the bathing area classification. Added value has been given by a small pilot study of some selected dune systems with respect to dune vulnerability and management. The coastal zone of province of Nador, Morocco, includes the urban centres of Nador and Beni Ansar, and the rural communes adjacent to the coast from the commune of Kariat Arekmane to the commune of Boudinar (Fig. 1.1.).

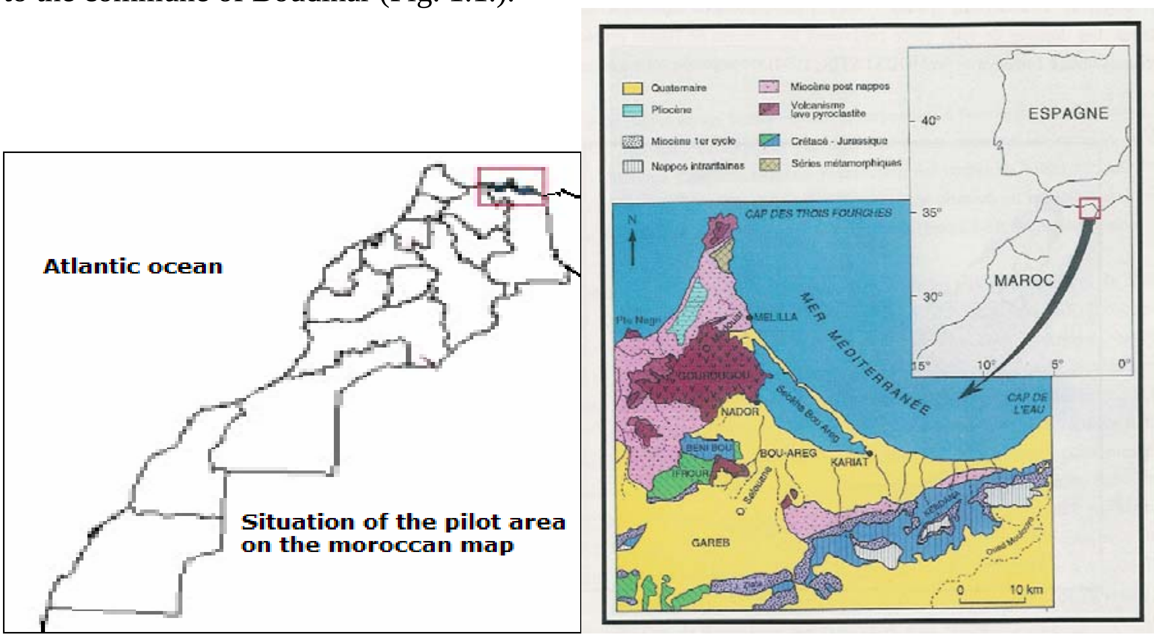


Figure 1.1 The pilot study area.

The central core of the area was Nador lagoon, which through time has had several inlets cut through the main spit and which now represent positions of the old flood tidal deltas (Fig. 1.2.). The project covered 21 sites (Fig. 1.3) in total (two sites were visited at Miami and Boukana)and all aspects of BARE were covered during field visits. A problem that arose was that *detailed* local knowledge was not readily available, so that the initial registration form (Appendix 1) was not fully completed. This however, can be done fairly easily by the relevent people with the requisite local knowledge.

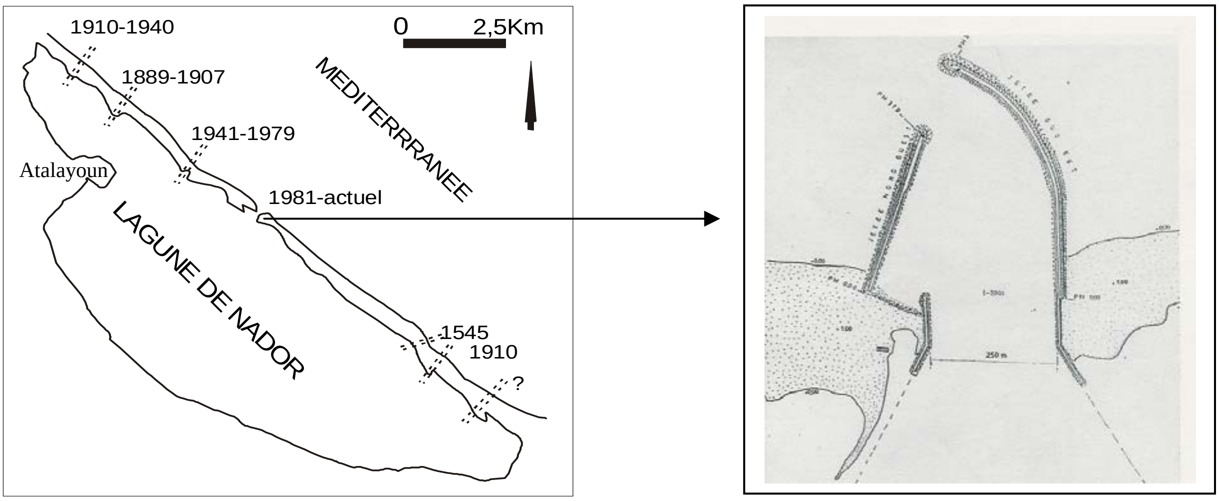


Figure 1.2. Inlet passes to the lagoon through time

Figure 1.3. Site locations

Figure 1.3. (continued)

Key:

1 - Kamkoum El Baz	**8 - Miami**	**15 - Sidi Hsaine**
2 - Ras El Ma	**9 - Tibouda**	**16 - Tazaghine**
3 - Plage Rouge	**10 - Charranna**	**17 - Sidi Driss**
4 - Arekmane	**11 - Sidi Lahcen**	**18 - Sidi Abderrazak**
5 - Taourirt	**12 - Kalat**	**19 - Suani**
6 - Firme	**13 - Chemlala**	
7 - Boukana	**14 - Amejaou**	

Within this framework the authors concentrated upon:

- Application of a Coastal Scenic Evaluation (CSE) to identify places (some photographs are shown in Appendix III) of highest tourist potential and possibilities of improving scenic values of coastal areas and preserving ecosystems integrity
- Application of the BARE technique, a state of the art beach rating scheme (Appendix I and II) including a beach user's preference and priorities study (Appendix IV)
- A dune vulnerability pilot study for 4 locations.
- Presentation of two lectures to the CAP-Nador group on the techniques together with some preliminary results (Appendix V).

To achieve these ends two field work sessions were organized:

- Public perception studies, August 2006, so that ENFI organized field work could be carried out regarding 176 beach user questionnaires.
- Field work visits re CSE, BARE & the dune study (Sept 24 to Oct 3, 2006).

Coastal Scenic Evaluation

The recently developed Coastal Scenic Evaluation (CSE) Methodology was used to:

(a) assess the scenic quality for developing conservation/management measures (e.g. zonation policies, access regulation, diversification of activities etc) with the aim of promoting public understanding and interest in the coastal environment,
(b) help foster leisure activities which rely on natural scenery and not on man made activities.

Coastal landscape evaluation has proven to be a valuable tool for:

- landscape preservation (identifying the value to society of particular areas/views);
- protection (identifying high quality landscapes and controlling development); and
- improvements (identification of components that can detract from views).

The BARE System

The Bathing Area Registration & Evaluation (BARE) system is an innovative beach rating scheme that evaluates not only the beach itself but the bathing area as a whole, considers a wide variety of beach types, and classifies beaches from a user perspective. Beach tourism is one of the main income generating activities for local authorities in the Nador area. The BARE System allows an identification of management priorities required to improve the quality of individual beaches and therefore to increase income from tourism.

Particularly in the Mediterranean, the beach is a main attraction for the bulk of holiday tourists and as a consequence, they represent a highly valued resource. Beaches bring in tourists, which equates to money. For example, Houston (1995, 1996, 2002), has indicated that Miami beach spent *circa* $70 million on a beach nourishment, which brought in some $2 billion annually from foreign tourists alone. This has more tourist visits alone than twice the combined number of tourist visits from Yellowstone, Grand Canyon and Yosemite National

Parks. With increasing demand for leisure opportunities, beach environments figure highly in any social valuation of coastal recreational amenities, the latter often seen as a safe recreational environment that is enjoyed by a wide spectrum of society (adults and children visiting as individuals, couples, families, overseas and local holiday-makers). By definition, beach management "*seeks to maintain or improve a beach as a recreational resource and a means of coast protection, while providing facilities that meet the needs and aspirations of those who use the beach*" (Bird, 1996 p. 212.). In this context, the impact of sound beach management may be seen as an effective utilisation of an increasingly valuable (socio-economic and ecologic) national resource. It may also lead to encouragement of overseas tourism, an increase in quality for local recreational opportunities and an enhancement of nearby urban settlements.

In practice, beach management may be seen to address socio-economic and environmental considerations as well as engineering aspects largely related to sediment dynamics. Beach rating procedures and award schemes (e.g. Blue Flag - FEE, 2002; Green Coast Award - Nelson & Botteril, 2002) tend to either focus on single or few issues of concern to beach users or to ignore the nature of varying beach types and individual beach type requirements. When speaking about award schemes, it is worth mentioning the "importance" of the European Blue Flag in Croatia. In 2005, 80 beaches were awarded the Blue Flag. Such beaches are promoted as the one with the *highest safety, ecological and touristic standards* (HCK, 2006). Still, some evidence has shown that Blue Flag beaches are not always the cleanest, safest and with the best water quality, For example, "Laguna" beach in the northern part of Croatia, has the Blue Flag award, but the water quality of the beach is Orange/Red, according to the EU Bathing Water Directive (CEC 1976). Tudor and Williams (2006) have shown that beach users place little reliance on such flags, and it ranks low down in their preferences and priorities when selecting a beach site.

Beach awards are used worldwide as a promotional tool for beaches, but information regarding public knowledge of them is sparse. Studies carried out at important UK resorts e.g. at Barry and Weston-super-Mare, have shown that, even though beach users stated that beach awards were an important parameter for choosing the beach (72% out of a total of 700), only 18% beach users understood the meaning of the flag flying on the beach (i.e. beach award flag) and 17% of users questioned on beaches in Wales thought it was a sign for danger (Nelson *et al.*, 2000). Based on subjective experiences gleaned from talking to beach users during evaluation of beaches in Croatia, it was found that Croatian residents and tourists were not aware of the beach flag and what it really meant.

Repeated surveys have shown that five factors are extremely important in determining a successful beach holiday (Micallef *et al.*, 2004). These are safety, water quality, facilities, scenery and litter. A novel system for beach evaluation BARE – the Bathing Area Registration and Evaluation system, follows these findings and includes five most important evaluation parameters (Micallef *et al*., 1999, 2004; Micallef & Williams, 2002), i.e. safety, water quality, availability of facilities, scenery and litter. Their prioritisation is a function of beach type, i.e. in a resort area, the first three parameters are deemed to be the most important; in a remote area, scenery and litter take precedence. The choice and order of priority of parameters considered for the bathing area classification system was ascertained on results of literature surveys concerning beach management guidelines and view-points expressed by beach-user questionnaire/beach rating surveys (e.g. Chaverri, 1989; Morgan *et al*., 1993; Williams & Morgan, 1995; Morgan *et al.*, 1995; Micallef, 1996; Williams & Davies, 1999; Micallef *et al*., 1999; Williams *et al*., 2000, Ergin *et al*, 2004).

2. METHODOLOGY

2.1. BARE

A novel Bathing Area Registration & Evaluation (BARE) system was applied to beaches on the Moroccan coast (remote, rural, village, urban, resort) with the purpose of demonstrating method and ease of application to diverse beach environments. BARE incorporates a *Register* (Appendix I), used to collect a wide array of data pertinent for subsequent beach management purposes and a *Rating & Classification system* (Appendix II) relating, in order of priority to safety parameters, water quality criteria, availability of facilities, beach surroundings and litter assessment.

The BARE approach differs from other beach rating/award giving schemes on a number of issues (Micallef, 2002) in that it:

- Evaluates the bathing area as a whole (i.e. the beach together with that area within walking distance and generally visible from the beach);
- Considers a wider variety of beach types;
- Focuses on five main beach-related issues rating highly in beach user preferences and priorities for beach rating and subsequent classification;
- Awards a bathing area classification not only as an incentive for enhanced advertising potential but primarily as a tool to identify priority needs in management.

For each of the five parameters evaluated by the Bathing Area Evaluation system (safety parameters, water quality criteria, availability of facilities, hinterland scenery, litter), a rating scheme (sensitive to beach type requirements) was developed (Appendix I) enabling a rating score A – D to be awarded for each parameter. By integrating the five rating scores awarded, an overall Bathing Area Classification that also recognises beach type sensitivity, is enabled, based on criteria awarding 1 – 5 Star classification.

Safety-related parameters are recorded using a check-list approach (Appendix I, section 2.1) which refers to presence/absence of lifeguards, fixed safety equipment, first-aid posts, swimming safety warning notices, emergency phone facilities, bather / boat zonation marker buoys and a safe bathing environment. Scoring of this criterion is carried out according to a rating scheme that distinguishes between beach type and safety equipment expected (Micallef *et al*., 2004). It is very easy to confirm/deny these parameters..

The Bathing Area Register records *water quality* (Appendix I, section 2.2), as the most recent national bathing water quality monitoring results (e.g. by Health, Tourism, Environment Departments). In scoring this criterion, Table 2 refers to the two most widely applied water quality standards in the Euro-Mediterranean region namely the '*Mediterranean Interim Criteria for Bathing Waters Adopted by the Contracting Parties to the Barcelona Convention'* in 1985 and the criteria established by the European *Bathing Water Directive* (76/160/EEC). This rating scheme applies solely to resort, urban and village-associated beaches; for the rural and remote bathing areas visual observation is used (Appendix I, section 2.2) (Micallef *et al*., 2004). This is a desk top study.

Facilities (Appendix I, section 2.3), utilises a checklist approach, the priority of facilities reflected known beach user preferences and priorities. In the rating scheme proposed by the BARE system care and attention is recommended for evaluation of certain facilities such as toilets, showers and parking where the adequacy of such facilities is determined in relation to the bathing area's carrying capacity and occupancy rates. Carrying capacity is a 'complex issue where consensus is hard to achieve' (Pereira da Silva, 2002, p196). Section 3.3 of the Bathing Area Register (Appendix I) provides the beach manager with the opportunity of estimating percentage beach occupancy for the bathing season, week-days and week-ends within the bathing season and the non-bathing season. This allows for identification of beach-user trends, for different times of the day that is relevant for determining operational management strategy for provision of services e.g. beach / toilet / shower cleaning and other supervisory operations. This data has strong management relevance in that it can be used to effective allocation of potentially limiting resources such as lifeguards. Determination of beach carrying capacity will also indicate upper thresholds for which some essential facilities (e.g. toilets, showers, parking facilities) must cater for, if they are to provide an efficient service (Micallef *et al*., 2004)

Scenery is recorded in section 2.4 of Appendix I. This involves assessing and rating 26 coast-related parameters, each sub-divided into 5 categories. Site evaluation involves a technique described by Ergin *et al*. (2002; 2003) who applied a Fuzzy Logic System approach in order to obtain an objective evaluation of an otherwise subjective entity. The end-result provided a site evaluation table, which grades coastal scenery into 5 distinct classes, A – E (Micallef *et al*., 2004).

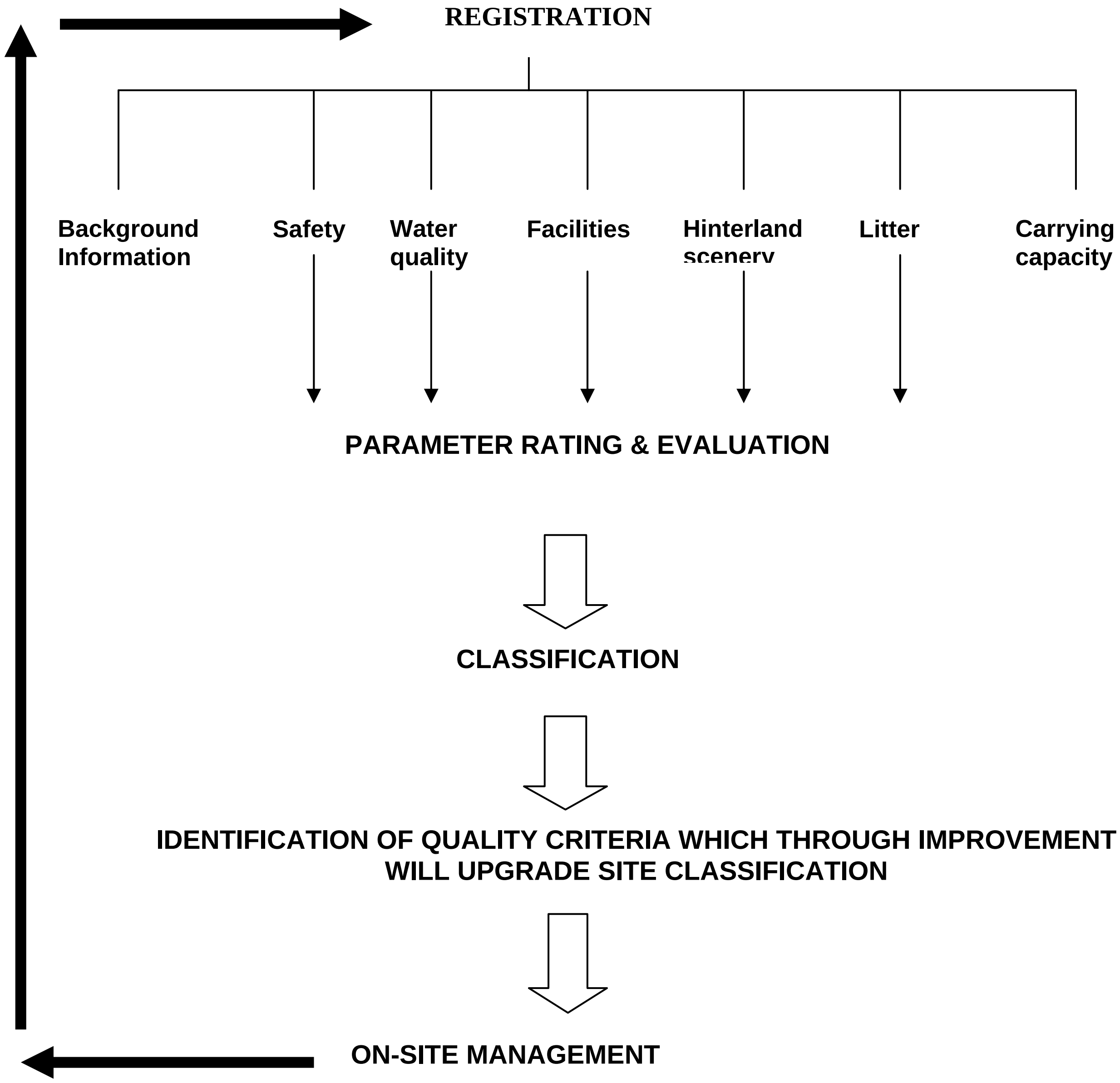
Litter was recorded and scored according to the EA/NALG (2000) Protocol (Appendix I, section 2.5), which involves surveying a 100m stretch of beach (50m each side of an access point), assessing the amounts of litter in the area between the high water strand line and the back of the beach. If the beach was narrow and dominated by a micro-tide, (typical of pocket beaches found in the Mediterranean), the entire width of the beach was surveyed for litter,

Using this approach, 21 Moroccan bathing areas were registered using the Bathing Area Registration form (Appendix 1) and classified according to the Bathing Area Evaluation scheme (Figure 2.1; Appendix II). Five main bathing area types (resort, urban, village, rural and remote) can be considered by the evaluation technique. In the absence of referenced definitions in the scientific literature for such bathing area types, the BARE technique defines these beach types as follows:

Remote: A bathing area largely defined by its difficult access (by foot or boat) and not supported by public transport. A remote bathing area would have no public service facilities and very limited (0 – 5 if any) temporary summer housing. Safety-related facilities and "official" water quality monitoring are not expected on remote bathing areas. Still, water quality is evaluated using visual observation (see Appendix I, section 2.3). Evaluation parameters rated for remote bathing areas, next to visually observed water quality, were limited to hinterland scenery and litter.

Rural: A bathing area located outside the urban environment and not readily accessible by public transport and usually having no public service facilities. However in the Mediterranean context, some resort facilities may be found in the summer months. Housing at rural bathing areas may be limited in number (0 – 10), either of a temporary (summer) or permanent (year long) nature, but having no community focal centre such as local shops or cafes/bars. At such bathing areas, public service and safety-related facilities and "official" water quality monitoring are not expected. As with remote areas, rated parameters were limited to hinterland scenery, litter and visually observed water quality only.

Figure 2.1.1: Flow-chart depicting the BARE system.



Village: A village bathing area is one associated with a small but permanent population reflecting organized but small-scale community services (local shop/s, cafes/bars, bed/breakfast accommodation, toilets & litter bins) but located outside the main urban environment. Village bathing areas may be reached by public and private transport and would offer some basic safety-related facilities such as fixed safety equipment or safety related warning notices. Water quality monitoring would be expected at such bathing sites.

Urban: Urban bathing areas are sites within the immediate urban environment and may therefore serve large communities with well-established public services e.g. banks, post-office, hotel accommodation & restaurants. In the proximity of urban bathing areas, one may often find commercial activities such as fishing/boating harbours and marinas. Stringent safety-related facilities and water quality monitoring would be expected at urban bathing areas. None were found in th3 current study

Resort: A resort bathing area is defined by its largely recreational orientation and usually, by an absence of any marine-based commercial activities. It is served by a wide variety of public service facilities such as large hotels, good camping grounds, restaurants, beach showers and beach-related recreational activities e.g. sport, wind-surfing, jet skiing, paragliding, etc. Resort bathing areas are managed by the resort and are mainly opened for resident users. It may be open for public against payment. Stringent safety-related facilities and water quality monitoring are expected at resort bathing areas.

Water quality is based on Government statistics or visual observation, safety and facilities on a beach are easily recorded. Scenery and litter are detail with in some detail in the next section as their scoring value is new. Capacity building measures e.g. on applying more efficiently territorial planning instruments, estimating the carrying capacity of the coastal zone, law enforcement mechanisms, fund raising or other topics should be the provenance *of ad-hoc* advice to the 'Cellule du Littoral' and dealt with in workshops, in particular for the Forestry Service and the Department of Maritime Public Domain. Further work is being developed on this topic, one which is currently hotly contested, as estimates fro a beaches carrying capacity currently range from 2-7 m^2 per person. Due to the timing of the current surveys very few people were found on the beaches, so this section of Appendix 1, Section 1, was not carried out.

2. 2. Coastal Scenic Evaluation (CSE).

The importance of landscape was highlighted by Wascher (2001), who, for example, identified that 12.7% of the UK land area was assigned for landscape conservation as opposed to 5.3% for nature conservation. The aesthetic quality of landscape is often assessed using checklists to rate different scenic characteristics. Most checklist type of ratings used for coastal assessment are open to criticism with regard to subjectivity and weightings, particularly in rating the aesthetic qualities of a scene where viewer's preferences and priorities dominate (for example Leatherman, 1997). Checklists can be extremely helpful, and in this report, useage was made of Leopold's (1969) seminal paper. Leopold (1969) arrived at a series of parameters that he claimed could assess the aesthetic value of a site. His aim was to reduce subjectivity so that results '*could be used in many planning and decision making contexts*' (Leopold, p4, 1969). He ranked parameters on a 1-5 scale (bad-good) and produced several calculations and graphs depicting and rating the aesthetic ratings of the chosen sites.

Public perception studies.

Some 176 (124 male, 52 female) beach users were questioned as to what they thought best exemplified attractive, and its corollary, unattractive, coastal scenery. Sixty eight people were in the 18-29 age group, 82 in the 30-44 bracket and 26 in the 45-65 bracket. These responses for the parameters were compared with *circa* 1000 responses obtained from Malta, Turkey, Croatia and the UK. The responses represented the fundamental features with which to assess coastal scenery. These were then pilot tested and field results later refined. In essence, field work consisted of checking a box (1 to 5 attribute scale – presence/absence or poor quality [1], to good [5]) for all listed parameters (Appendix IV). This perception study, enabled weightings to be given to these parameters (BCR 2003). As found in previous surveys, the high ranking parameters were again sewage, water colour, a preference for sand beaches and a lack of noise. Flat landforms plus access were deemed important to Moroccan beach users as against historical features and the presence of utilities for the Turkish survey, so weighting parameters were changed slightly for scenic evaluation. (Table 2.2.1). A broad consensus existed for other parameters with the exception of biotypes. Grade 1 (not important) groupings were for rock beaches (108) and mountains (101), the latter being a surprising result. The variation between beaches was negligable.

However, quantified grading and/or order forms obtained from qualitative, subjective observations and/or pronouncements made in linguistic terms, as in the case of many coastal scenic assessment and landscape evaluations, do not replace or overcome data vagueness. Therefore, to quantify any uncertainties and subjective pronouncements inherited in assessment parameters a Fuzzy Logic Assessment (FLA) approach was used as an appropriate methodology (Zadeh, 1965; Ambala, 2001). Application of FLA, produces robust decisive factors based upon the notion of possibility (magnitude) of participation of each assessment parameter introduced into the assessment procedure as weighted averages. The factor assessment set is

$$F = \{PHYSICAL, HUMAN\} = \{P, H\}$$

where: subsets are formed from the 26 assessment parameters as:

Table 2.2.1 Overall Questionnaire Result for Turkish (T) beaches (n = 270) and Moroccan (M) beaches (n=173)

'Top six' = number of people choosing this parameter. The actual 'top 6' numbers are given in bold

	Parameters			Grading. Not Important 1	2	3	4	Very Important 5	'Top Six' T	M
1	Cliff	Height		47	29	76	64	54	6	23
2		Slope		50	34	81	53	52	6	6
3		Special Features (Indentation, Bending, Folding)		34	19	49	58	110	13	3
4	Beach Face	Type	Sand	32	17	24	51	146	**81**	**98**
5			Pebble / Gravel	75	46	68	45	36	18	19
6			Rocky	124	40	44	31	31	5	1
7		Width		30	22	48	58	112	22	19
8		Colour		42	30	54	57	87	8	7
9	Rocky Shore Platform	Slope		58	47	77	52	36	2	1
10		Extent		45	54	79	53	39	3	8
11		Roughness		38	35	62	54	81	16	16
12	Sand Dunes			74	64	53	40	39	4	16
13	Valley and River Mouth			42	25	42	75	86	14	8
14	Landform	Flat		70	51	68	43	38	12	**63**
15		Undulating		51	40	86	66	27	3	5
16		Mountainous		37	23	43	53	114	28	1
17	Tides			85	52	61	33	39	5	8
18	Coastal Landscape Features (Caves, Waterfalls, Islands, Rocks…)			7	5	21	53	184	**90**	29
19	Vistas of Far Places			18	15	49	65	123	23	43
20	Historical Features (Castles, Towers, Historical Remains...)			8	16	23	63	160	**85**	16
21	Water Colour and Clarity			4	0	5	21	240	**183**	**102**
22	Seaweed Banquetts			35	24	44	41	126	35	21
23	Biotype Diversity (Fauna)			17	6	44	58	145	64	2
24	Natural Vegetation Cover (Flora)			10	7	23	71	159	76	41
25	Absence of Noise			7	6	13	39	205	**138**	**66**
26	Absence of Sewage and Litter			6	0	5	13	246	**210**	**145**
27	Land use (Monoculture, Many Crops...)			40	24	84	62	60	15	6
28	Absence of Buildings and Utilities (Powerlines…), Natural View of the Skyline			3	5	16	40	206	**137**	19
29	Ease of Access			26	33	44	53	114	48	**104**

P = {Cliff Height/Slope/ Special Features, Beach Type/ Width/ Colour, Rocky Shore Slope/ Extent/ Roughness, Tides, Dunes, Valley, Landforms, Landscape Features, Vistas, Water Colour, Natural Vegetation Cover, Vegetation debris}

H = {Disturbance Factor, Litter, Sewage, Non-Built Environment, Built Environment, Access Type, Skyline, Utilities}

For this specific study, the sets P and H consist of eighteen and eight assessment parameters, respectively. The subgroups of the set P were further subdivided into the following influences

P = {P_1 , P_2 , P_3 , P_{other} }

where;

$\mathbf{P_1}$ = {cliff height, slope, indentation},

$\mathbf{P_2}$ = {beach type, width, colour},

$\mathbf{P_3}$ = {rocky shore slope, extent, roughness}

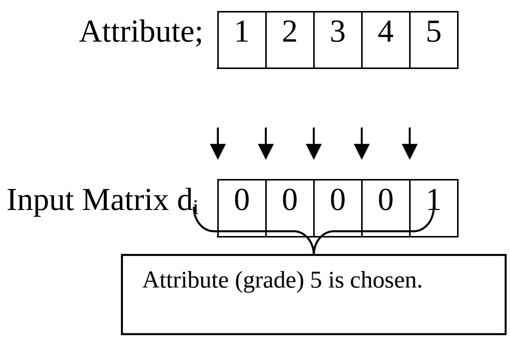
$\mathbf{P_{other}}$= {Dunes, Valley, Landform, Tides, Landscape Features, Vistas}.

The rating for the assessment parameters may take any attribute between 1 and 5, establishing a possible square matrix M_g.

Attributes

$$M_g = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix}$$

As an example, if the attribute rated as 5, the input matrix obtained from M_g is;



Input matrices of assessment parameters were obtained from parameter ratings.

Grading Matrix M_i

To quantify uncertainties and subjective pronouncements inherited in the assessment parameters; the "Fuzzy Logic Membership Grading Matrix" M_i was introduced to replace matrix M_g. This matrix hinges on the viewpoint that an error may be introduced on the chosen grades when a unique decision is made from assessment of several other possible grades.

$$M_i = \begin{bmatrix} 1 & ? & ? & ? & ? \\ ? & 1 & ? & ? & ? \\ ? & ? & 1 & ? & ? \\ ? & ? & ? & 1 & ? \\ ? & ? & ? & ? & 1 \end{bmatrix}$$

where: '?' stands for uncertainty and subjectivity.

The uncertainty is estimated as the probability that a mistake may be made in assigning grades. For example, if an attribute grade e.g. litter (parameter 21) is selected as a '5' then the input matrix is:

$$D_{21} = (0\ \ 0\ \ 0\ \ 0\ \ 1)$$

and the membership grade for this is given in the last row (see below). The estimated error is given as 0.1 in the fourth column. Other probability errors are given in the preceeding rows. All 26 parameters were treated in this manner.

$$M_{21} = \begin{array}{c} \begin{matrix} 1 & 2 & 3 & 4 & 5 \end{matrix} \\ \begin{bmatrix} 1 & 0.3 & 0 & 0 & 0 \\ 0.3 & 1 & 0.2 & 0 & 0 \\ 0 & 0.2 & 1 & 0.2 & 0 \\ 0 & 0 & 0.2 & 1 & 0.1 \\ 0 & 0 & 0 & 0.1 & 1 \end{bmatrix} \end{array}$$

Algorithms developed for assessing membership degrees of all attributes, together with weighted averages vs. attributes (Figures 2 to 5; Ergin et al, 2002, 2003), when graphed, enabled a Decision parameter D (an Evaluation Index) to be calculated (Table 1; Figure 6).

$$D = \frac{(-2 \times A_{12}) + (-1 \times A_{23}) + (1 \times A_{34}) + (2 \times A_{45})}{A_T} \quad \text{where:}$$

The area under the curve between attributes 1 and 2 is termed A_{12}
The area under the curve between attributes 2 and 3 is termed A_{23}
The area under the curve between attributes 3 and 4 is termed A_{34}
The area under the curve between attributes 4 and 5 is termed A_{45}
The total area under the curve is termed A_T

D values obtained for all investigated sites, which statistically best describe attribute values in terms of the weighted areas were found. The grade divisions were obtained from analysis of >100 investigated coastal sites in Turkey, Malta, UK, and various localities around the world. Five classes of scenery can be represented according to the D value, i.e:

CLASS 1: Extremely attractive natural site with a very high landscape value, having a D value >0.85.
CLASS 2: Attractive natural site with high landscape value, having a D value between 0.65 and 0.85.
CLASS 3: Many natural with little outstanding landscape features and a D value between 0.4 and 0.65.
CLASS 4: Mainly unattractive urban, with a low landscape value, and a D value between 0

and 0.4.

CLASS 5: Very unattractive urban, intensive development with a low landscape value and a D value <0.

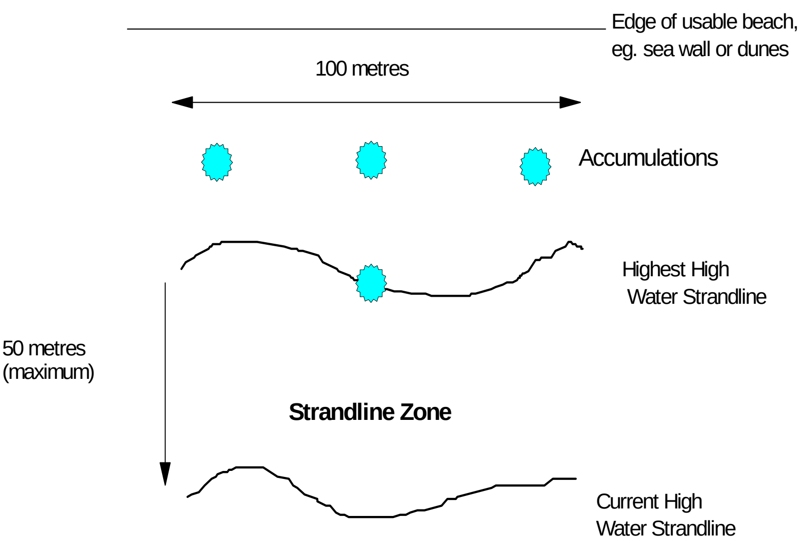
Further details of the methodology and classification, may be found in (Ergin *et al.*, 2002, 2003), including a statistical analysis of the normality of these clases. For the Moroccan field study sites investigated under the Coastal Action Plan for Nador, D values and their classes are shown in the Results and Discussion (Section 3).

2.3. Litter

Sampling Unit & Sampling Zone

The standard sampling unit consists of a 100 metre wide transect of the beach with assessments made over an area comprising the following zone. The area of usable beach behind the highest high water strandline, up to, for example, a sea wall or the edge of the dune line, (to assess primarily, wind blown accumulations of litter). **T**he section along the highest high water strandline, the area between this line and the current high water strandline (up to a maximum depth of 50 metres). The zone that comprises the sampling unit is shown i in Figure 1. The sampler should assess the area behind the high water strandline, then walk along the high water strandline and back between the two strandlines, recording the number of items in each category. This is also illustrated in Figure 2.3.1.

Figure 2.3.1 : Assessment Zone comprising the Sampling Unit



Assessment of Litter Categories:

Sewage Related Debris should include:

a) General Sewage Related Debris

- feminine hygiene products (sanitary towels, tampons and applicators);
- contraceptives;

- toilet paper;
- fatty deposits; and
- identifiable faeces of human origin.

b) ***Cotton Bud Sticks (Q tips)*** should be counted as a separate item. The Grade is determined by the worst case. Any other general comments should be recorded in the appropriate box on the survey form. An example of sewage related debris is given below.

:


c) Potentially Harmful Litter

This category includes items, which are considered dangerous to either humans or animals using the beach. These are

- sharp broken glass (counted as a separate category);
- medical waste (e.g. used syringes);
- sharps (metal wastes, barbed wire etc.);
- soiled disposable nappies;
- containers marked as containing toxic products;
- other dangerous products such as flares, ammunition and explosives; and
- Dead domestic animals

a) used syringe; b) colostomy bag .

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Any other general comments should be recorded in the appropriate box on the survey form. In this case note the type of potentially harmful litter found. For example, what hazardous material may be in a container, or specific details about other dangerous products such as ammunition. Examples of potentially harmful litter are shown above.

Health and Safety

Warning. This is a visual survey. On no account should the sampler handle material found during the survey. This applies to all categories of litter. This of course particularly applies to the potentially harmful litter category. If the sampler suspects that an item poses a significant risk to the public, for example, suspected live ammunition is found, the emergency services should be contacted immediately.

Gross Litter

Gross litter comprises items that have at least one dimension greater than 50 cm. These include such items as:

- shopping trolleys;
- pieces of furniture;
- large plastic or metal containers;
- road cones;
- bicycles, prams;
- tyres; and
- large items of processed wood e.g. pallets.

Driftwood should not be included.

General Litter

General litter includes all other items less than 50 cm in dimension such as:

- drink cans;
- food packaging;
- cigarette packets; and
- any other items.

Items with a maximum diameter of less than 1 cm should **not** be counted.

Oil and other oil like substances

Oil should be assessed as to its general presence or absence, and whether it is objectionable. This should cover all oil waste (mineral or vegetable), either from fresh oil spills or the presence of weathered oil deposits and tarry wastes. The assessment will necessarily be subjective. The following guidelines should be used to help in the categorisation of oil pollution:

Grade A: No oil present at all within the survey area. Beach considered pristine in this respect.

Grade B: Traces of oil found but in a weathered state i.e. obviously old residues. Traces found but only on other litter items such as plastic containers.

Grade C: Quantities of oil present that are a nuisance and interfere with proper use of the beach. For example, oil is found in places that are immediately noticeable, can be smelt or seen, which would prevent e.g. a person sitting on parts of the beach.

Grade D: Objectionable quantities of oil that prevents normal use of the entire beach at which the survey area is located.

Faeces (Non Human)

The numbers of animal faeces (dogs) should be counted in the survey zone. Faeces from animals such as sheep or horses should not be counted. These are not considered to be a general nuisance or hazard. However their presence should be recorded in the comments box.

Accumulations

Accumulations of litter can occur behind the highest high water strandline either as a result of being blown by the wind or dumped by users of the beach, and in the high water strandline, often in seaweed. The numbers of significant accumulations of litter are recorded. An accumulation is defined as a discrete aggregation of litter clearly visible when approaching the survey area. An example of an accumulation of litter is shown below

Any Other Items

In addition to the seven commonly occurring categories of beach litter defined above, there will be occasions when other items will be found during a survey. While these are not included in the formal classification of the beach they should be recorded on the survey form in the space provided. Examples of such items are, coal and other types of industrial waste, and naturally occurring deposits such as foam (which when decaying may be offensive and look and smell rather like oil).

Note : If during the survey there is any doubt as to which category an item should be allocated, default to the worst case. For example, if an item of general litter ***could*** be deemed harmful, but the surveyor is unsure, then **default to the harmful category**..

Classification scheme

The classification scheme is based on four Grades A - D, describing the aesthetic quality as Very Good, Good, Fair and Poor (Table 2. 3.1). The overall grade is the **worst grade** of the individual grades for each parameter.. Litter items are graded on the total numbers counted in each category. Accumulations are graded according to the number of occurrences. Oil is assessed on an estimate of the its presence or absence in the survey zone

Table 2. 3. 1 : Litter categories

	Category	Type	A	B	C	D
1	Sewage Related Debris	General	0	1-5	6-14	15+
		Cotton Buds	0-9	10-49	50-99	100+
2	Gross Litter		0	1-5	6-14	15+
3	General Litter		0-49	50-499	500-999	1000+
4	Harmful Litter	Broken Glass	0	1-5	6-24	25+
		Other	0	1-4	5-9	10+
5	Accumulations	Number	0	1-4	5-9	10+
6	Oil		Absent	Trace	Nuisance	Objectionable
7	Faeces		0	1-5	6-24	25+

The final grading is simply the worst grade for any of the above parameters. For example, a if beach is graded "A" for all parameters except General Litter which was "B", the overall grade assigned to the beach is "B".

GRADE	DESCRIPTION
A	Very Good
B	Good
C	Fair
D	Poor

2.4. Pilot study of dune vulnerabilty

Up until the 1980's the basic concept applied to dune processes was that of a steady state equilibrium system. It is only in the past 15 years that analysis of dune ecosystems has concentrated upon the idea of non-equilibrium systems. However, research has concentrated upon aspects of the physical sciences e.g. geomorphology, biology, hydrology and large proportions of the literature in this field have been concerned with micro process studies. Little attempt has been made to integrate disciplines and analyse quantitatively the holistic nature and time evolution of the whole dune system. Sherman and Bauer (1993, p440) have argued, that it *'remains a daunting prospect to develop the appropriately parameterized process based numerical model'* of the beach dune interaction. Even where some predictive morphodynamic models of the beach - dune erosion system exists, management of the latter remains an increasingly difficult task. As outlined by Walker (1990) with respect to the coastal zone, policy makers and managers require holistic techniques of data collection and analyses to enable them to cope with the large and growing population pressure on such coastal systems. This is particularly relevant to areas such as the Mediterranean dune systems which are vulnerable and in a critical phase for survival.

Theoretical/Philosophical Frameworks

Change in coastal dune systems is generated through interaction between the objective and subjective variables constituting the environment. Objective variables are those parameters accurately measured within the physical environment, for example beach width, vegetation cover, dune area. Subjective variables are set within the complex of socio-economic and cultural factors influencing system utilisation; they are more difficult to quantify. An effective management strategy depends upon the availability of essential information which is objectively measured if possible rather than anecdotal. The quality of decision making suffers if data on the system's controlling parameters is not systematically collected and analysed. This is particularly critical in assessment of dune vulnerability and determination of dune management policies because of the range of processes operating, some of which are sporadic in occurrence. A procedure of structured data collection is needed that is incorporated into the management policy with clear objectives. The aim of this work is to set structured data collection within the context of a theoretical perspective; currently these are sadly lacking within dune management strategies and procedures.

Methodology

Checklists are common in many scientific disciplines e.g. Leopold (1969), and have been applied by the authors and associates to dune systems e.g. Williams *et al.*, (1993), Matias *et al.*, (1998), Pereira *et al.*, (2000). Additionally, Partridge *et al.*, (1994) attempted to use dune vegetation as an indication of dune erosion vulnerability. A series of papers developed the methodological approach utilised (for example, Bodéré, *et al.*, 1991; Williams *et al.*, 1993; Davies, *et al.*,1995), and this was applied to selected Moroccan dune systems. The checklist procedure is a structured approach to assessment of dune conditions, which can be used both spatially and temporally (Williams, *et al.*, 1993). The condition of the system is assessed by utilising a 0-4 scaling procedure for each of 54 parameters. Details of the checklist used can be found in Davies *et al*., (1995). The parameters are organised into 5 sections (Table 2.4.1):

A. Site and Dune Morphology (8 parameters);
B. Beach Condition (9 parameters);
C. Surface **C**haracter of the Seaward 200m (12 parameters);
D. Pressure of Use (14 parameters);
E. Protection Measures (11 parameters).

Percentage scores for the ratings in each section are calculated and summation of the scores in sections A-D gives a measure of the overall environmental characteristics of the system coupled with the effects of visitor pressure, this is termed the site Vulnerability Index (VI). The percentage score for the remaining 11 parameters provides an overall indication of the extent of specific procedures applied to the system, this is referred to as the index of Protection Measures (PM). Protection in this context being defined as procedures aimed at countering the processes causing loss of diversity within the dune system and which threaten the existence of the system itself. A VI/PM ratio can be obtained to describe the equilibrium relationship at the site. The data can be presented in Tabular (Table 3.3.1) or graphical form. Systems equilibrium tend to have a VI/PM ratio between 0.8 and 1.3; systems out of equilibrium either have a positive ratio of < 0.8 or a negative one of > 1.3. These indices allow managers to assess changes at a site through time or to compare dune sites on a regional scale.

TABLE 2.4.1. Coastal sand dune vulnerability checklist.

				SCORES		
	Section A - Site and dune morphology	**0**	**1**	**2**	**3**	**4**
1	Slope of inter-tidal zone	gentle slope [ ]		medium [ ]		steep slope [ ]
2	Length of dune coast (km)	> 20 [ ]	> 10 [ ]	> 5 [ ]	> 1 [ ]	> 0.1 [ ]
3	Width of dune belt (km)	> 5 [ ]	> 2 [ ]	> 1 [ ]	> 0.1 [ ]	< 0.1 [ ]
4	Maximum height of dunes (m) from MHWS	> 25 [ ]	> 10 [ ]	> 5 [ ]	> 1 [ ]	< 1 [ ]
5a	If ridged - number of major ridges (< 1 m)	> 10 [ ]	5-9 [ ]	3-4 [ ]	2 [ ]	1 [ ]
5b	If plastered to slope - slope steepness	moderate [ ]		gentle [ ]		steep [ ]
5c	If perched on cliff - cliff height (m)	< 2 [ ]		2-5 [ ]		> 5 [ ]
6	Relative total area of low zones/wet slacks	moderate [ ]		small [ ]		none [ ]
7	Particle size in foredunes/upper beach	100-200		200-400		>400 / <100
	Compare particle size with index Phi sizes	=< -1 [ ]	0 [ ]	+ 1 [ ]	+ 2 [ ]	+ 3 [ ]
8	Infra-tidal topography	elevated structures		flat		canyons
	Total score/percentage					
	Section B - Condition of the beach					
1	Width of inter-tidal zone (km)	> 0.5 [ ]	> 0.2 [ ]	> 0.1 [ ]	> 0.05 [ ]	< 0.05 [ ]
2	Sand supply input	high [ ]		moderate [ ]		low [ ]
3	Pebble cover as % of surface	0 [ ]	< 5 [ ]	> 5 [ ]	> 25 [ ]	> 50 [ ]
4	% foredunes cliffed by the sea	0 [ ]	< 25 [ ]	> 25 [ ]	> 50 [ ]	> 75 [ ]
5	Dune cliff as % dune height	0 [ ]	< 25 [ ]	> 25 [ ]	> 50 [ ]	> 75 [ ]
6	Breaches in seaward face	none [ ]		some [ ]		many [ ]
7	Width of breaches in seaward face	< 2[ ]		2-10 [ ]		> 10 [ ]
8	Seaweed on upper beach	much [ ]		some [ ]		none [ ]
9	Colonisation by vegetation in zone between dune face and HWSM	much [ ]		some [ ]		neg [ ]
	Total score/percentage					

Section C - Surface character of seaward 200m

1	% system surface unvegetated	< 10 [ ]	> 10 [ ]	> 20 [ ]	> 40 [ ]	> 75 [ ]
2	Blowouts as % of system area	< 5 [ ]	> 5 [ ]	> 10 [ ]	> 20 [ ]	> 40 [ ]
3	Sand blown inland from system	little [ ]		some [ ]		much [ ]
4	Saltwater invasion of dunes	none [ ]		some [ ]		much [ ]
5	% new dunes along seaward edge	> 50 [ ]	> 25 [ ]	> 5 [ ]	< 5 [ ]	0 [ ]
6	% breaches with new dunes	> 75 [ ]	> 50 [ ]	> 25 [ ]	> 5 [ ]	0 [ ]
7	% seaward dune front vegetated	> 90 [ ]	> 60 [ ]	> 30 [ ]	> 10 [ ]	< 10 [ ]
8	If recent sand deposition assess colonisation by marram, *Elymus* etc	much [ ]		some [ ]		none [ ]
9	% impenetrable cover	some [ ]		little [ ]		none/much [ ]
10	Frontal change since 1940	advance [ ]		oscil. [ ]		retreat [ ]
11	Vegetation cover change since 1940	inc. [ ]		oscil. [ ]		decr. [ ]
12	Relic quarries in frontal 200m	none [ ]		small [ ]		large [ ]

Total score/percentage

Section D - Pressure of Use

1	Visitor pressure	low [ ]	moderate [ ]	high [ ]
2	Road access	none [ ]	moderate [ ]	good [ ]
3	On-dune driving	none [ ]	some [ ]	much [ ]
4	Horse riding	none [ ]	some [ ]	much [ ]
5	Path network density	low [ ]	medium [ ]	high [ ]
6	Paths incised	little [ ]	moderate [ ]	deep [ ]
7	Commercial camping	little [ ]	some [ ]	much [ ]
8	Dispersed camping	little [ ]	some [ ]	much [ ]
9	Housing	little [ ]	some [ ]	much [ ]
10	Owners	one [ ]	some [ ]	many [ ]
11	Main owner/manager	protection org's[ ]	public	private [ ]
12	Commercial/random extraction	none [ ]	some [ ]	much [ ]
13	Grazing by cattle/sheep/goats	none [ ]	some [ ]	much [ ]
14	Rabbit population	small [ ]	moderate [ ]	large [ ]

Total score/percentage
Vulnerability score and index

Section E - Recent protection measures

1	Surveillance and maintenance	none [ ]		some [ ]		much [ ]
2	% area with restricted access	0 [ ]	< 10 [ ]	> 10 [ ]	> 25 [ ]	> 50 [ ]
3	Controlled parking	none [ ]		some [ ]		all [ ]
4	Horse riding controlled	none [ ]		some [ ]		all [ ]
5	On-dune driving controlled	none [ ]		some [ ]		all [ ]
6	Managed paths	none [ ]		some [ ]		all [ ]
7	Sand traps	few [ ]		some [ ]		many [ ]
8	Planting on mobile areas (%)	0 [ ]	< 10 [ ]	> 10 [ ]	> 25 [ ]	> 50 [ ]
9	Information boards	none [ ]		some [ ]		many [ ]
10	If protection against marine erosion, impact on the dune	neg. [ ]		some [ ]		much [ ]
11	Protection by legislation	weak [ ]		moderate [ ]		str. [ ]

A simple descriptive classification is also possible where, Low Vulnerability - Low Response (Category 1), or High Vulnerability - High Response (Category 11), equates to systems in equilibrium. Out of equilibrium: positive dune systems, would be those sites described as having Low vulnerability and High Response characteristics (Category 111), they are the highly protected sites. Out of equilibrium: negative systems, would be those described as having High Vulnerability - Low Response characteristics (Category IV) and are clearly the most problematic sites with regard to conservation.

3. RESULTS AND DISCUSSION

3.1. COASTAL SCENERY

Table 3.1 gives calculated scenic values for all sites and Figure 3.1.1 gives the various graphed parameters for all sites. A breakdown is:

Class I

Kamkoum El Baz, was the only first class site seen. With respect to the physical parameters: spectacular cliff formations, beach characteristics, landscape features, natural vegetation features and dunes each scored scores maximum values. Human parameters (except the ubiquitous litter problem), obtained the highest attribute values. Litter was found on the full strand line.

Class II

Three sites fell into this category. Taourirt had excellent attribute values for its beach, even though no cliff/rocky shore existed. Several dunes were seen and its skyline form was very good. All human parameters were excellent except for litter and sewage evidence. Sidi Driss had a very good attribute score for its beach and valley parameters. With regards to human parameters, no sewage evidence was found and little urbanisationhas occurred. Litter had an attribute score of 1 with continuous accumulations being found. Plage Rouge - a small pocket beach, scored highly on its cliff, valley and beach parameters. Human parameters scored well apart for litter.

Class III

Eight sites were found. Natural parameters tended to be similar for all sites. Litter and urbanisation were the common denominator for the lower scoring sites Bokhane, investigations on the western and eastern environments, revealed similar charactistics apart from the built environment factor which affected D values. The eastern segment was rated a class III whereas the west was a class IV. The former has had sensitive urbanisation, whereas the latter had heavy industry (e.g. commercial port), which affected the rating. Kalat is a future resort site and as work is in progress here, results will undoutedly change in the near future. Little litter was found here as a result of the construction process.

Class IV

A further nine sites fell into this group. Nothing spectacular was seen with repect to the physical parameters. Most all had no cliff/rocky shore and medium values for the rest. The low D values were based in the main on litter and urbanisation together with little natural vegetation.

(a) (b)

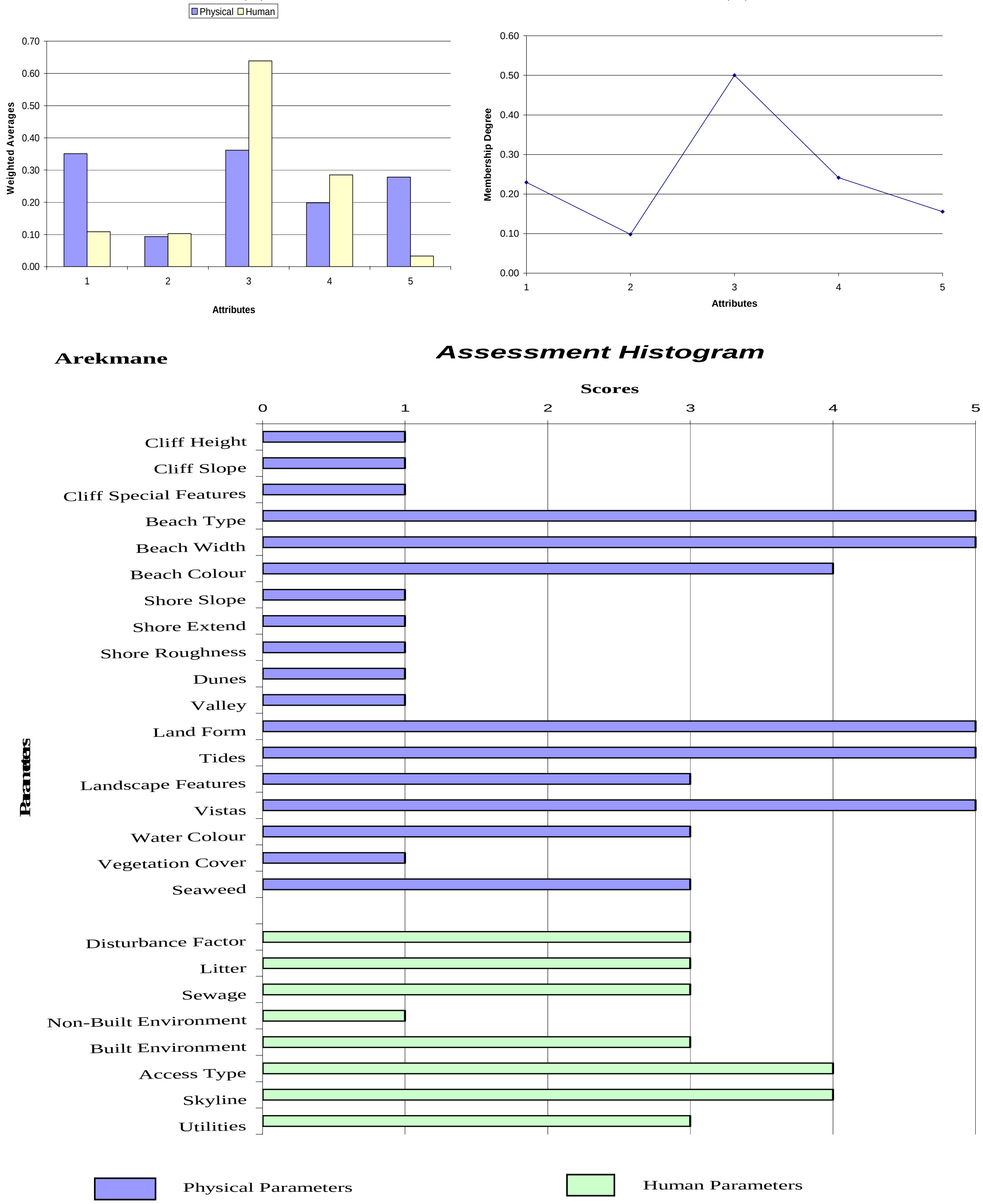
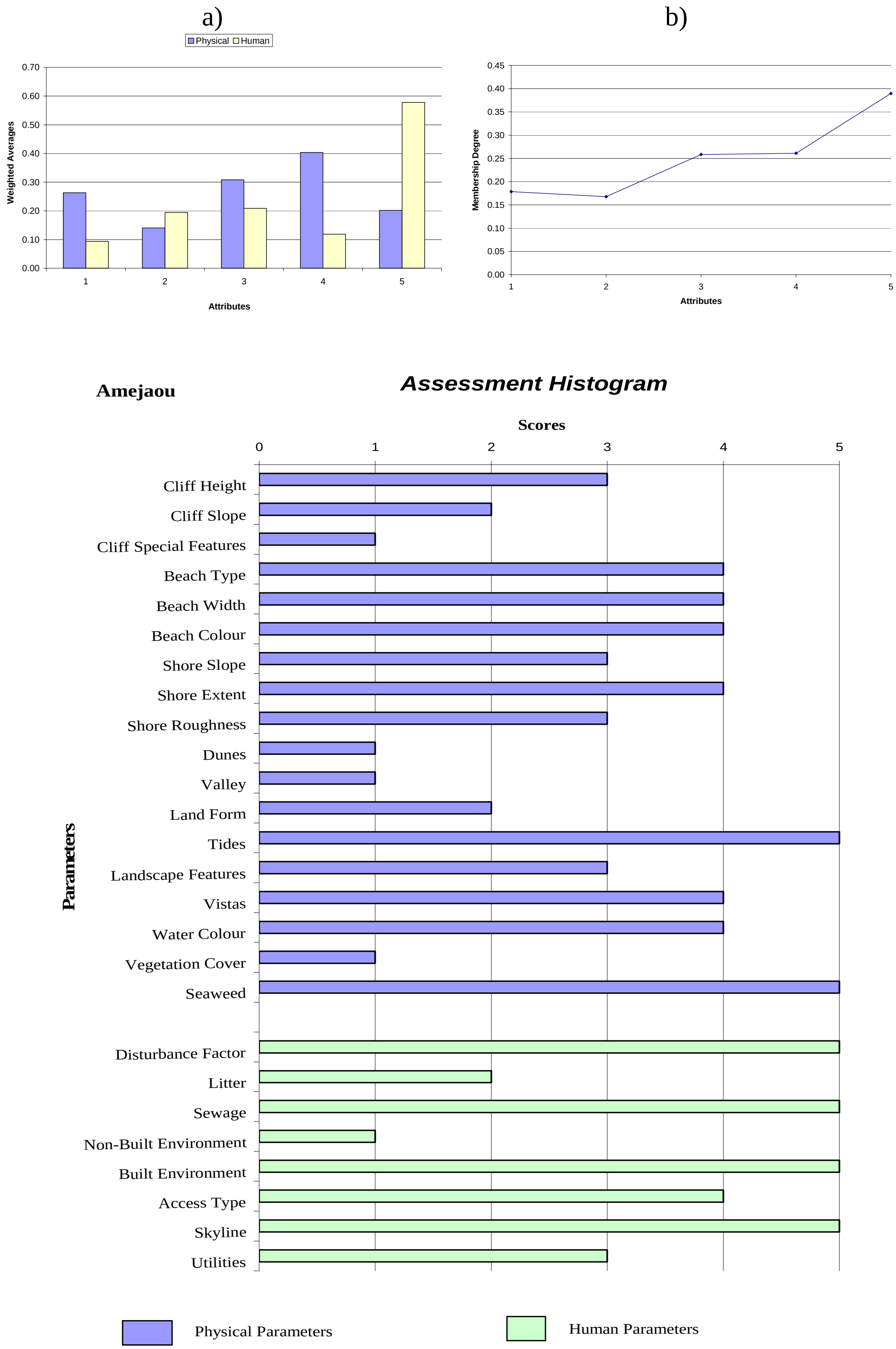
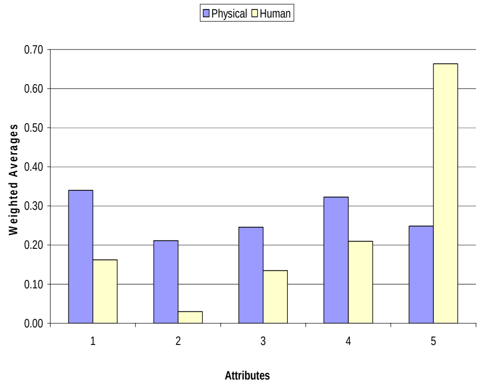


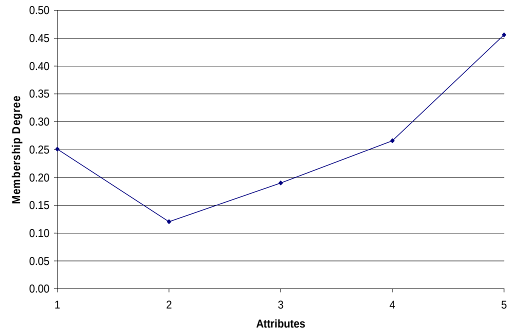
Fig. 3.1.1. **Arakmane**: Weighted averages (a), membership degrees (b) and assessment histogram

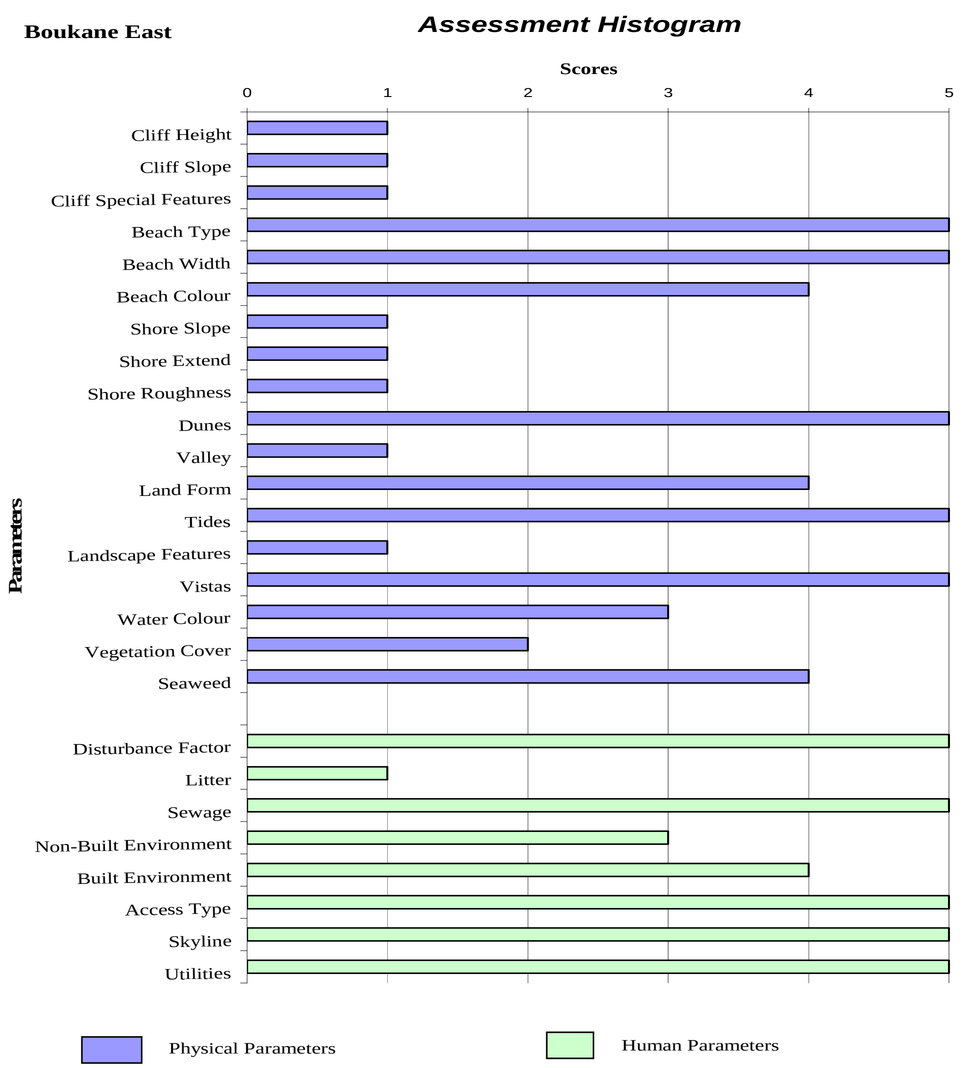


Amejeau: Weighted averages (a), membership degrees (b) and assessment histogram

a) b)

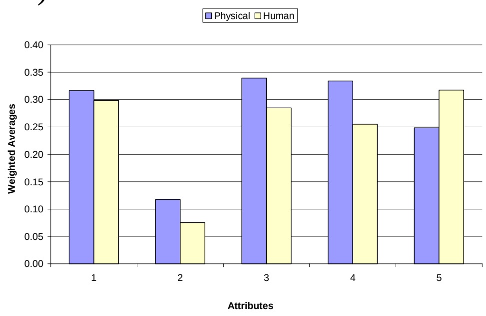




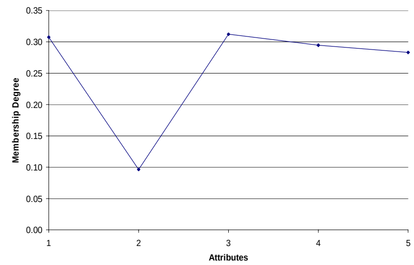


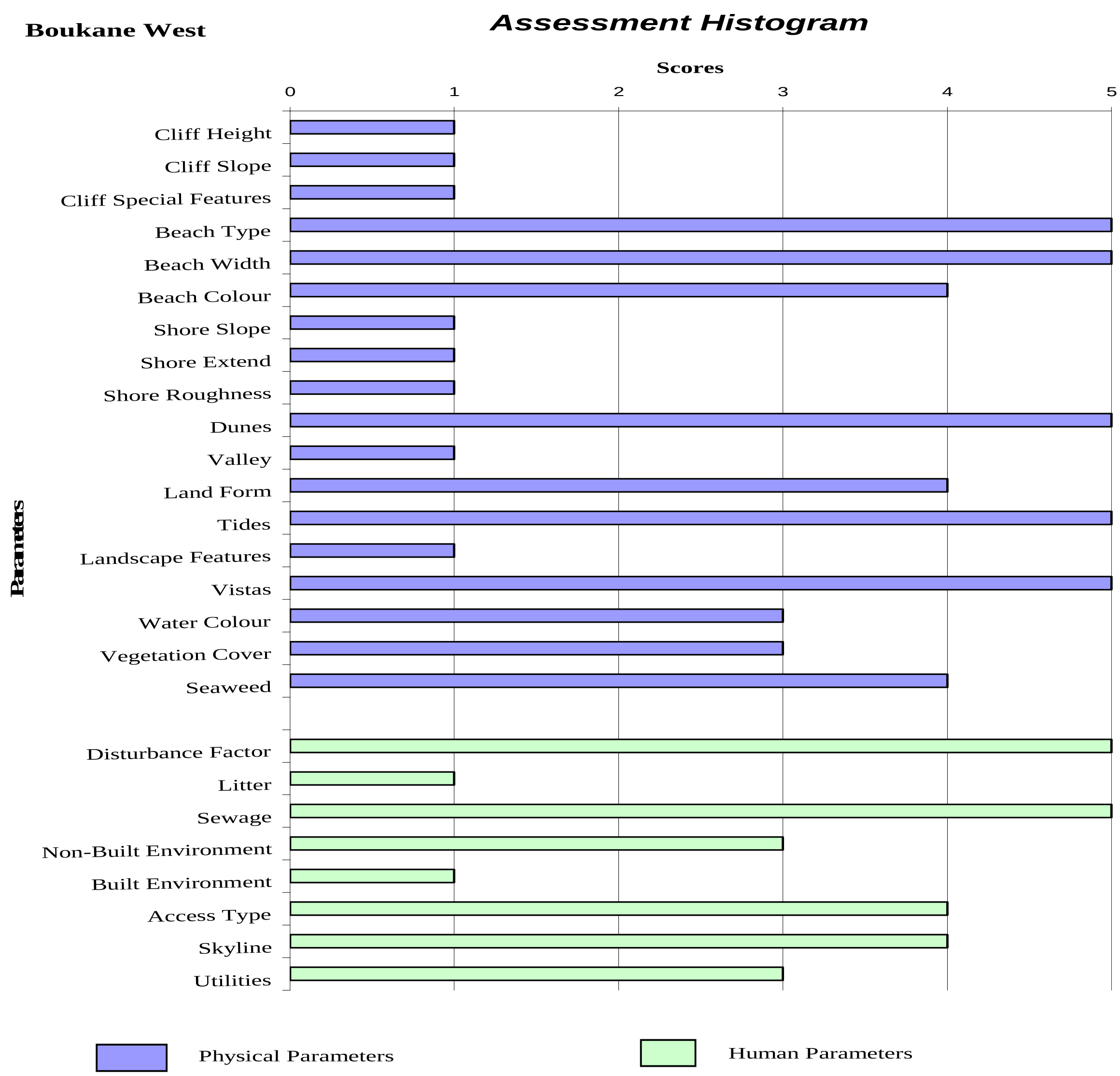
Boukama east: Weighted averages (a), membership degrees (b) and assessment histogram

a)



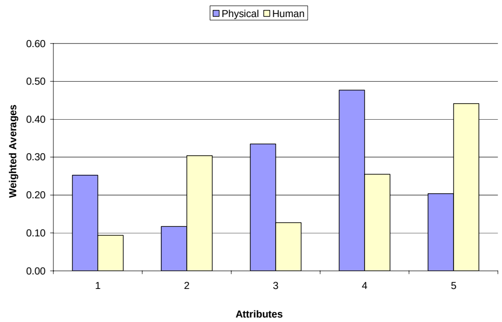
b)

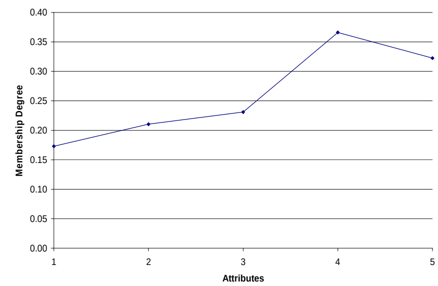


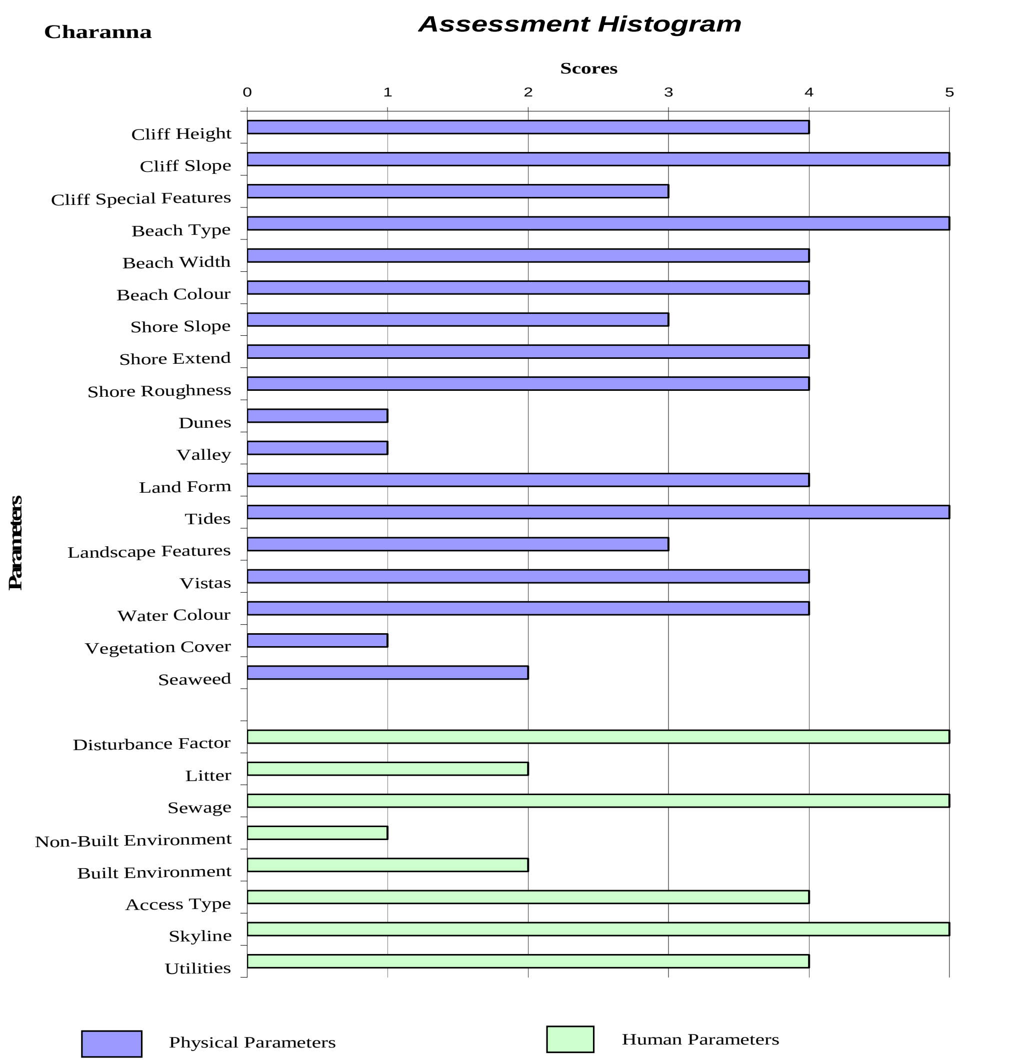


Boukama west: Weighted averages (a), membership degrees (b) and assessment Histogram

a) b)

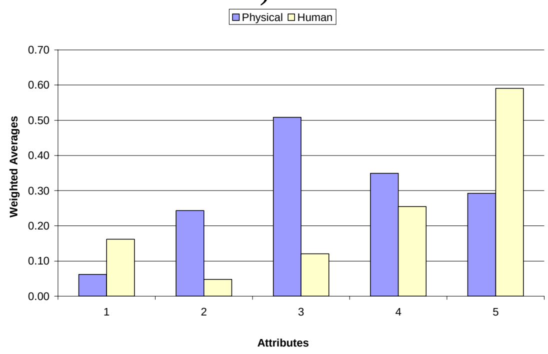






Charanna:: Weighted averages (a), membership degrees (b) and assessment histogram .

a)



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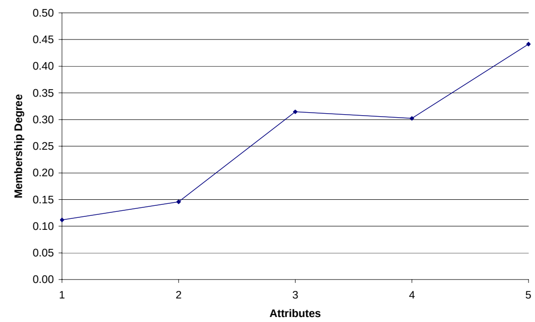
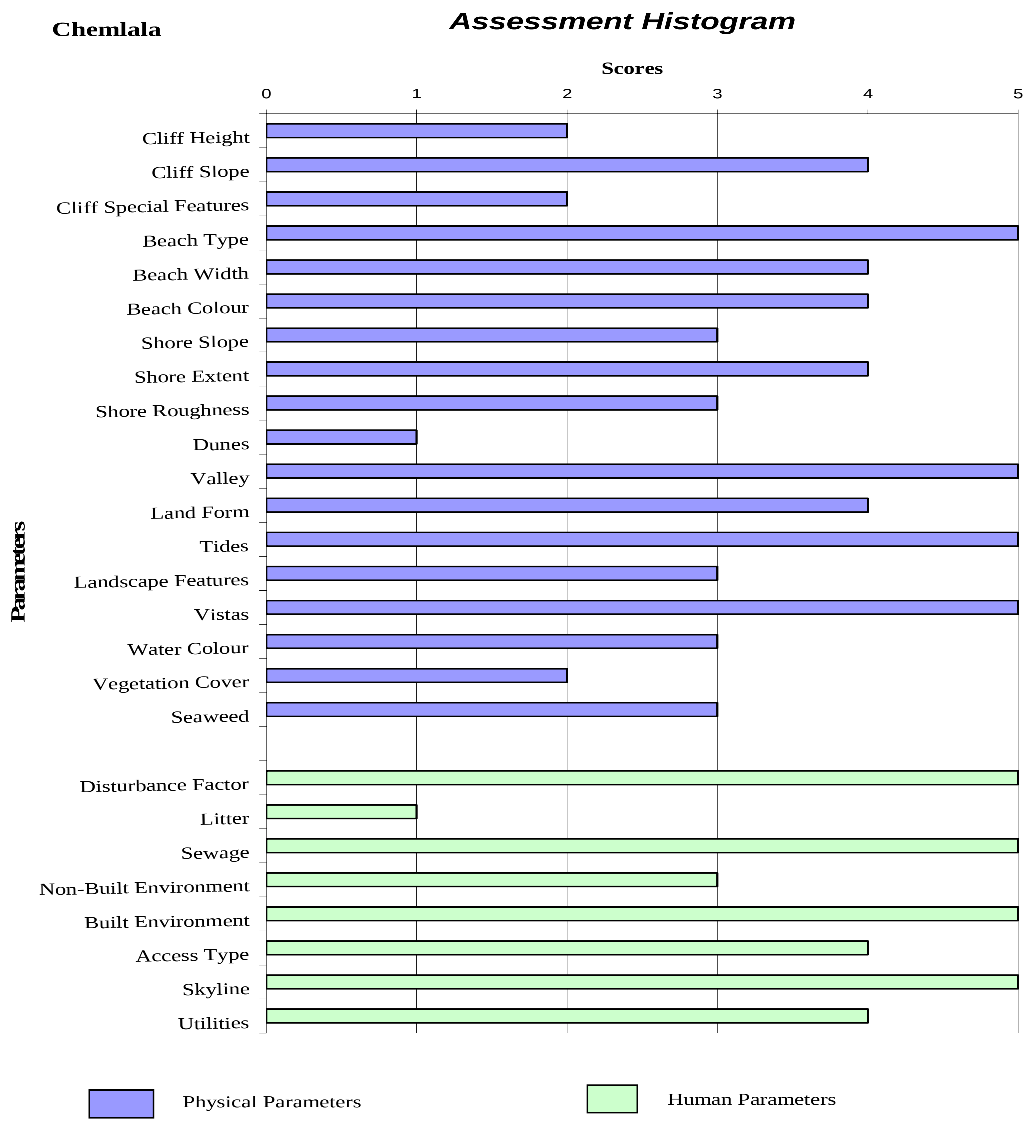
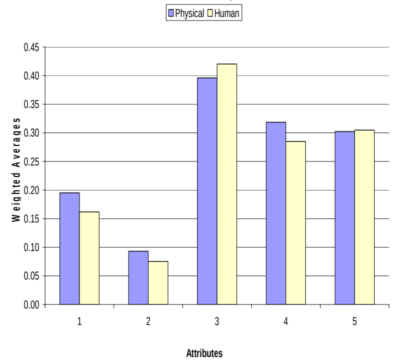


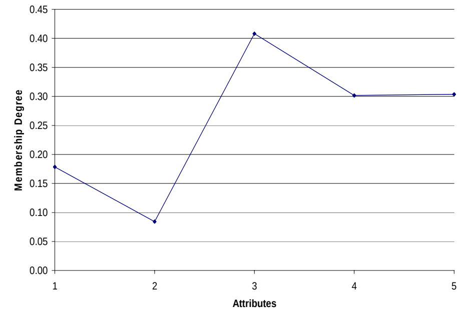


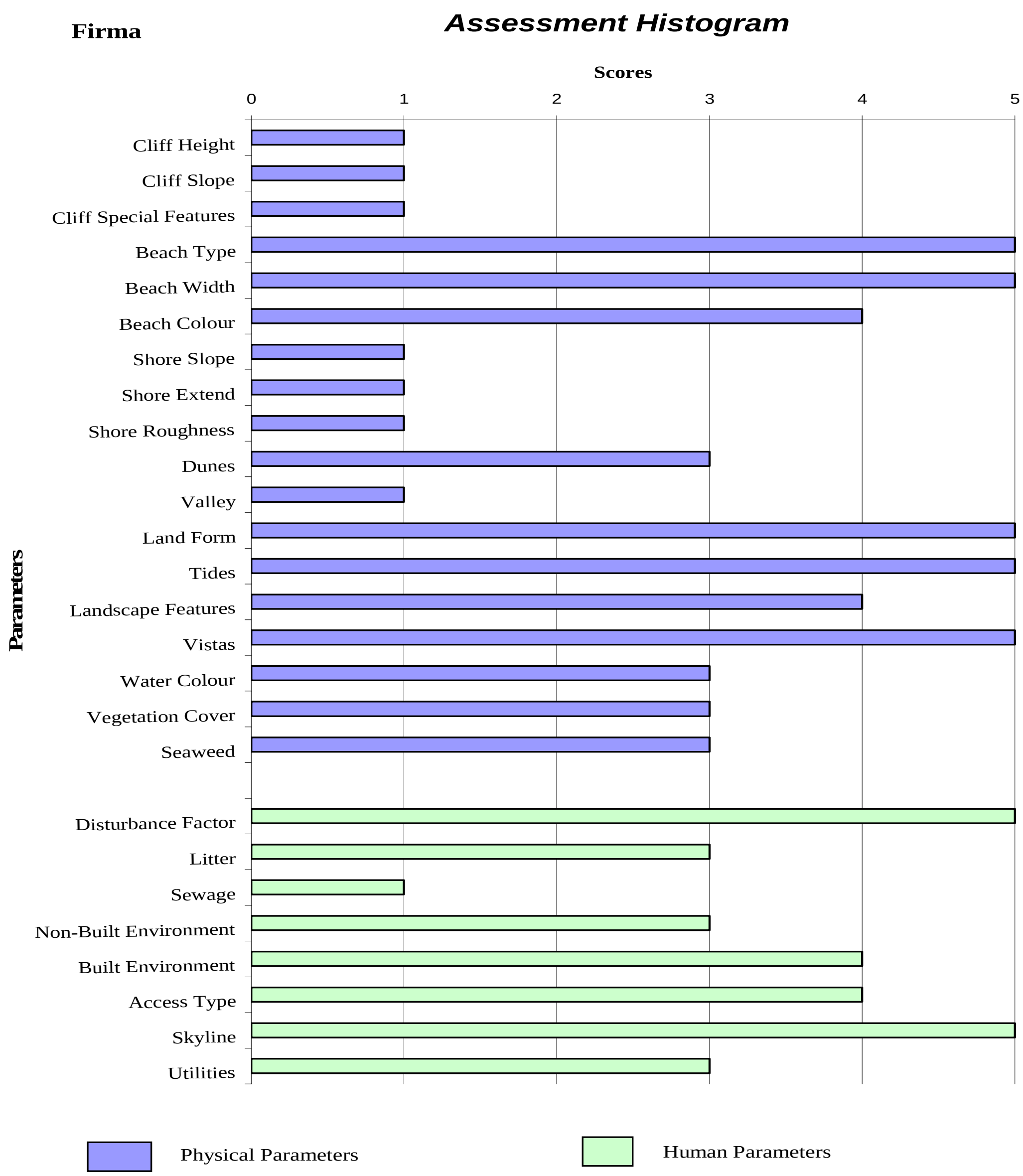
Chemlala:: Weighted averages (a), membership degrees (b) and assessment histogram .

a)



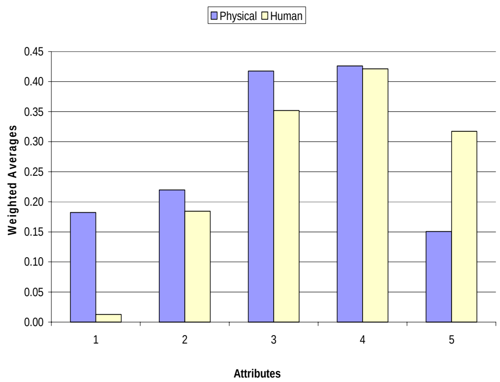
b)

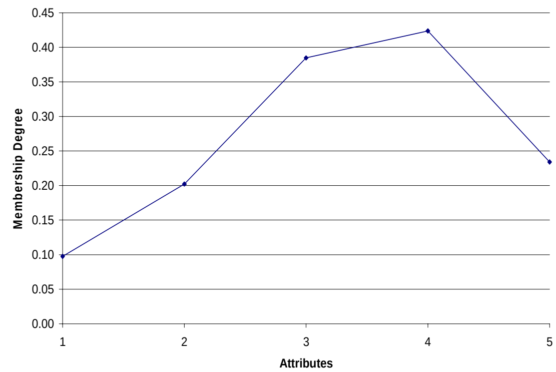


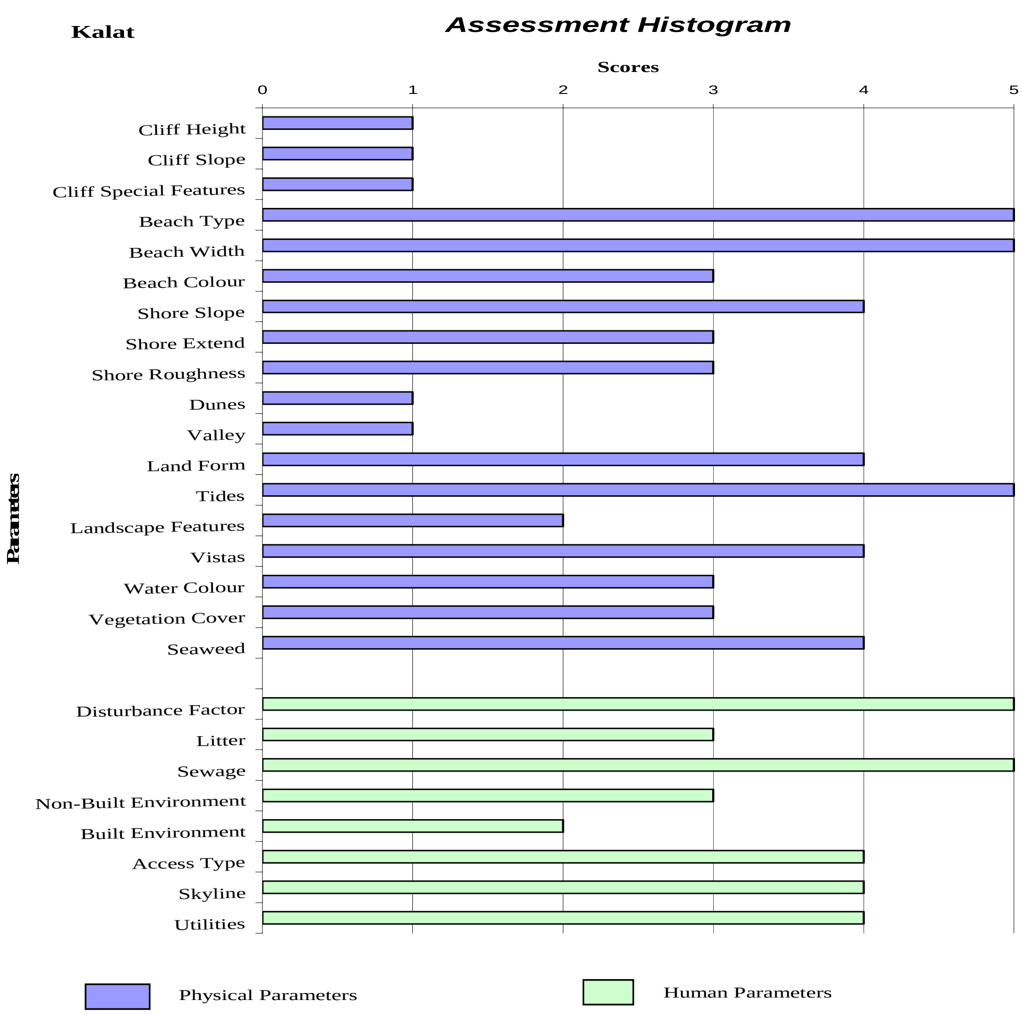


Firma: Weighted averages (a), membership degrees (b) and assessment histogram

a) b)

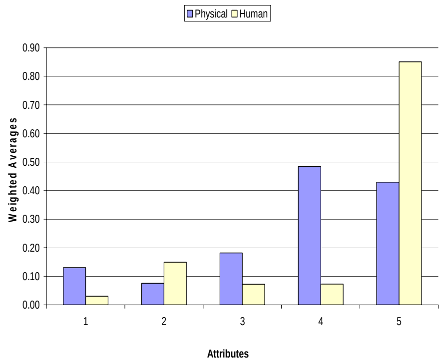


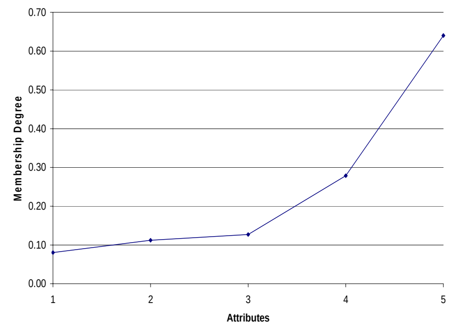


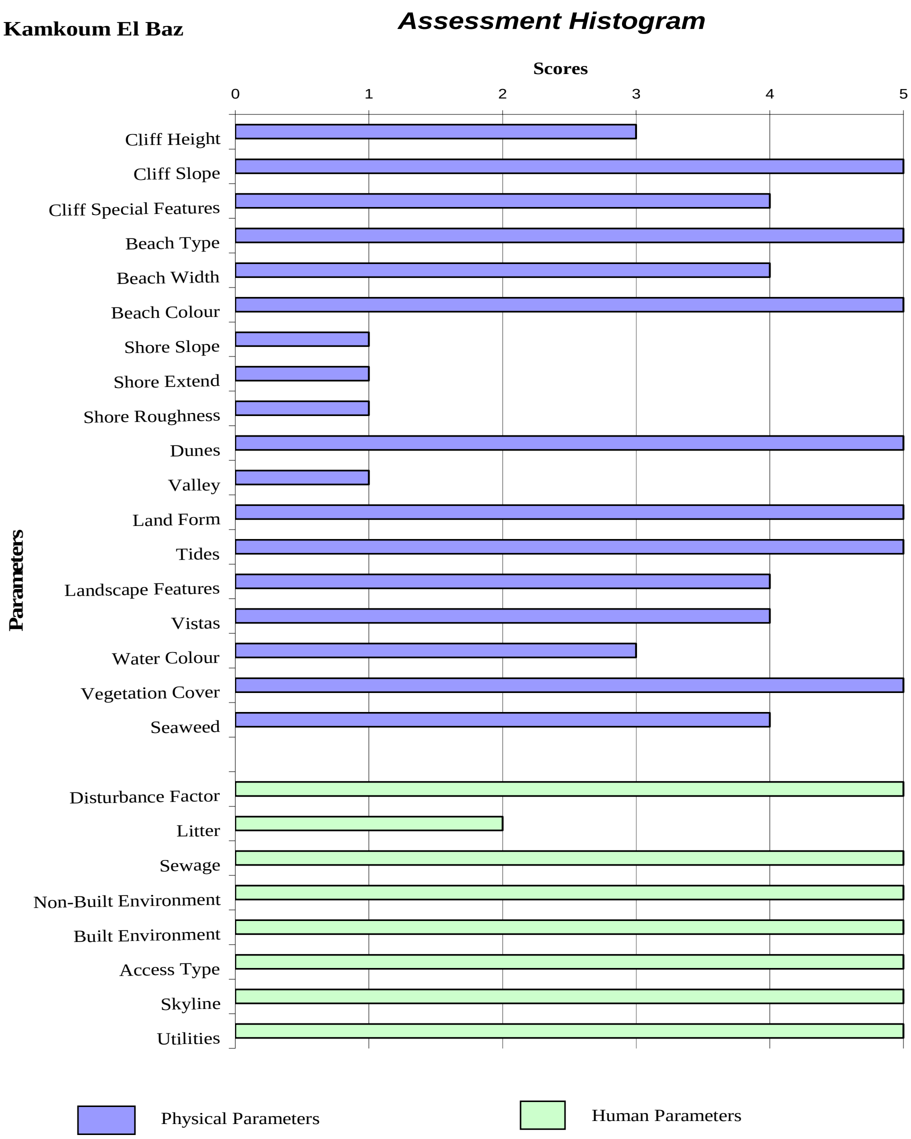


Kalat: Weighted averages (a), membership degrees (b) and assessment histogram

a) b)

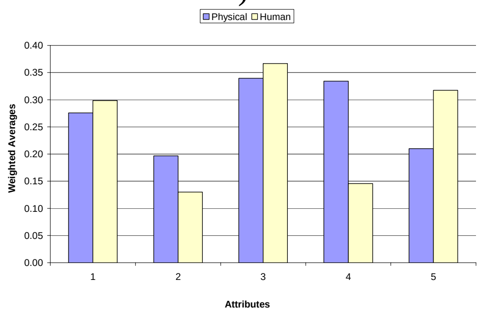




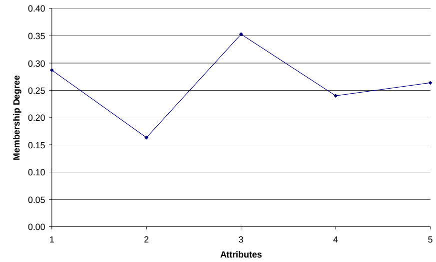


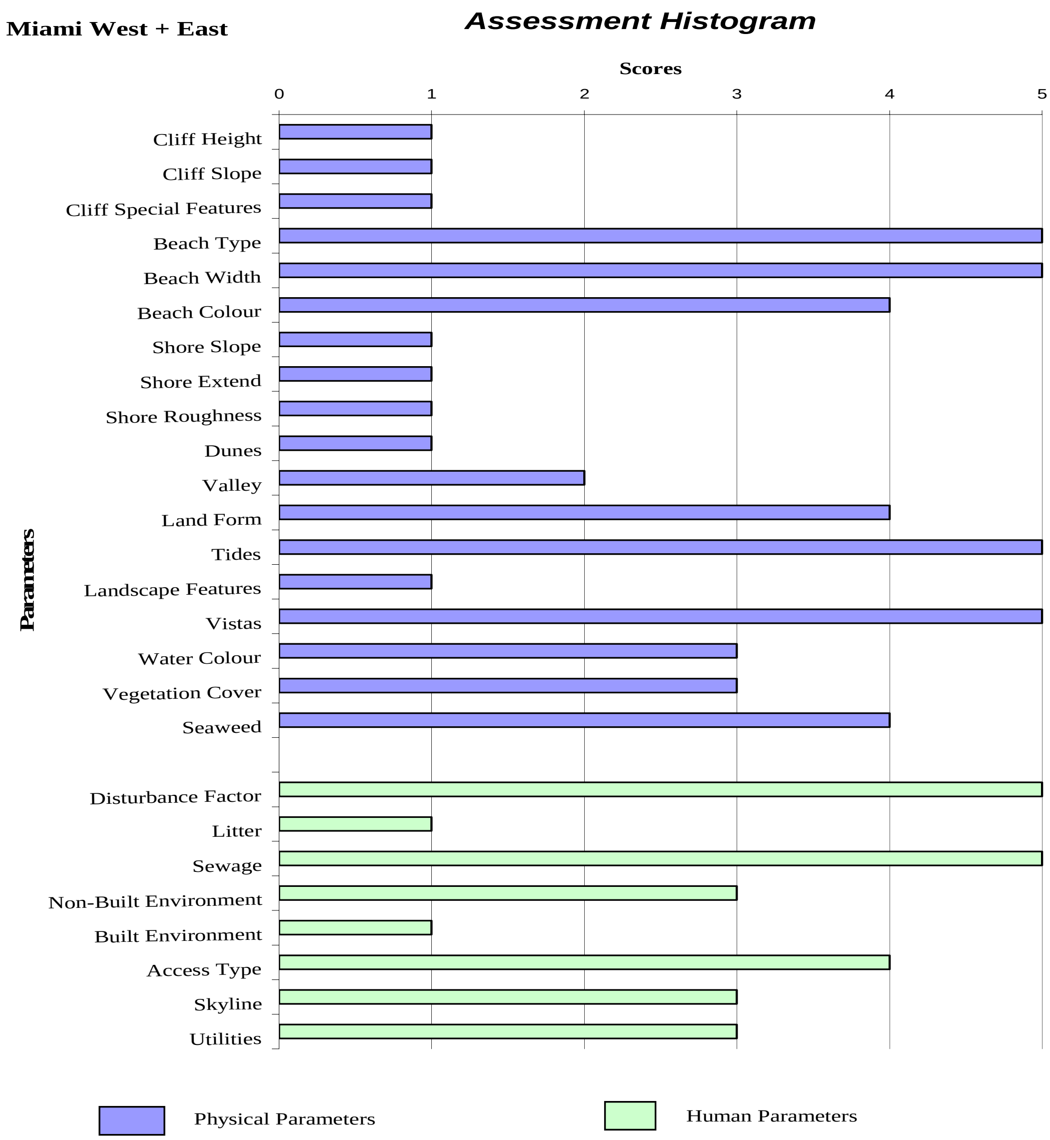
Kamkoum Ej Baz: Weighted averages (a), membership degrees (b) and assessment histogram

a)



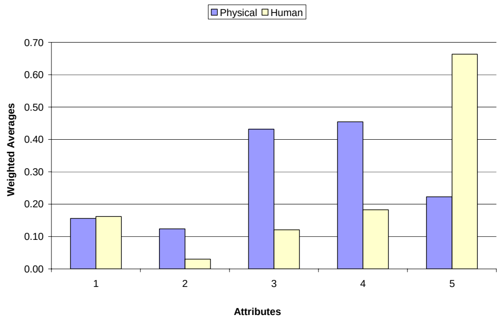
b)

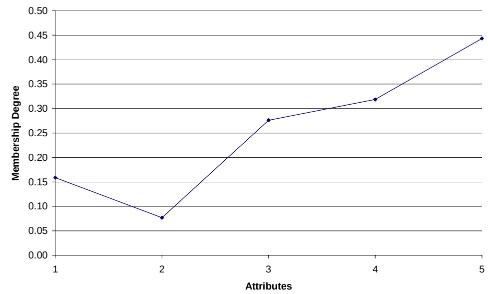


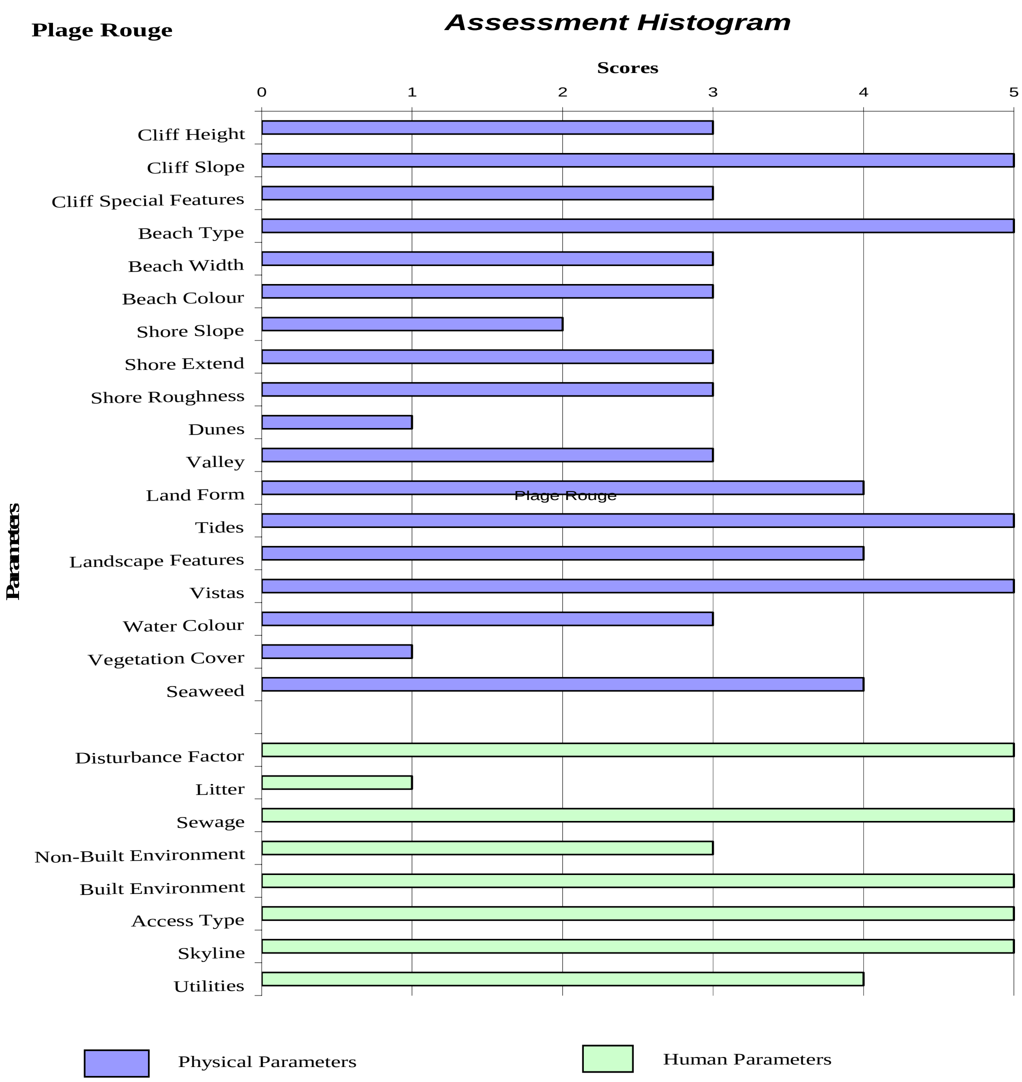


Miami East and West: Weighted averages (a), membership degrees (b) and assessment histogram

a) b)

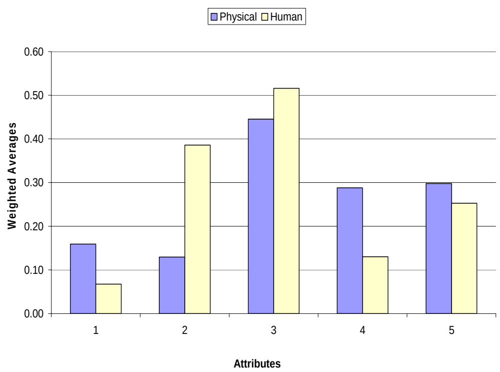


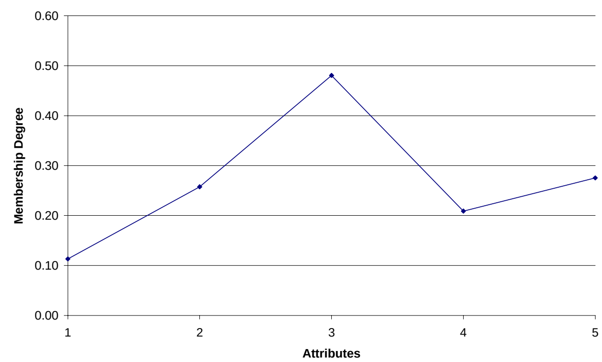


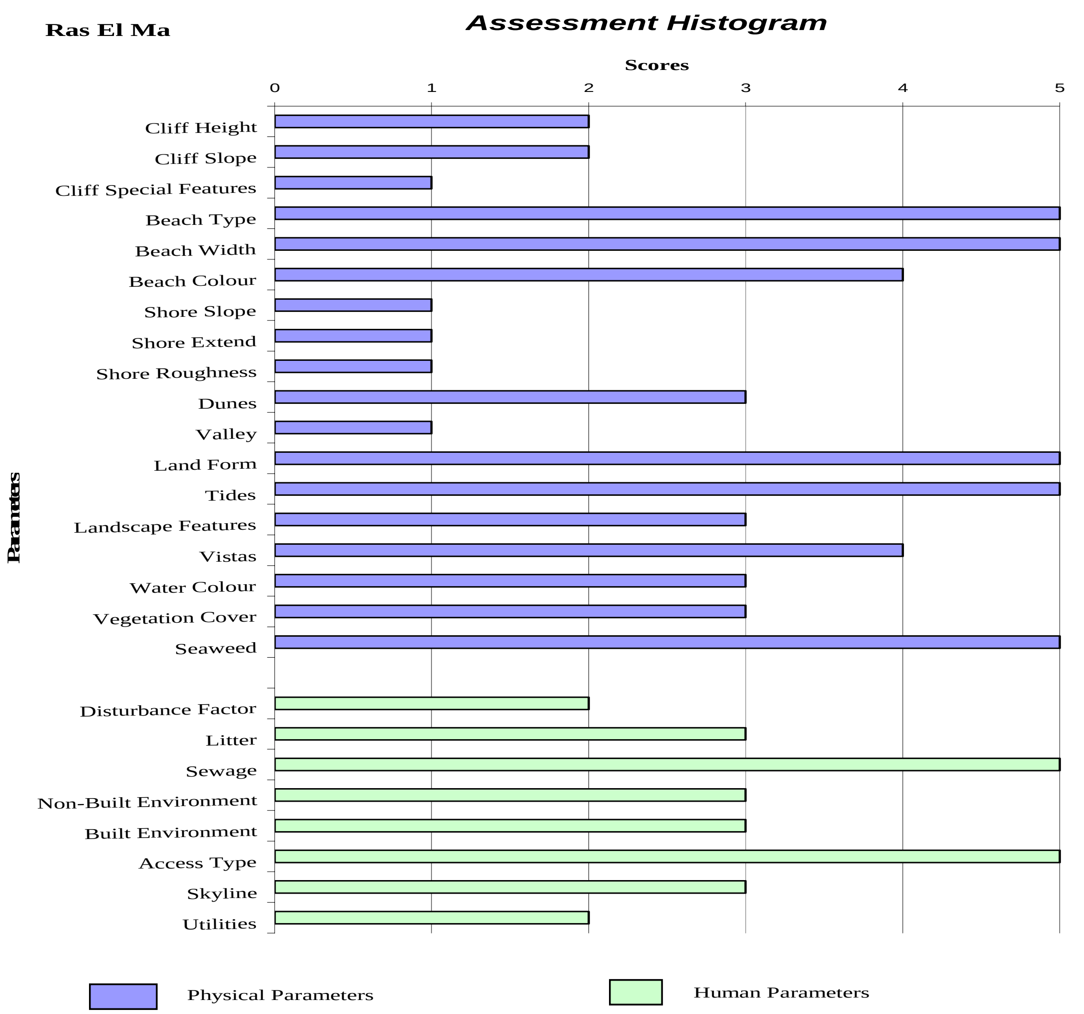


Plage Rouge : Weighted averages (a), membership degrees (b) and assessment histogram

a) b)

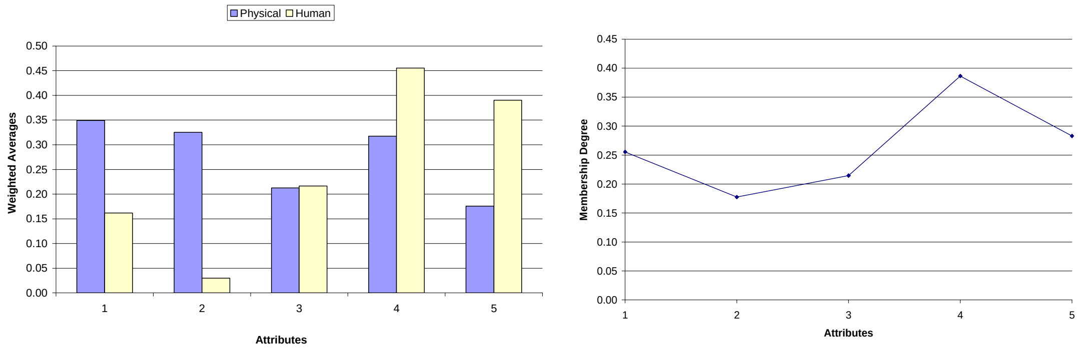


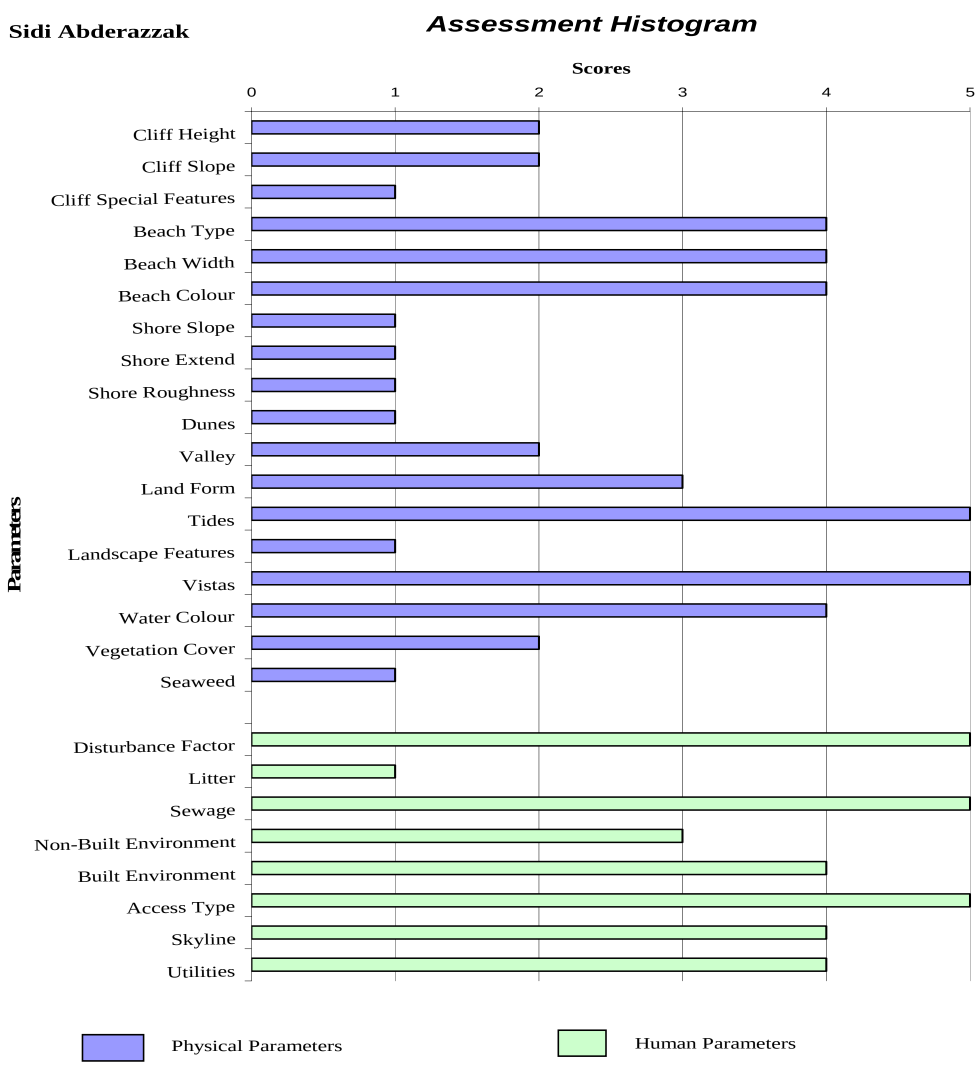




Ras El Ma : Weighted averages (a), membership degrees (b) and assessment histogram

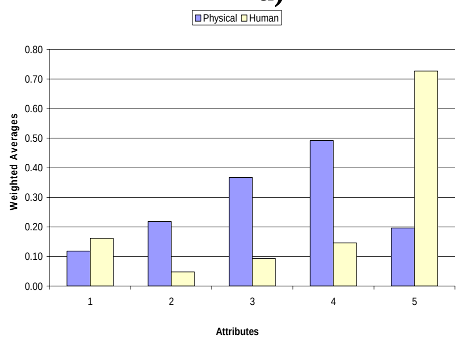
a) **b)**



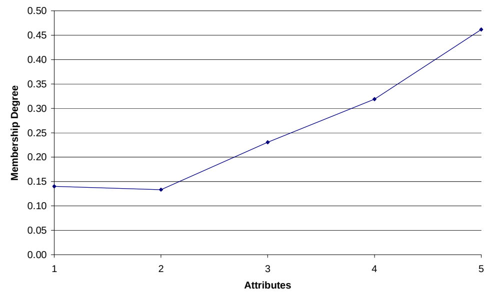


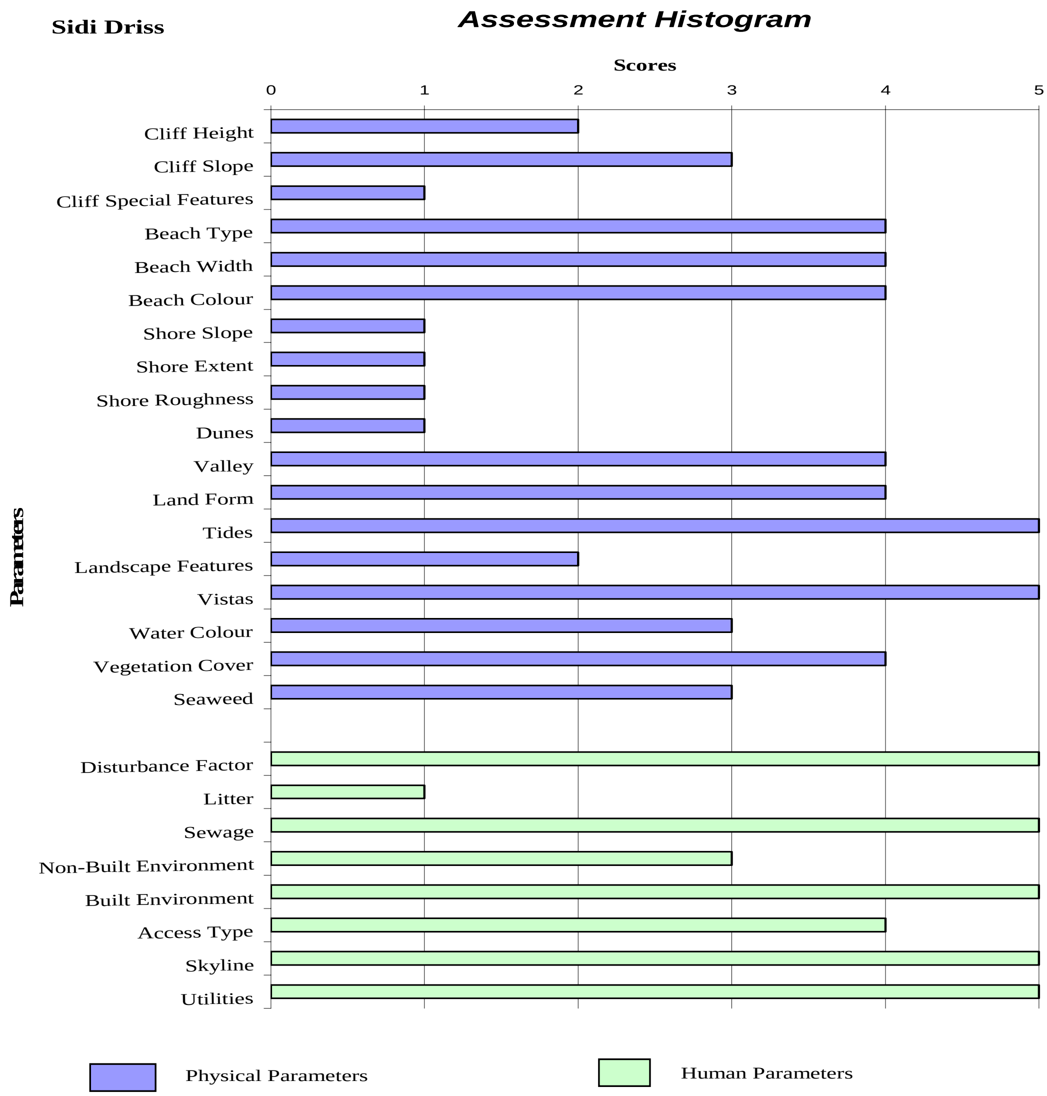
Sidi Abderazzak: Weighted averages (a), membership degrees (b) and assessment histogram

a)

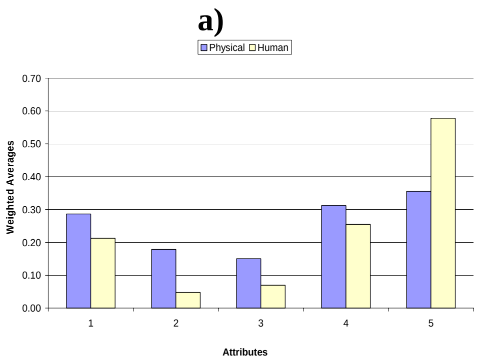


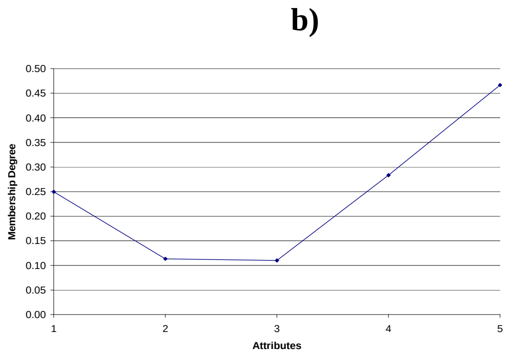
b)

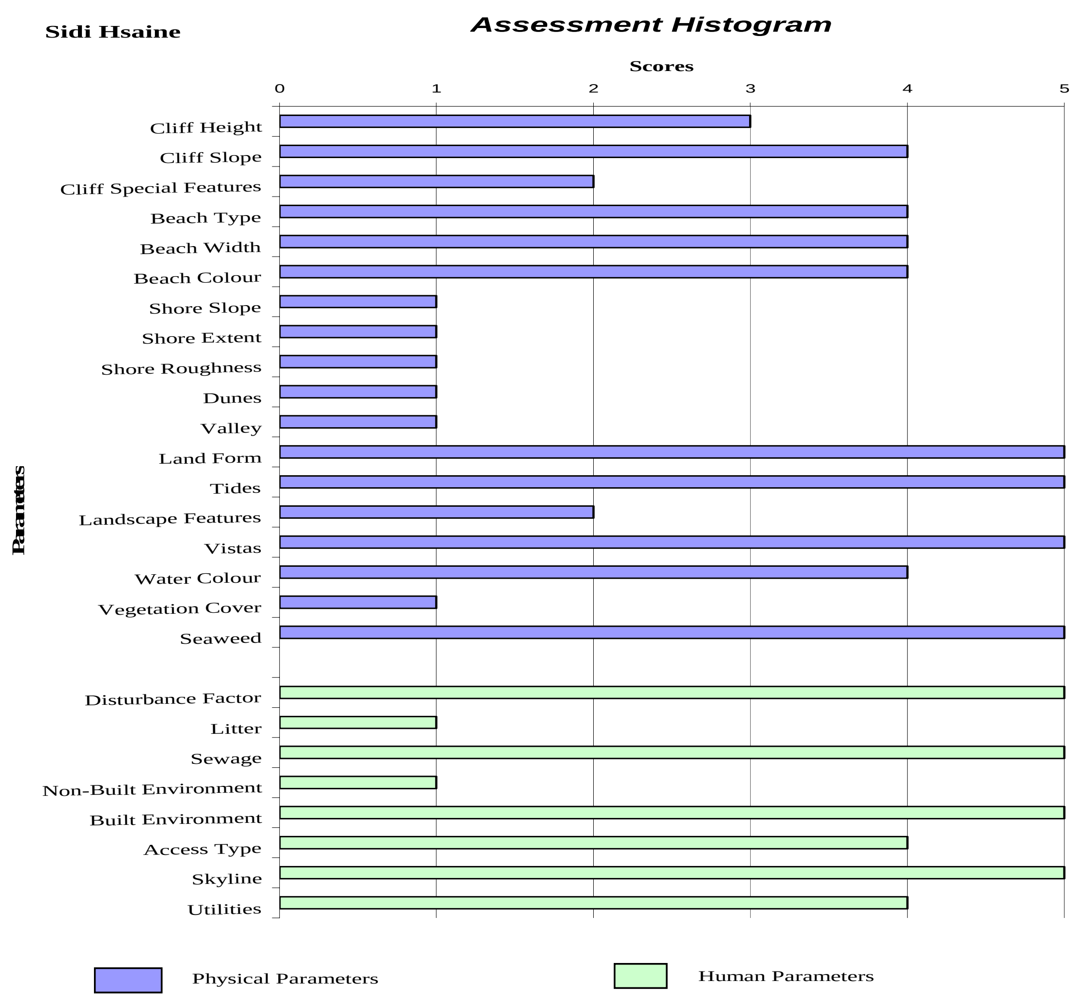




Sidi Driss: Weighted averages (a), membership degrees (b) and assessment histogram

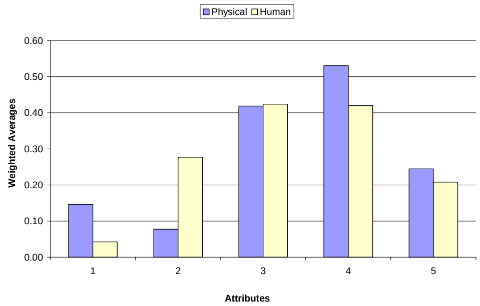


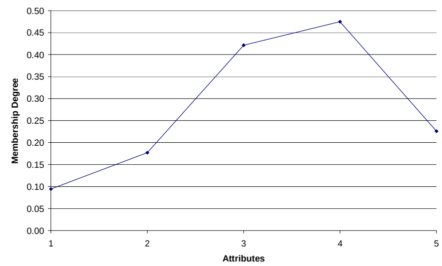


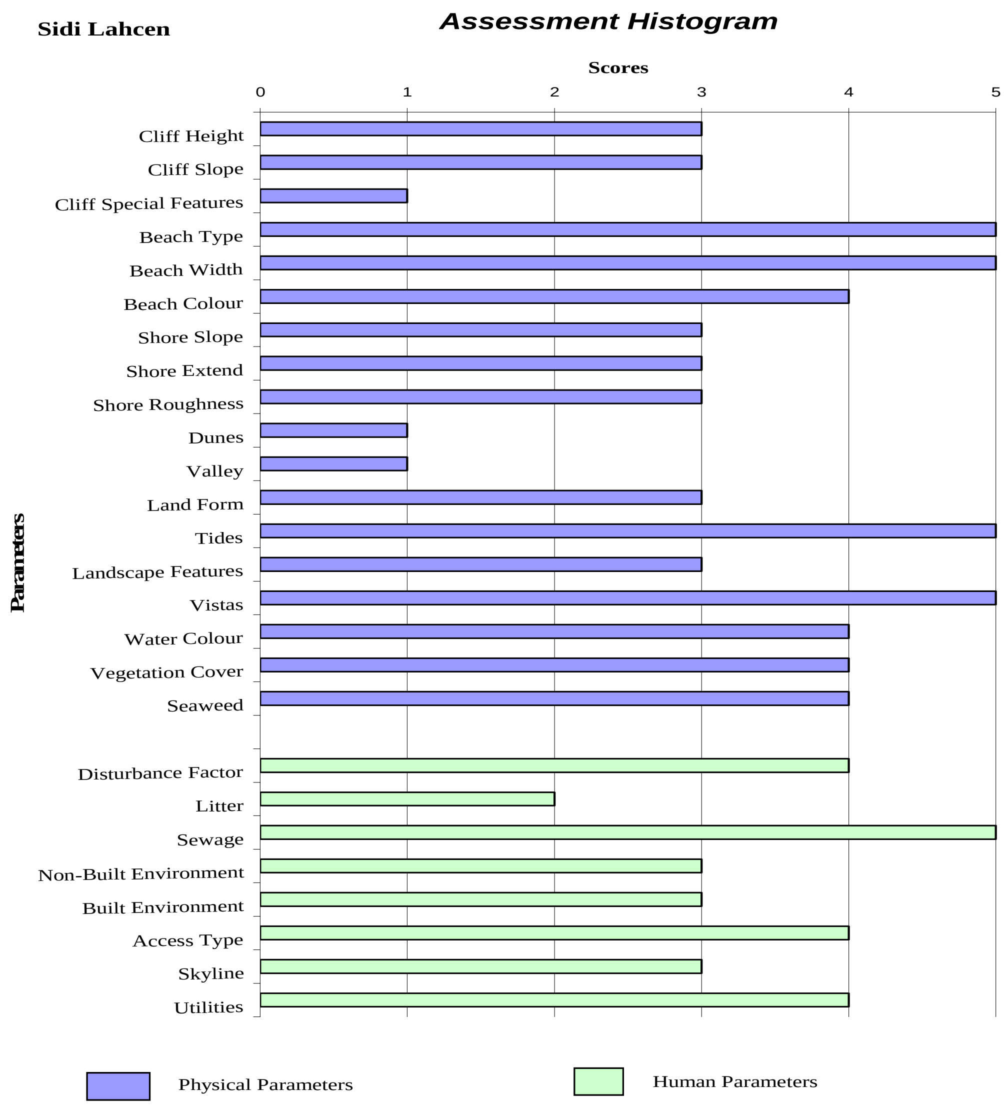


Sidi Hsaine: Weighted averages (a), membership degrees (b) and assessment histogram

a) b)

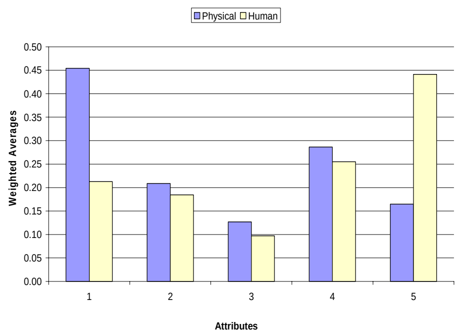


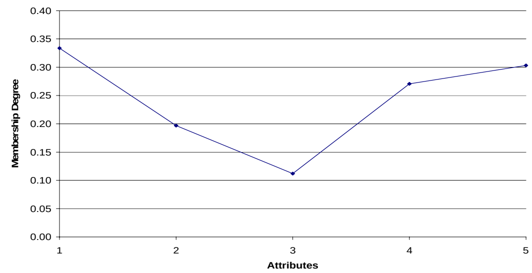


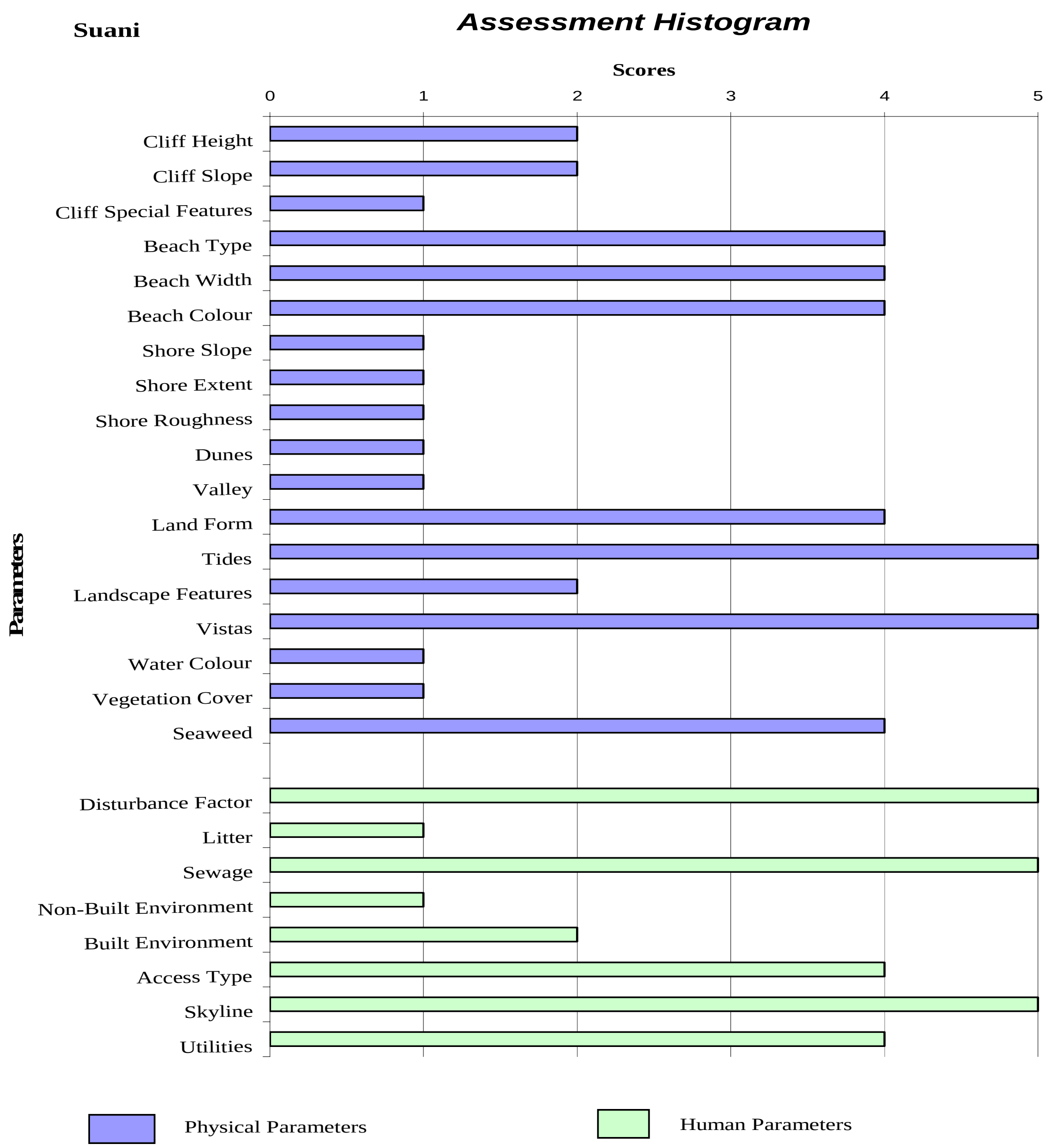


Sidi Lahcen: Weighted averages (a), membership degrees (b) and assessment histogram

a) b)

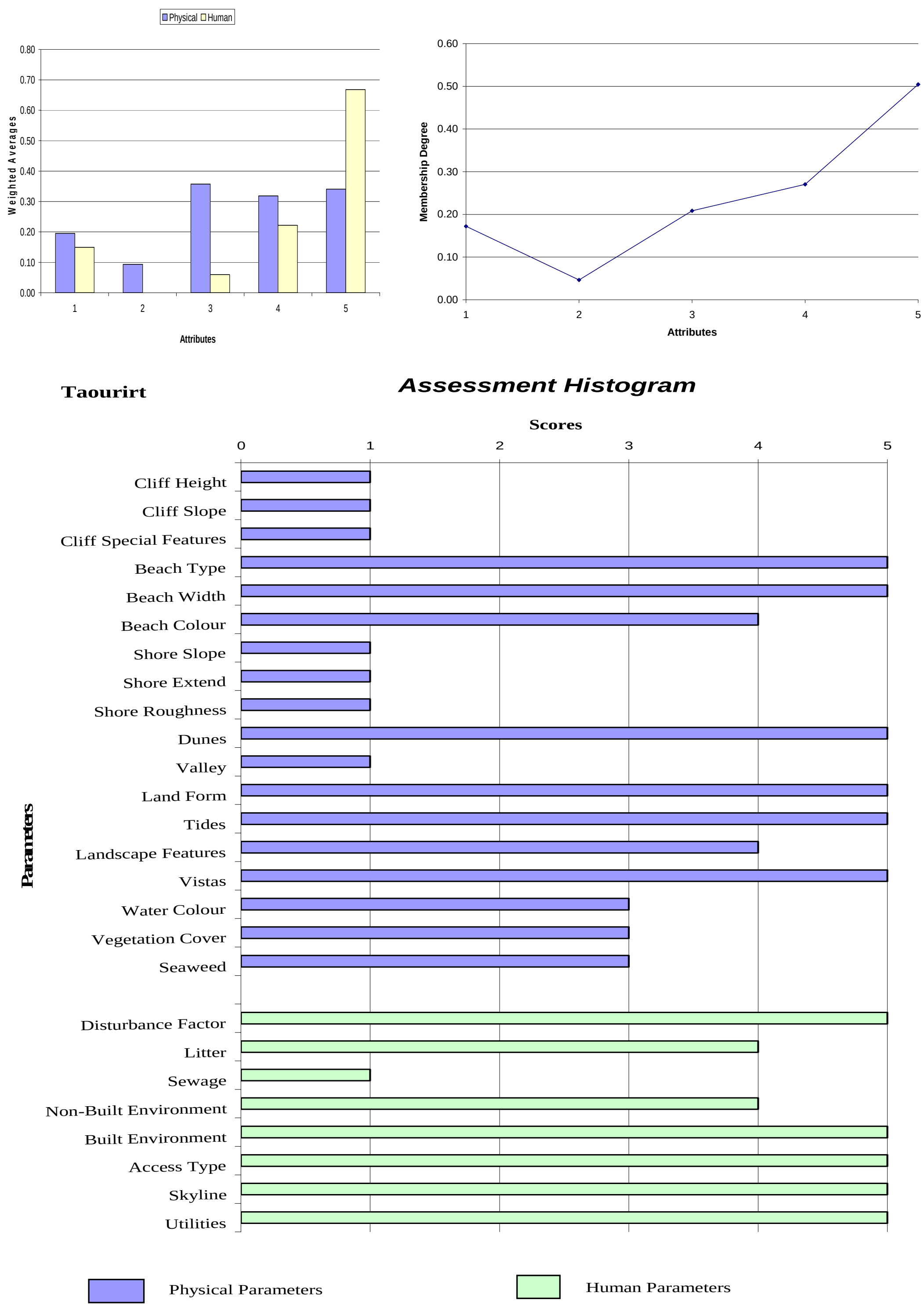






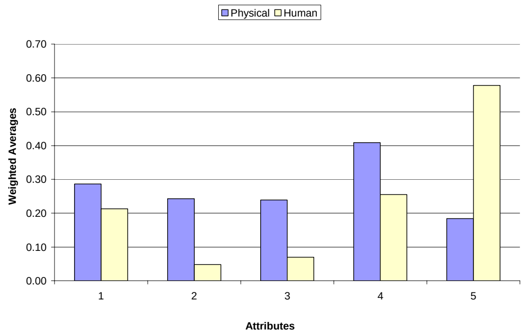
Suani: Weighted averages (a), membership degrees (b) and assessment histogram

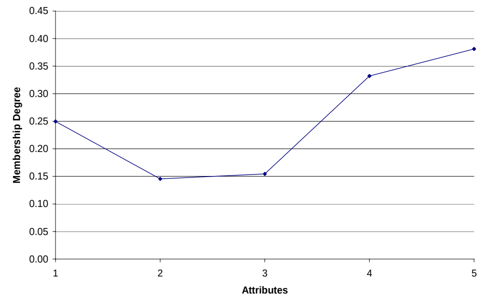
a) b)

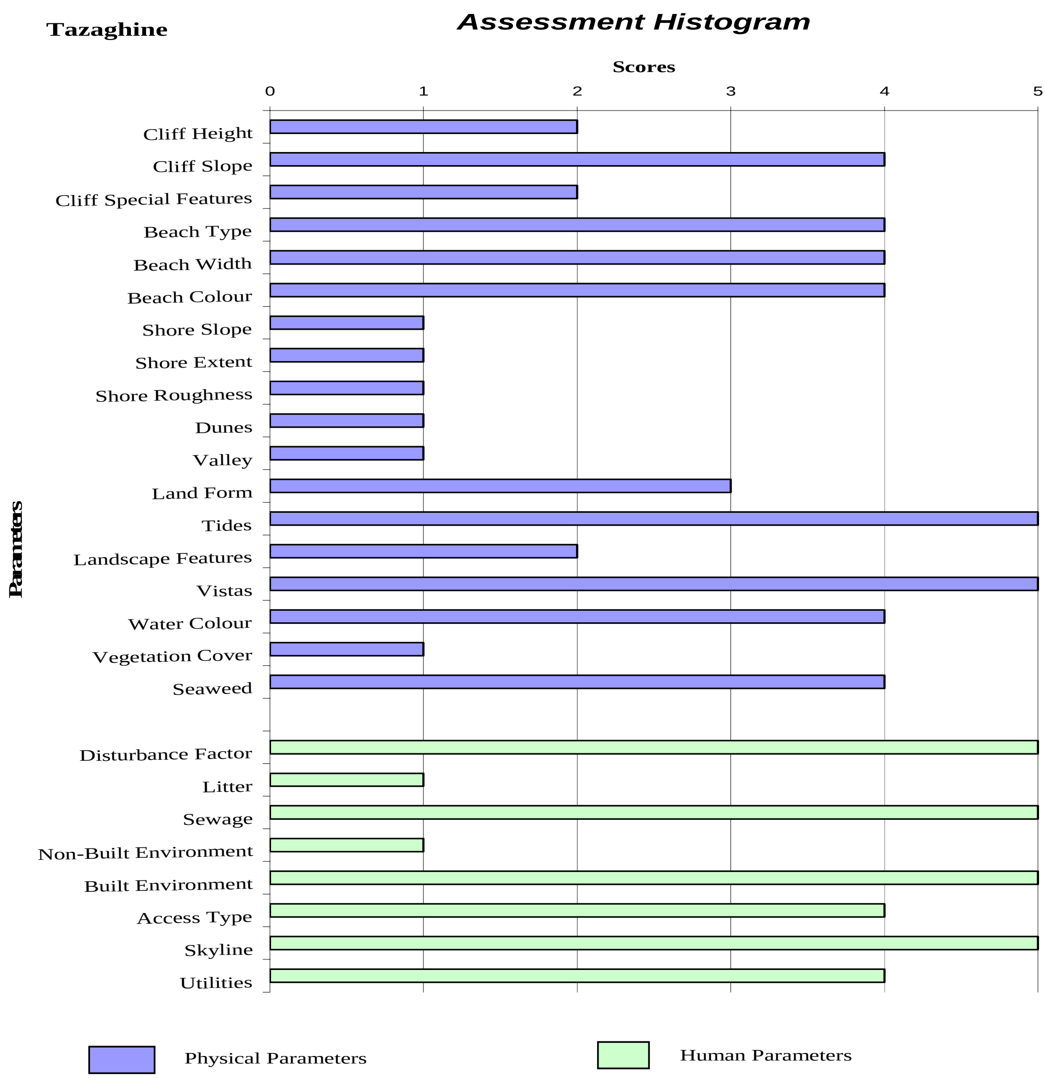


Taourirt: Weighted averages (a), membership degrees (b) and assessment histogram

a) b)

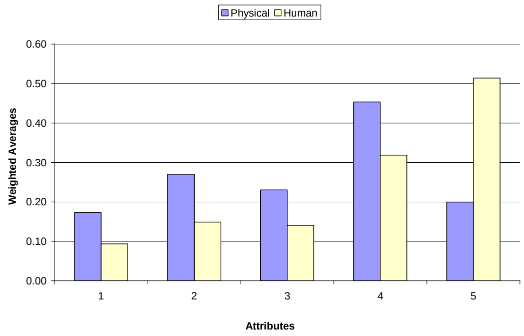


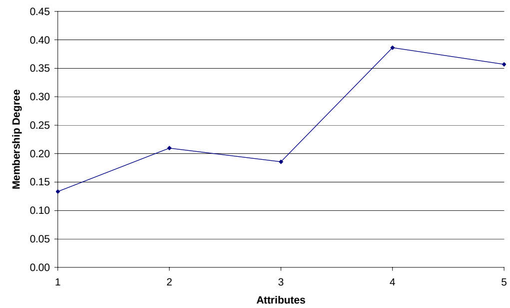


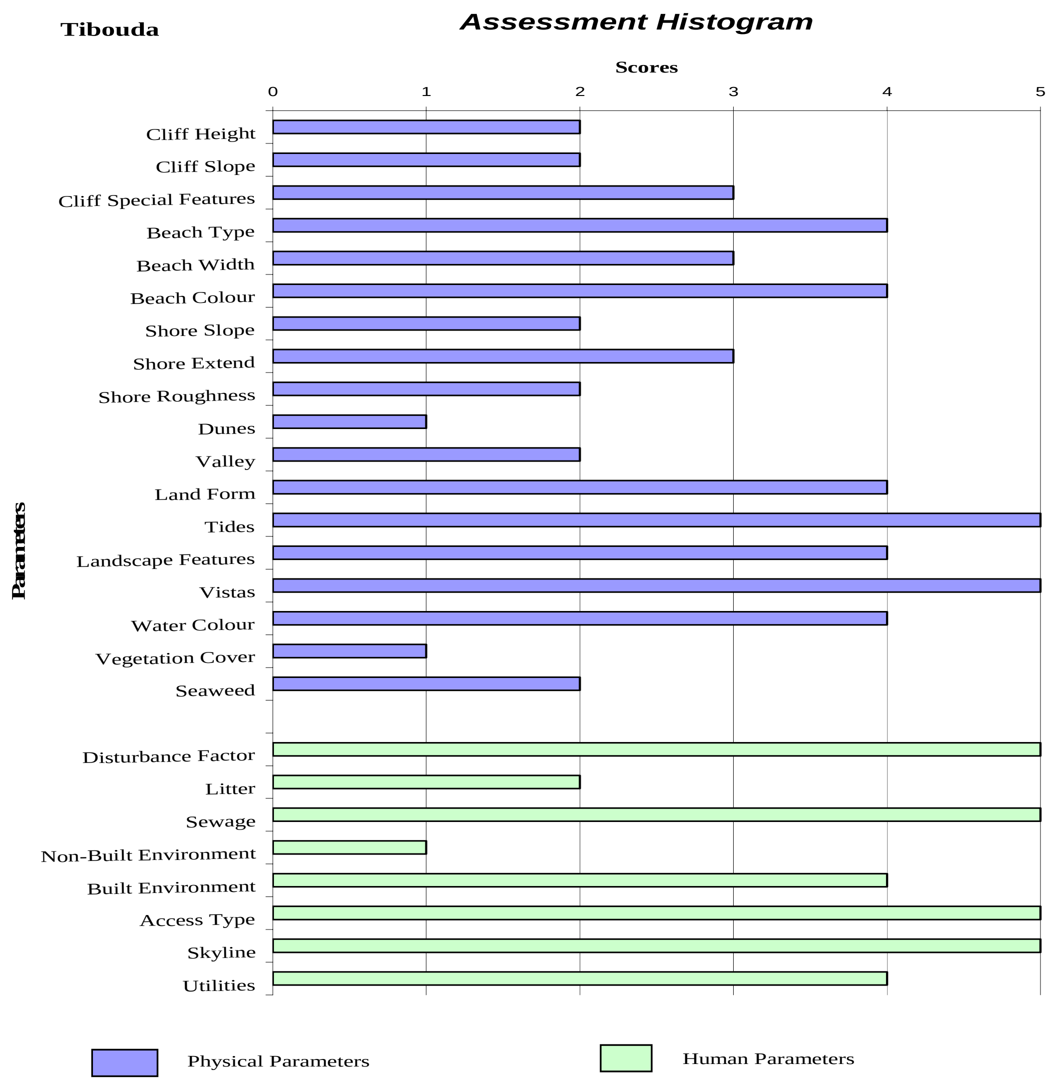


Tazaghine: Weighted averages (a), membership degrees (b) and assessment histogram

a) b)







Tibouda: Weighted averages (a), membership degrees (b) and assessment Histogram.

No class V sites were found

SITE	D Value	CLASS
Arekmane	**0.14**	IV
Amejaou	**0.36**	IV
Boukane East	**0.44**	III
Boukane West	**0.27**	IV
Charanna	**0.36**	IV
Chemlala	**0.54**	III
Firma	**0.54**	III
Kalat	**0.40**	III
Kamkoum El Baz	**0.92**	I
Miami West	**0.09**	IV
Miami East	**0.09**	IV
Plage Rouge	**0.66**	II
Ras El Ma	**0.08**	IV
Sidi Abderrazak	**0.33**	IV
Sidi Driss	**0.61**	II
Sidi Hsaine	**0.55**	III
Sidi Lahcen	**0.47**	III
Suani	**0.09**	IV
Taourirt	**0.77**	II
Tazaghine	**0.43**	III
Tibouda	**0.48**	III

Table 3.1.1 Scenery D values for investigated sites

Numbers: Class I – 1; Class II – 3; Class II - 8; Class IV – 9.

3.2 BARE (Tables 3.2.1 to 3.2.4)

Rural sites (Table 3.2.1).

Fifteen sites fell into this category, and the dominant characteristic was that litter brought all sites (except Sidi Driss) down to a one star level. The amount of litter evident on the beaches was appalling. Especially apparent was the dominance of glass, which in many cases was then main cause of such low litter gradings. The main problem stemmed from litter accumulations at the rear of the beach, which inevitably was never swept clean and consequently accumulations were ubiquitous. Beaches in eastern Nador appeared to be in a far worse state than those to the west, although the whole coast was very bad. For examples, in the surveyed areas: Sidi Lahcen 86 glass items, Boukama East 64, Chemlala had 56, Charanna 54, Suani 44, Amejeau and Firma 35 each. Typical general litter counts were of the order of several hundreds, e.g. Boukama East 660, Charanna 710, with Amejeau being the lowest (284). The litter at Amejeau was 'low' by virtue of a cafe proprietor who swept the beach himself, but did not appear to bother with the rear beach. This was a pity as the beach as a whole was excellent. Nails hammered through planking also contributed to the low score, e.g. being counted at Tazaghene. Gross litter was not readily encountered but 15 items were recorded at Chemlala! No oil or faeces were recorded at any site and only small numbers of sewage items and accumulations were found. Scenic evaluations were graded C or D and these grades mainly concerned the litter encountered. Visual observation of water quality was carried out at all sites even though it was not needed for analysis and Charrana stood out as it failed completely due to floating debris. Cleaning of beaches, it cannot be stressed enough, would change ALL of the star grades.

SITE	Water Quality	Scenery	Litter	GRADE
Amejaou	A	D	D	*
Boukana East	A	D	D	*
Boukana West	A	C	D	*
Charrana	D	D	D	*
Chemlala	A	C	D	*
Firma	A	C	D	*
Miami East & West	A	D	C	*
Sidi Driss	A	C	B	***
Sidi Hsaine	B	C	C	**
Sidi Lahcen	A	C	D	*
Suani	A	D	B	*
Taourirt	A	D	B	*
Tazaghene	A	C	D	*
Tibouda	A	C	D	*

Table 3.2.1 Star rating for rural sites investigated

Remote sites (Table 3.2.2)

Three sites were found. Sidi Abderrazak had 7 glass items and 380 general litter items, so could easily have obtained a B grade which would have given it a 3 star rating. Litter was essentially strand line so could easily have been cleaned. Plage Rouge, a small pocket beach had similar characteristics with 310 general items recorded and two accumulations. This could easily have been graded an A beach, and hence a 4 star rating. Kamkoum El Baz rated the highest value with respect to scenery (A), as the beach is located in front of a spectacular cliff face fronted by dunes. However the amounts of general litter (775) and broken glass found (46) caused it to score a low litter grade.

SITE	Water Quality	Scenery	Litter	GRADE
Kamkoum El Baz	A	A	D	*
Plage Rouge	A	B	B	***
Sidi Abderrazak	A	D	C	*

Table 3.2.2. Star rating for remote sites investigated

Village Site (Table 3.2.3)

Only one site was recorded (Table 3.2.3). Safety wise no zonation markers were found or fixed safety equipment; the human resources re scenery were generally poor, which together with >750 general litter items, all conspired to give a poor grade. Four sewage related items were counted as were 4 gross litter items and 1 nailed plank.

SITE	Water Quality	Scenery	Litter	Facilities	Safety	GRADE
Ras El Ma	A	D	C	B	C	***

Table 3.2.3. Star rating for 'village' site investigated

'Resort' site (Table 3.2.4)

Two were found. Kalat is an exception in that it is being made into a resort and construction is currently under way. This meant that no facilities or safety equipment is currently in the region so the grade cannot be given. Litter wise, 1 nailed plank and some 433 general litter items were counted, whilst the human parameters scored mainly in the mid- range. Arakmane, was an interesting location. Locals maintain that it is a 'resort' town', yet it has few of the characteristics of a standard resort. As regards safety, zonation markers were not evident; litter wise, sewage items, gross litter and general litter earned it a C grade. The question of zoning bathing areas is problematic. Throughout the northern Mediterranean, bathing areas are invariably zoned. In the case of Morocco, this does not appear to be the case, and these categories will invariably fail to reach an A grade under the current scheme.

SITE	Water Quality	Scenery	Litter	Facilities	Safety	GRADE
Arakmane (!)	A	D	C	B	B	*
Kalat	A	C	B	!	!	U/known

Table 3.2.4 Star rating for resort sites investigated, (!) represents a questionable site classification.

3.3. DUNE VULNERABILITY

The main interest for the dune study was the spit which separates Nador lagoon from the Mediterranean sea and four segments of the large dune system running along the spit were examined - Miami east and west, Boukane east and west. In addition dune sites at Thourirt, and Kamkoum El Baz (Table 3.3.1), were investigated.

Results found for Miami east and west were the same and the system appears to be in equilibrium with a VI/PM ratio of 1.08. The vulnerability averaged out as 39% and they fit into Category 1. All figures have been rounded upwards. Thourirt and Kamkoum El Baz also appear to be in equilibrium, with vulnerabilty scores of 34% and 29% respectively. However, the Boukane sites are negatively out of equilibrium (Table 3.3.1) and attention should be paid to this system as they slot into descriptive Category IV (high vulnerability and low response). It should be noted that the systems were analysed without the benefit of a local dune expert, and the checklist approach demands that one should be present. However, the results are probably a good indicator of the current state of the system, as only a few of the checklist parameters are likely to change,

Site	A (%)	B (%)	C (%)	D (%)	E (%)	VI/PM
Boukane E	81	44	35	18	27	1.4
W	81	36	27	25	21	1.8
Kamkoum	68	31	35	4	32	0.93
Miami E&W	88	39	39	11	36	1.08
Thourirt	53	31	35	4	43	0.79

Table 3.3.1 Dune vulnerability scores

4. CONCLUSIONS AND SOME RECOMMENDATIONS

1. The work carried out in this project represents state of the art baseline information and involves innovative techniques. Suggestions in no particular order are:

2. The lagoon area – a Ramsar site, has a very clear issue. It has a serious pollution problem, which is not covered in this report and also a huge litter problem, as has the whole of the investigated area.

3. Tourism, an economic potential, can easily be developed for the areas west of Nador. The area is naturally beautiful, has easy access and little urban and industrial development.

4. For any sustainable development, some tools for success are:

- Eco-tourism
- Controlled urbanization.
- Controlled tourism development – as a first stage on a small scale.
- Local involvement – eco-agriculture, handicrafts etc.
- Education at all levels especially primary
- NGO involvement
- Public awareness – a major issue.

5. Places such as Miami should have planned development for industry and urbanization and we recommend techniques to be carried out such as SWOT analyses, functional analyses, etc. for these areas.

6. The study sites selected fell mainly in rural/remote areas and only two 'resort', one village AND no urban site was seen. The overwhelming feeling was that the appalling amount of litter found at all sites, dragged down star ratings. The absence of litter is a high priority for beach users and cleaning up the areas would be a start. On the SCE scale, litter has high priority and the litter found adversely affected the D values. However, this is not the answer, as cutting off litter at source is the key to successful control. This necessitates a long gestation period and involves culture, education, the home environment and peer pressure.

7. The CSE study identified only 1 Class I site, but many of the others could be upgraded by ensuring that the beaches were cleaned of litter.

8. The dune study revealed that the Boukama system is the most threatened.

ACKNOWLEDGEMENTS

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