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SOIL CLASSIFCATION AND LAND SUITABILITY OF MASIRAH ISLAND, SULTANATE OF OMAN

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Abstract

Thirty nine soil profiles representing Masirah Island were studied in the field. Eight out of them were selected to represent different soil mapping units. The soil profiles were classified and land sultability evaluation were carried out using both FAO, and Sys & Verheye systems.

On the basis of soil morphological, physical, and chemical properties the soils are classified into the following mapping units:

1- Lithic Calcigypsids - rock outcrop; coarse loamy, shallow, undulating to gently undulating on coastal plains. The soils are not suitable (N1ms) under LUT1, LUT2, and LUT3 (FAO) and marginally suitable (S3) for irrigated agriculture (Sys & Verheye).

2- Torripsamments - rock outcrops; dunes and rock outcrops, very deep, undulating on coastal plains. The soils are not suitable (N1m) under LUT1, LUT2. and LUT3 (FAO and Sys & Verheye).

3- Lithic Torripsamments and Torripsamments; shallow to moderately deep, gently undulating on coastal plains. This soil mapping unit is not suitable (N1s) according to (FAO) and (N2) for irrigated agriculture (Sys & verheye).

4- Aquisalids-Torriorthents; sandy and/or loamy skeletal, deep, nearly level on coastal plains. This soil mapping unit is not suitable (N1) according to (FAO and Sys & Verheye).

5- Calcigypsids; coarse loamy or loamy skeletal, deep, nearly level to gently undulating on alluvial fans. This soil mapping unit is marginally suitable (S3) according to (FAO and Sys & Verheye).

6- Haplocalcids-Torripsamments; sandy loam over loam and/or sandy, deep, nearly level on flood plains. This mapping unit is marginally suitable (S3) according to (FAO and Sys & Verheye).

7- Torriorthents; sandy skeletal or loamy skeletal, deep, nearly level to very gently sloping on flood plains. This soil mapping unit is moderately suitable (S2) according to (FAO) and not suitable (N1) for irrigated

agriculture (Sys & Verheye.
8- Calcigypsids - Torriorthents; sandy loam over sandy clay loam, deep, nearly level on wadis. The soils in this mapping unit are marginally suitable (S3) according to (FAO and Sys & Verheye).
9- Mountains and strongly dissected rocky plateau.

INTRODUCTION

The Sultanate of Oman occupies the south-eastern part of the Arabian peninsula. It extends along the Gulf of Oman and the Arabian Sea, from the Straits of hormaas in the north to the Yemeni border in the South (Map 1). The country has an approximate total area of 314,000 km^2. It consists of a main landmass, two enclaves separated from it by territory belonging to the United Arab Emirates, and of numerous islands among which Masirah and Kori-Moria are the largest. Beside the Republic of Yemen and the United Arab Emirates, Oman also shares borders with the Kingdom of Saudi Arabia. The Masirah Island lies east of Sultanate of Oman inside the Arabian sea (Map1), and front of El-Huqf area.

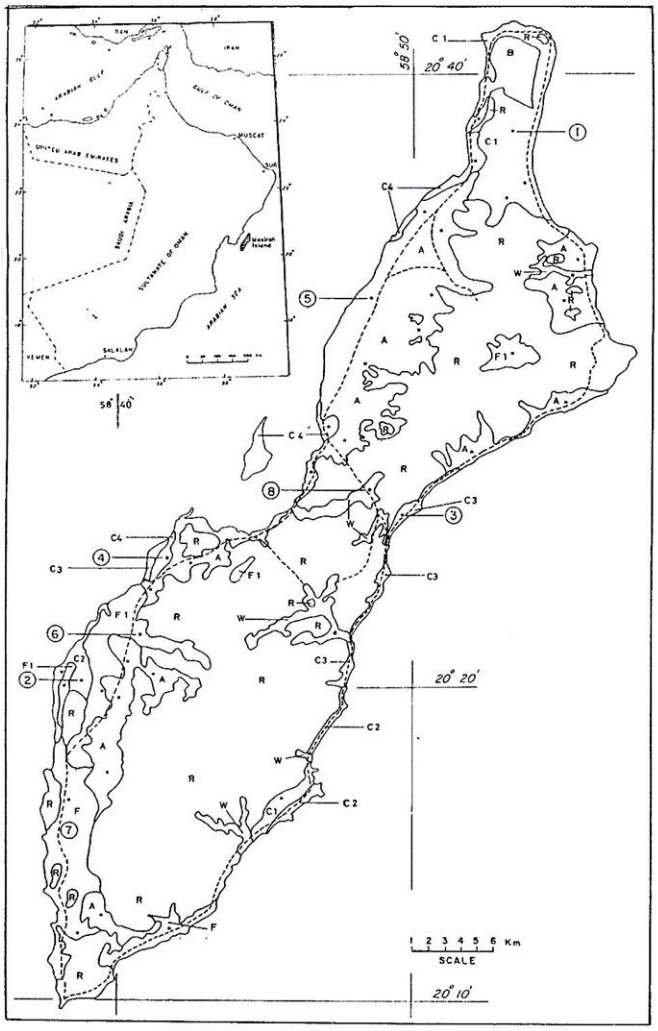
The Masirah Island has a hot and humid climate during summer and comparatively cool in winter. The mean annual temperature is (>22^{0}C) with great difference between summer and winter (>5^{0}C). The maximum average temperature (about 35^{0}C) is usually recorded in July, and the minmum average about (22^{0}C) is usually recorded in January and December. The mean annual rainfall is around 100 mm in Masirah Island and the monthly mean relative humidity is high in the Island as it ranges from 50 to 90% (MAF 1990). During the monsoon wind, in winter season, mist and fog are very common in this area, and may contribute a significant amount of moisture to vegetation .

The present study aims at determining the soil characteristics of Masirah Island in order to evaluate it for a better and sustainable agricultural use.

MATERIALS AND METHODS

A semi detailed soil survey of the Masirah Island (62,155 ha) was carried out. The studied area lies between 20^0 10' south to 20^0 41'36" north latitudes and 58^0 37' 15" west to 58^0 57' 42" east longitudes, (Map 1).

Enhanced and geometrically corrected false colour Landsat Thematic Mapper



Map 1. Representative soil profiles and mapping units of Masirah Island soils.

imagery, at a scale of 1:100, 000 was used to produce a preliminary soil map. This map was based on image analysis and interpretation of the landform characteristics.

During the field work, information of landscape was carefully observed in addition to vegetation and soils morphological characteristics.

Thirty nine profiles were examined and eight out of them were chosen to represent the different mapping units which were identified and delineated within the studied area. The profiles were dug to 150 cm or more, morphologically described according to FAO system (1970), Table (1).

Soil Samples representing the subsequent morphological variations within the entire depth of each profile were collected for laboratory analysis. The samples were air dried and subjected to physical and chemical analyses including particle size distribution, EC, pH, Ca CO_3, $CaSO_4$ $2H_2O$ and O.M. contents.

Land evaluation was assessed using the quantitative system of Sys and Verheye (1978).

Land use classification for irrigated agriculture has been extracted from the frame work of FAO (1976 and 1985).

The studied area has been characterized into three land utilization types (LUTs); all subdivisions of irrigated agriculture. The differentiation between the LUTs is based on irrigation systems.

Each soil mapping unit has been appraised according to the land use requirement given in Table (2), depending on the land characteristics of soil mapping unit.

RESULTS AND DISCUSSION

Based on the field studies and the interpretations of the Landsat Thematic Mapper (TM) images, five physiographic units were recognized and may be classified as follows:

A. Coastal plains.
B. Alluvial fans.
C. Flood plains.
D. Wadis.
E. Mountains and plateau.

Table 1. Main morphological features of the representative profiles in Masirah Island*.

Prof No.	Geomor-phology	Slope %	Depth cm.	Colour Dry	Colour Moist	Textural Classes	Gravel %	Struc-ture	Consistence Dry	Consistence Moist	Consistence Wet ST	Consistence Wet PL	Secondary formation SA	Secondary formation K	Secondary formation GY	Efferve-sence	Boundary
1	Coastal plains	0-3	0-15	7.5YR6/4	7.5YR4/4	SL	36.6	SB	SO	VFR	SST	SPL		C	C	+++	CW
			15-60	10YR5/2	10YR4/2	SL	30.2	SG	LO	LO	NST	NPL			M	+++	CS
			60-80	10YR5/2	10YR3/2	LS	58.2	SG	LO	LO	NST	NPL			C	+	CW
2		0-1.5	0-17	10YR7/4	10YR6/4	VFS	3.4	SG	LO	LO	NST	NPL				+++	ABS
			17-100	7.5YR7/4	7.5YR7/6	FS	0.0	SG	LO	LO	NST	NPL				+++	CS
			100-150	7.5YR7/4	7.5YR7/6	FS	0.0	SG	LO	LO	NST	NPL				+	
3		0-2	0-20	10YR7/4	10YR6/4	VFS	0.0	SG	LO	LO	NST	NPL				+++	ABS
			20-45	10YR7/4	10YR7/6	FS	0.0	SG	LO	LO	NST	NPL	C			+++	CS
4		0-3	0-20	10YR5/4	10YR5/4	S	18.3	MA	LO	LO	NST	NPL	C			++++	CW
			20-70	10YR4/4	5Y5/2	LS	23.0	MA	SO	VFR	NST	NPL	C			++++	ABS
			70-94	80%	Salts	LS	24.1									++++	ABS
			94-120	10YR4/4		FSL	25.7	MA	SO	VFR	NST	NPL				++++	ABS
			120-140	10YR4/4		FSL	24.5	MA	SO	VFR	NST	NPL	C			++++	
5	Alluvial Fans	0-5	0-25	7.5YR6/4	7.5YR4/4	SL	35.5	MA	SO	VFR	SST	SPL		C		+++	CW
			25-70	10YR5/2	10YR4/2	SL	28.4	MA	SHA	FR	ST	PL		M	C	+++	CS
			70-100	10YR5/2	10YR3/2	LS	51.6	SG	LO	LO	NST	NPL		C	M	+++	
6	Flood plains	0-5	0-20	10YR5/4	10YR5/3	SL	0.2	MA	SO	VFR	SST	SPL		C	C	++++	CS
			20-30	10YR6/4	10YR5/4	SL	0.1	MA	SO	VFR	SST	SPL		C		++++	CS
			30-40	10YR6/4	10YR5/4	SL	0.0	MA	SO	VFR	SST	SPL		C		++++	CS
			40-50	10YR6/4	10YR5/4	L	0.0	MA	SO	FR	SST	SPL		C		++++	ABS
			50-105	10YR6/4	10YR5/4	SL	0.0	MA	SO	FR	SST	SPL		C		++++	ABS
			105-135	10YR6/4	10YR5/4	L	0.5	MA	SO	FR	ST	PL		C		++++	
7		0-3	0-4	10YR6/4	10YR5/4	S	21.0	MA	SO	LO	NST	NPL				+++	CS
			4-15	10YR6/4	10YR5/4	LS	5.3	MA	LO	LO	NST	NPL				+	CS
			15-40	10YR6/4	10YR5/4	LS	19.4	MA	LO	LO	NST	NPL				+	CS
			40-114	10YR6/4	10YR5/4	LCOS	51.9	MA	LO	LO	NST	NPL				+++	CS
			114-150	10YR6/4	10YR5/4	LCOS	49.3	MA	LO	LO	NST	NPL		F		+++	
8	Wadis	0-1	0-23	10YR5/4	10YR4/4	SL	10.0	MA	SO	VFR	SST	NPL		F		+++	DS
			*23-45	10YR5/4	10YR4/4	SL	5.0	MA	SO	VFR	SST	SPL		F	F	++	CS
			45-72	10YR5/4	10YR4/4	SCL	5.0	MA	SO	FR	ST	SPL		C	C	++	CS
			72-110	10YR5/4	10YR4/4	SCL	20.0	MA	SHA	FR	ST	PL			C	+++	

* All abbreviations according to FAO (1990)

Texture:
S sand
FS fine sand
VFS very fine sand
LS loamy sand
LCoS loamy coarse sand
SL sandy loam
FSL fine sandy loam
L loam
SCL sandy clay loam

Structure:
SG single grains
MA massive
SB subangular blocky

Boundary:
CW clear wavey
CS clear smooth
ABS abrubt smooth
DS diffuse smooth

Consistence:
Dry :
LO loose
SO soft
SHA slightly hard

Moist :
LO loose
VFR very friable

Wet :
NST non sticky
SST slightly sticky
ST sticky
NPL non plastic
SPL slightly plastic
PL plastic

Secondary formation :
SA salts
K carbonate
GY gypsum
F few
M many
C common

The mapping units may be composed of one or more dominant soils; they are then called consociations and associations, respectively.

The components of an association can not be separeted at the scale which this soil survey was made. Each major component of an association is described separately but suitability interpretations are made for the mapping unit as a whole (USDA 1986). The relative proportion of the components of each mapping unit is estimated according to the interpretation of satellite imagery and field examination.

Most mapping units have minor soils as inclusions of other soils or have small areas of rock out-crop; these inclusions were not taken into account when assigning suitability class to every map unit. Accordingly, due to their limited existence, inclusions are not considered in calculating the suitability class of each mapping unit. Map (1) shows the profile locations and the different mapping units.

Soil classification:

Classification was carried out on the basis of soil Taxonomy system of the USDA (1975), and using the USDA (1994) keys to soil taxonomy. The soils of the studied area were classified to both order Entisols (profiles 2,3,6 and 7) and Aridisols (profiles 1,4,5 and 8).

Table 2. Key attributes of land utilization types (LUTs)*

LUT1	LUT2	LUT3
Field crops		
Centre pivot irrigation	Sprinkler irrigation	Surface irrigation
Cereals (mainly wheat and barley) Fodders (maily grasses, alfalfa, sorghum and berseem) Limited range of shoot vegetables (mainly tomato, cucumber, lettuce, okra, and squash)		

* LUT = land utility type

Table (1) shows the morphological description of the studied profiles, while physical and chemical analyses data are presented in Table (3). Climatic data indicated that the soil moisture regime is usually dry in most years in all parts of soils (torric moisture regime) and soil temperature regime of these area is hyperthermic. Table (4) shows the soil taxonomy classification up to the family level according to USDA (1994).

Table 3. Some physical and chemical properties of soil profiles representing different mapping units in the studied area.*

Prof. No	Depth cm.	SP	pH	EC dSm^{-1}	Partical Size Distubuation			Textural classes	Carbonate %	Gypsum %	OM %	ESP
					Sand %	Silt %	Clay %					
1	0-15	23.5	7.3	84.0	71.6	11.9	16.5	SL	25.0	5.7	1.4	16.7
	15-60	39.6	7.1	70.3	74.0	11.0	15.0	SL	15.5	5.7	0.9	9.3
	60-80	28.8	7.5	58.5	86.3	7.4	6.3	LS	21.2	10.1	0.3	6.1
2	0-17	23.5	7.5	0.7	89.2	6.8	4.0	S	44.2	0.0	1.8	10.2
	17-100	28.1	7.6	0.4	96.2	1.3	2.3	S	47.6	0.0	0.7	10.3
	100-150	23.5	7.2	0.5	98.3	0.5	1.2	S	37.0	0.0	0.0	13.6
3	0-20	24.0	7.6	0.9	90.1	6.3	3.6	S	18.2	0.0	0.2	9.6
	20-45	24.5	7.7	0.6	92.3	4.5	3.2	S	27.6	0.0	0.1	8.7
4	0-20	18.3	6.9	500	90.7	5.8	3.5	S	18.7	0.0	0.2	60.0
	20-70	23.0	7.0	488	84.0	10.6	5.4	LS	27.6	0.0	0.2	36.8
	70-94	24.1	6.9	485	83.1	10.4	6.6	LS	13.7	1.5	0.1	--
	94-120	25.7	7.0	478	74.7	17.5	7.8	SL	33.3	0.7	0.2	52.6
	120-140	24.5	6.8	460	70.5	19.3	10.3	SL	31.3	0.3	0.3	35.0
5	0-25	24.5	7.1	43.6	73.7	12.0	14.3	SL	15.6	27.6	1.4	12.6
	25-70	38.1	7.3	39.1	75.1	11.3	13.6	SL	11.3	18.4	1.1	6.4
	70-100	26.5	7.4	31.6	84.3	7.0	8.7	LS	16.6	22.6	0.6	5.2
6	0-20	27.5	8.0	52.6	66.2	25.6	8.2	SL	27.0	0.0	3.1	23.2
	20-30	29.5	8.1	35.0	53.4	39.7	6.9	SL	27.0	0.0	3.5	20.1
	30-40	35.7	8.2	21.1	57.0	34.1	8.9	SL	23.0	0.0	2.3	25.0
	40-50	30.9	8.1	13.8	49.0	41.4	9.0	L	25.7	0.0	2.3	22.4
	50-105	25.5	8.1	12.5	72.5	20.9	6.6	SL	31.6	0.0	1.1	19.2
	105-135	46.4	8.1	17.7	31.5	47.8	20.6	L	32.2	0.0	2.1	32.8
7	0-4	23.9	7.9	1.9	92.4	4.6	3.0	S	27.4	0.0	0.2	14.3
	4-15	30.9	8.0	2.9	83.3	11.2	5.6	LS	26.6	0.0	0.2	11.3
	15-40	28.0	8.1	2.5	81.4	12.1	6.6	LS	24.6	0.0	0.2	14.3
	40-114	23.3	7.9	9.0	76.1	15.1	8.8	LS	24.8	0.0	0.3	27.8
	114-150	22.5	7.7	12.3	84.8	8.2	7.1	LS	25.4	0.0	0.2	46.5
8	0-23	32.4	7.2	62.1	72.0	12.4	15.6	SL	21.3	2.4	1.8	24.3
	23-45	38.7	7.1	52.6	71.7	11.9	16.4	SL	17.44	7.7	1.2	23.1
	45-72	53.1	6.9	48.4	62.9	14.6	22.5	SCL	19.6	13.2	1.6	20.6
	72-150	52.4	7.0	37.6	64.3	13.9	21.8	SCL	18.8	10.7	1.5	19.1

* All abbreviations according to FAO, (1990).

Mapping unit description:

A. Coastal plains:

1- Lithic calcigypsids-rock outcrop, coarse loamy, shallow, 0-3 convex slope on coastal plain.

This mapping unit is represented by profile No. (1) and consists of undulating to gently undulating surface on coastal plains and areas of rock outcrop. It occupies an area of 4467.9 ha, representing about 7.2% of the total studied area. About 70% of this mapping unit are Lithic Calcigypsids, coarse loamy, mixed, hyperthermic; 15% rock outcrop and the remaining 15% includes Lithic Torriorthents, sandy skeletal; Lithic Torripsamments; Aquisalids, sandy, mixed, hyperthemic.

The gypsids and similar soils are shallow, gravelly sandy loam over gravelly loamy sand. Very strongly saline soils EC = 62 dsm^{-1} (>16 dSm^{-1}) with neutral reaction (pH value 7.1-7.5), and the soils have a varnished desert pavement.

According to FAO land suitability system (FAO 1976 and 1985), this mapping unit is not suitable (N1ms) under LUT1, LUT2 and LUT3, due to that rock out-crop is a very severe limitation for potential mechanization of farm operations and soil salinity hazard (Table 5). According to Sys and Verheye (1978) this mapping unit is marginally suitable (S3) for irrigated agriculture (Table 6).

2- Torripsamments - rock outcrops, dunes and rock out crops, 0 to 1.5% slope on coastal plain.

This mapping unit consists of undulating soils on coastal plains and areas of rock outcrop, it is represented by profile No. 2 and covered an area of 1015.9 ha, representing about 1.6% of the total studied area. About 50% of this mapping unit are Typic Torripsamments, sandy, carbonatic, hyperthermic (on dunes); 30% of the area is rock outcrop and 20% minor soils inclusions may be Lithic Torripsamments, and Typic Aquisalids, sandy, carbonatic, hyperthemic.

The characterized Torripsamments and similar soils are present on dunes and they are non saline soils EC = 0.47 dSm^{-1} (<4 dSm^{-1}) with neutral reaction (pH value 7.2-7.6). The areas of rock outcrop are hilly including knolles shape scattered within this mapping unit. Inclusions in this mapping unit are small areas of nearly level to gently sloping surface, shallow and moderately deep soil to the bedrock. According to FAO land suitability system (FAO 1976 and 1985), this mapping unit is not suitable (N1m) for LUT1, LUT2, and LUT3; due to that rock outcrop is very severe limi-

Table 4. Soil classification of Masirah Island soils.

Prof. No.	Order	Suborder	Great group	Sub great group	Family
1	Aridisols	Gypsids	Calcigypsids	Lithic Calcigypsids	Coarse loamy, mixed, hyperthermic
2	Entisols	Psamments	Torripsamments	Typic Torripsamments	Sandy, Carbonitic, hyperthermic
3	Entisols	Psamments	Torripsamments	Lithic Torripsamments	Sandy, mixed, hyperthermic
4	Aridisols	Salids	Aquisalids	Typic Aquisalids	Sandy, mixed, hypertheric
5	Aridisols	Gypsids	Calcigypsids	Typic Calcigypsids	Coarse loamy, mixed, hyperthermic
6	Entisols	Calcids	Haplocalcids	Typic Haplocalcids	Coarse loamy, mixed, hyperthermic
7	Entisols	Orthents	Torriorthents	Typic Torriorthents	Sandy skeletal, mixed, hyperthermic
8	Aridisols	Gypsids	Calcigypsids	Typic Calcigypsids	Fine loamy, mixed, hyperthermi

Table 5. Land suitability and limitation of soil mapping units to surface irrigation purposes (LUTs 1,2 & 3) [according to FAO 1985].

Map unit No.	Rating Conditions			Soil aerat-ion	Potential for mechanization of farm operation			Nuitrients storage capacity and availability			Soil salinity hazard	Flooding hazard	Wind erosion and deposition hazard	Ease laying & maint. irriga-tion system		Ease in water application managemen	Land suitability subclass	Land suitability unit	Land untility type
	r			d	rn			n			l	f	e	i		w			
	r1	r1	r1	d	m1	m2	m3	n1	n2	n3	l	f	e	i1	i2	w			
1	S2	S2	S1	S1	S1	S1	N1	S1	S1	S2	N1	S1	S1	S1	S1	S2	N1Ms	N1	LUT 1
	S2	S2	S1	S1	S1	S1	N1	S1	S1	S2	N1	S1	S1	S1	S1	S2	N1Ms	N1	LUT 2
	S2	S2	S1	S1	S1	S1	N1	S1	S1	S2	N1	S1	S1	S1	S1	S3	N1Ms	N1	LUT 3
2	S1	S1	S1	S1	S1	S1	N1	S2	S1	S3	S1	S1	S2	S2	S1	S2	N1m	N1	LUT 1
	S1	S1	S1	S1	S1	S1	N1	S2	S1	S3	S1	S1	S2	S2	S1	S2	N1m	N1	LUT 2
	S1	S1	S1	S1	S1	S1	N1	S3	S1	S3	S1	S1	S2	S2	S1	N1	Nlmw	N1	LUT 3
3	S3	S1	S1	S3	S2	S1	S1	S2	S1	S2	S1	S1	S1	S1	S1	S2	S3rdm	S3	LUT 1
	S3	S1	S1	S3	S2	S1	S1	S2	S1	S2	S1	S1	S1	S1	S1	S2	S3rdm	S3	LUT 2
	S3	S1	S1	S3	S2	S1	S1	S3	S1	S2	S1	S1	S1	S1	S1	N1	N1w	N1	LUT 3
4	S1	S1	S1	S2	S1	S1	S1	S2	S1	S2	N1	S1	S1	S1	S1	S2	N1s	N1	LUT 1
	S1	S1	S1	S2	S1	S1	S1	S2	S1	S2	N1	S1	S1	S1	S1	S2	N1s	N1	LUT 2
	S1	S1	S1	S2	S1	S1	S1	S3	S1	S2	N1	S1	S1	S1	S1	N1	N1s	N1	LUT 3
5	S2	S2	S1	S1	S1	S1	S1	S1	S3	S2	S2	S1	S1	S1	S1	S1	S3n	S3	LUT 1
	S2	S2	S1	S1	S1	S1	S1	S1	S3	S2	S2	S1	S1	S1	S1	S1	S3n	S3	LUT 2
	S2	S2	S1	S1	S1	S1	S1	S2	S3	S2	S2	S1	S1	S1	S1	S2	S3n	S3	LUT 3
6	S1	S1	S1	S2	S1	S1	S1	S1	S1	S3	S3	S1	S1	S1	S1	S1	S3s	S3	LUT 1
	S1	S1	S1	S2	S1	S1	S1	S1	S1	S3	S3	S1	S1	S1	S1	S1	S3s	S3	LUT 2
	S1	S1	S1	S2	S1	S1	S1	S2	S1	S3	S3	S1	S1	S1	S1	S2	S3s	S3	LUT 3
7	S1	S2	S1	S1	S1	S1	S1	S2	S1	S3	S1	S1	S1	S1	S1	S2	S3n	S3	LUT 1
	S1	S2	S1	S1	S1	S1	S1	S2	S1	S3	S1	S1	S1	S1	S1	S2	S3n	S3	LUT 2
	S1	S2	S1	S1	S1	S1	S1	S3	S1	S3	S1	S1	S1	S1	S1	S3	S3n	S3	LUT 3
8	S1	S1	S1	S2	S1	S1	S1	S1	S1	S2	S3	S1	S1	S1	S1	S1	S3s	S3	LUT 1
	S1	S1	S1	S2	S1	S1	S1	S1	S1	S2	S3	S1	S1	S1	S1	S1	S3s	S3	LUT 2
	S1	S1	S1	S2	S1	S1	S1	S2	S1	S2	S3	S1	S1	S1	S1	S2	S3s	S3	LUT 3

r1 = effective soil depth
r2 = content of coarse fragments
r3 = soil consistence

m1 = topography
m2 = stones in top soil
m3 = rockines

n1 = soil texture
n2 = gypsum content
n3 = carbonate content

i1 = slope
i2 = gypsum content

S1 = suitable
S2 = moderately suitable
S3 = marginally suitable

N1 = unsuitable (correctable
N2 = unsuitable (permanent)

Table 6. Rating of suitability indices of Sys and Verheye system of the studied profiles.

Soil mapping unit	Prof. No	Degree of limitations							Ci*	Suitability Class**
		t Topography	w Wetness	Y1 Texture	Y2 Depth	Y3 $CaCO_3$	Y4 Gypsum	n Salinity		
1	1	100	90	59	75	100	100	75	29.8	S3
2	2	90	100	30	100	90	90	100	21.9	N1
3	3	100	100	30	55	100	90	100	14.8	N2
4	4	100	100	34	100	100	90	45	13.8	N1
5	5	100	100	61.3	90	100	90	80	34.5	S3
6	6	100	100	56	100	90	80	75	34	S3
7	7	100	100	25	100	100	90	75	16.9	N1
8	8	100	100	80	100	100	100	58	46.4	S3
9	Rock land and mountains									N2

* According to Sys and Verheye (1978), $Ci = t \times w \times \frac{Y1}{100} \times \frac{Y2}{100} \times \frac{Y3}{100} \times \frac{Y4}{100} \times \frac{n}{\quad}$

** S3 = marginally suitable; N1= currently not suitable; N2 = permanently not suitable

tation (30%) for potential mechanization of farm operations. If the mechanization of farm operations (rockeness) is neglicted and the soils between the rock outcrop are evaluated then, 50% of this mapping unit is marginlly suitable (S3) for LUT1, LUT2, and LUT3 (Table 5). According to Sys and Verheye (1978) this mapping unit is not suitable (N1) for irrigated agriculture (Table 6).

3- Lithic Torripsamments and Torripsamments, sandy, shallow to moderatly deep, 0-2% flat slope on coastal plain.

This mapping unit consists of gently undulating soils on coastal plains, and represented by profile No. (3). It occupies an area of 562.9 ha and representing about 0.9% of the total studied area. About 70% of this maping unit are Lithic Torripsamments, mixed, hyperthemic; 15% Typic Torripsamments, and the remaining 15% include Typic Aquisalids; sandy, mixed, hyperthemic.

The Torripsamments and similar soils are shallow to bed-rock, very storngly saline = 24.3 dSm^{-1} (>16 dSm^{-1}) with mild alkaline reaction (pH value 7.6-7.7).

According to FAO land suitability system (FAO 1976 and 1985), this mapping unit is not suitable (N1s) for LUT1, LUT2, and LUT3; due to soil salinity hazard (Table 5). According to Sys and Verheye (1978) this unit is not suitable (N2) for irrigated agriculture (Table 6).

4- Aquisalids- Torrorthents, sandy and/or loamy skeletal, deep, 0.3 line slope on coastal plain.

This mapping unit consists of nearly level soil on flat interdunal plains and steep surface on high dunes (<10 m). This area is devoid of vegetation and represented by profile No. (4). It covers an erea of 944.6 ha and representing about 1.5% of the total studied area. About 50% of the soils of this mapping unit are Typic Aquisalids, sandy, mixed, hyperthermic; 30% Typic Torriorthents, loamy skeletal; and the remaining 20% includes Typic Torripsamments, mixed, hyperthermic, and rock outcrop.

The salids and similar soils are deep, very strong saline EC =483 dSm^{-1} with neutral reaction (pH value 6.8 - 7.5) and has a salic diagnostic horizon.

According to FAO land suitability system (FAO 1976 and 1985), this mapping unit is not suitable (N1s) for LUT1, LUT2, and LUT3 due to soil salinity hazard (Table 5). According to Sys and Verheye (1978) this mapping unit is not suitable (N1) for irrigated agriculture (Table 6).

B. Alluvial fans

5- Calcigypsids, coarse loamy or loamy skeletal, deep, 0-5% slope on young alluvial fans.

This mapping unit is nearly level to gently undulating soils on alluvial fans, and represented by profile No. (5). It occupies an area of 12974.6 ha, representing about 20.9% of the total studied area. About 80% of this mapping unit are Typic Calcigypsids (60% coarse loamy and 20% loamy skeletal); and the remaining 20% as inclusions are Typic Torrifluvents, loamy skeletal, and Typic Torriorthents, sandy skeletal, mixed hyperthermic.

The gypsids and similar soils are deep, gravelly sandy loam over gravelly loamy sand, very strong saline soils EC = 38 dSm^{-1} (>16 dSm^{-1}), with neutral reaction (pH value 7.1-7.4), and has a gypsic diagnostic horizon.

According to FAO land suitability system (FAO 1976 and 1985), this mapping unit is marginally suitable (S3n) for LUT1, LUT2, and LUT3; due to its nutrients storage capacity and availability (Table 5). According to Sys and Verheye (1978) This mapping unit is marginally suitable (S3) for irrigated agriculture (Table 6).

C- Flood plains:

6- Haplocalcids - Torripsamments, sandy loam over loam and / or sandy, deep, 0-5% linear slope on flood plain.

This mapping unit consists of nearly level soils on flood plains. Drainage ways are well developed everywhere, but they are poorly organized young fans. This mapping unit represented by profile No.(6). It occupies an area of 2536.3 ha, representing about 4.1% of the total studied area. About 70% of this mapping unit are Typic Haplocalcids, coarse loamy, mixed, hyperthermic; 20% Typic Torripsamments, sandy, mixed, hyperthermic, and the the remaining 10% includes Typic Aquisalids, sandy, mixed, hyperthermic. The Calcids and similar soils are very deep, sandy loam over loamy, very strong saline EC = 22.33 dSm^{-1} (>16 dSm^{-1}), with mild alkaline (pH 8.0-8.2).

According to FAO land suitability system (FAO 1976 and 1985), this unit is marginally suitable (S3s) for LUT1, LUT2, and LUT3, due to the salinity hazard (Table 5). According to Sys and Verheye (1978) this mapping unit is marginally suitable (S3) for irrigated agriculture (Table 6).

7- Torriorthents; sandy skeletal or loamy skeletal, deep, moderately flooded, 0-3% linear slope on flood plains.

This mapping unit consists of nearly level to very gently sloping soils on flood plains, young alluvial fans, and intermittent stream channels.

Profile No. (7) represents this unit, which covers an area of 3123.3 ha and representing about 5% of the total studied area. About 65% of this mapping unit are Typic Torriorthents; sandy skeletal, mixed, hyperthemic; 15% Typic Torriorthents; loamy skeletal, mixed, hypethemic, and the remaining 20% as inclusions are Typic Torripsamments; Typic Torrifluvents; loamy skeletal, and Typic Calcigypsids; loamy skeletal, mixed, hyperthemic.

The dominent soil in this unit is very deep, gravelly loamy sand over very gravelly loamy sand, moderatly saline EC = 8.1 dSm^{-1} (8-12 dSm^{-1}), with mild alkaline rection (pH value 7.7 - 8.1).

According to FAO land suitability system (FAO 1976 and 1985), this mapping unit is moderately suitable (S2nw) for LUT1, and LUT2; due to its nutrients storge capacity and availability and marginally suitable (S3nw) for LUT3 (Table 5). According to Sys and Verheye (1978) this mapping unit is not suitable (N1) for irrigated agriculture (Table 6).

D- Wadis

8- Calcigypsids-Torriorthents; gravelly sandy loam over gravelly sandy clay loam, deep 0-1% linear slope on wadis.

The wadis consist of nearly level soils, mainly meandering braided streams, these streams often cut deeply into the surrounding terrain. Topographically, they are the base-level and drainage outlets subjected to frequent and severe flooding. These are represented by profile No. (8) and covers an area of 1710.4 ha which representing about 2.8% of the total studied area. About 65% of this mapping unit are Typic Calcigypsids; fine loamy, mixed, hyperthermic; 20% Typic Torripsamments; coarse loamy, mixed, hyperthermic, and the remaining 20% as inclusions of Typic Calcigypsids; fine loamy, mixed, hyperthermic.

The gypsids and similar soils are very deep, gravelly sandy loam, very strong saline soils EC = 45.5 dSm^{-1}, with neutral reaction (pH value 6.9-7.1), and has a gypsic diagnostic horizon.

According to FAO land suitability system (FAO 1978 and 1985), this mapping unit is marginally suitable (S3s) for LUT1, LUT2, and LUT3; due to its salinity hazared (Table 5). According to Sys and Verheye (1978) this mapping unit is marginally suitable (S3) for irrigated agriculture (Table 6).

E- Mountains and plateau :

9- Mountains and strongly dissected rocky plateau; loamy skeletal to sandy skeletal, shallow soils, 0.80% slope.

This mapping unit consists of rock out-crop on highly dissected mountains, low hills, and steep soils on hill slope. Individual areas of this mapping unit are irrigular in shape.

This miscellaneous mapping unit is about 80% rock outcrops, and 20% Torriorthents lies between the mountains and rock outcrops. It covers an area of 34819.1 ha, repressenting about 56% of the total studied area.

The Torriorthents and similar soils are on piedmont slopes, foot slopes, and channeles. Slopes range from 0 to 15%. The Torriorthents are calcareous, very gravelly, loamy to sandy, shallow to deep soils.

This mapping unit is unsuitable (N2) for irrigated agriculture at any scale. The major limitation are rock outcrops, slope, and shallow depth of soil to rock. These limitations are continuous and non correctable.

Conclusion

The total area of Masirah Island is classified according to (FAO 1985) into four classes. The Moderately suitable soils (S2), covered 3123.3 ha and representing about 5% of the total studied area. The marginally suitable soils (S3), covered 17221.3 ha which represent about 27.7% of the total studied area. The unsuitable soils occupies about 41819.4 ha, divided to 7000.3 ha correctable (11.3%) and 34819.1 ha permanent not suitable (56%).

Using quantitative rating system the soils of Masirah Island can be classified in two classes. The marginally suitable soils covered about 21698.2 ha, representing 34.9% of the total area studied, while the not suitable soils occupy about 65.9% of the total area of Island, however 8.2% of these areas are correctable

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تقسيم وتقييم أراضى جزيرة مصيره بسلطنة عمان

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درس ٣٩ قطاع أرضى حقليا تمثل أراضى جزيرة مصيره، وقد أختبر ثمانية منها تمثل الوحدات المختلفة. وقد تم تصنيف أراضى هذه القطاعات كما تم تقييم مدى ملائمتها للزراعة بإستخدام نظامين هما نظام منظمة الأغذية والزراعة FAO ونظام Sys & Verheye.

وبناء على الوصف المورفولوجى والخواص الطبيعية والكيميائية، قسمت أراضى الجزيرة إلى تسع وحدات أراضى خرائطية كالتالى:

١ – Lithic Calcigypsids - rock out crop أراضى السهول الساحلية الطميية الخشنة الضحلة، المتموجة إلى بسيطة التموج. هذه الأراضى غير صالحة للزراعة (N1ms) وذلك بناء على نظام منظمة الأغذية FAO. وهذه الأراضى تكون هامشية الملائمة (S3) للزراعات المروية بناء على نظام Sye & Verheye.

٢ – Torripsamments - rock out crop أراضى السهول الساحلية ذات الكثبان الرملية المحتوية على بروزات صخرية، العميقة القطاع، المتموجة وهى أراضى غير صالحة للزراعة (N1n) وذلك بناء على النظامين Sye & Verheye, FAO .

٣ – Torripsamments and Lithic Torripsamments أراضى السهول الساحلية الضحلة إلى متوسطة العمق، البسيطة التموج، الرملية. هذه الوحدة الخرائطية للتربة غير صالحة للزراعة (Nis) بناء على نظام FAO, (N2) بناء على نظام Sye & Verheye.

٤ – Aqusalids - Torripsamment أراضى السهول الساحلية الملحية ، الرملية أو الطميية الهيكلية، العميقة، المستوية تقريباً. هذه الوحدات الخرائطية للتربة غير مناسبة (N1) تبعاً لنظام FAO ونظام Sye & Verheye.

٥ – Calcigypsids أراضى المروحيات الرسوبية، الطميية الخشنة أو الطميية الهيكلية، العميقة، المستوية تقريباً إلى بسيطة التموج. هذه الوحدة الخرائطية للتربة هامشية الصلاحية (S3) تبعاً لنظام FAO ونظام Sye & Verheye.

٦ – Haplocalcids - Torripsamments أراضى السهول الفيضية، الرملية أو الرملية، العميقة القطاع، المستوية تفريباً. وهذه الأراضى هامشية الصلاحية (S3) تبعاً لنظام FAO ونظام Sye & Verheye.

٧ – Torriorthents أراضى السهول الفيضية، الرملية الهيكلية أو الطميية الهيكلية، العميقة القطاع، المستوية إلى بسيطة جداً فى التموج. هذه الوحدة الخرائطية للتربة متوسطة

الصلاحية (S3) تبعاً لنظام FAO وغير صالحة (N1) للزراعة المروية تبعاً Sye & Verheye.

٨ – Calcigypsids - Torriorthent أراضى الوديان ، الطمبية الرملية فوق الطمبية الرملية الطينية، العميقة القطاع، المستوية تقريباً. هذه الوحدة الخرائطية للتربة هامشية الصلاحية (S3) تبعاً لنظام FAO ونظام Sye & Verheye.

٩ – Mountains and strongly dissected Rocky plateau. الجبال والهضاب شديدة التقطع.