

Vegetation Cover and Land Use Map of El-Hammam Area, Western Mediterranean Coast, Egypt

Sania A. Kamal and Salama M. El - Darier

*Department of Botany, Faculty of Science,
Alexandria University, Alexandria, Egypt*

ABSTRACT. The objective of this study is to construct a vegetation cover map and to quantify the different levels of human pressures upon land resources in the habitat of inland plateau at El - Hammam sector. The study revealed that overgrazing represents about (77.6%) while crop and orchard cultivations form 22.4% of the area. Species rated as dominants and codominants in the present study were: *Anabasis articulata*, *Thymelaea hirsuta*, *Plantago albicans*, *Noaea mucronata* and *Scorzonera alexandrina*. It was found by using spot image that 25.7 Km² of El - Hammam inland plateau to be completely destroyed; all woody species are suffering from eradication and the surface appears bare and disturbed due to urban land - use.

The ecosystem concept of land management has not been clearly developed for the more sophisticated land use systems (Godron 1978). Within the more natural, less intensive systems of land-such as range grazing and forestry, some ecological concepts have always been maintained to produce an optimum efficiency with a minimum of hazards. In many parts of the world natural and seminatural ecosystems are in the most danger of being degraded or lost through man's mistaking short term economic gains under temporarily favourable conditions for long term stability (Ayyad and Ghabbour 1977). Due to over exploitation of natural resources by man, desertification has proceeded at a rate of more than 100 km² per year (Le Houerou 1972).

The principle objective of this study is to construct a vegetation cover map and to quantify the different levels of human pressures upon land resources in the habitat of inland plateau at El-Hammam sector in the Western Mediterranean Coastal desert of Egypt.

Study Area

The study area is a part of the Western mediterranean Desert of Egypt (Fig. 1). It is located at about 65 Km west of alexandria (Longitude 29° 25' and latitude 30° 48'). The study sector is at about 4 Km south El-Hammam city, starting from irrigated area and extending 12.5 Km southward.

According to Selim (1969), geologically the study area is essentially quaternary and tertiary, sub-surface deposits are miocene and surface deposits are pleistocene and recent. Its soils are either lithosols or Ermosols, sandy fluviate deposits reworked by wind action and are usually several meters deep. Overlying horizontally laminated alluvial material containing lime concretions, the soils are uniform throughout and characterized by the presence of a weakly developed A-horizon of limited thickness (El-Gabaly *et al.* 1969).

The study area belongs to the dry arid climatic zone (BWH) of Koppen's system (Trewartha 1954), arid mesothermal province of Thornthwait (1948) and Emberger (1955), of a Saharan zone.

Methods

I - Preparation of a vegetation cover map

The land vegetation cover mapping was carried out using aerial photographs (scale 1:25,000 of 1977, available at the Egyptian Military agency of surveys) and topographic map 1:50,000 of 1986 prepared according to the procedure that are described in detail (Long 1979, Le Floc'H 1981).

II - Determination of distribution of major land-use types

The area of isophenes located and identified in the land vegetation cover map was calculated using Digitizer (Summagraphics LCL-Series) AutoCAD release 10 (386).

III - Fifteen stands were chosen in the study area so as to represent most of the microenvironmental variations in this area

In each stand, a list of species was recorded and the two most dominant species were designated. Stands are classified into vegetation groups according to the tabular comparison technique as described by Muller-Dembois and Ellenberg (1974).

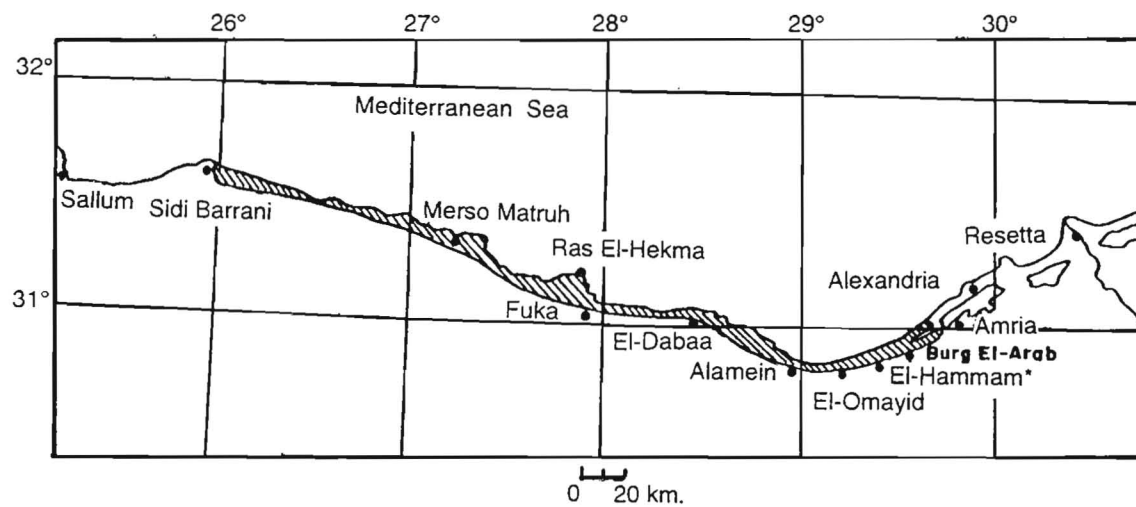


Fig. 1. Map of the western Mediterranean coastal region of Egypt indicating* the location of the study sector.

Results

The vegetation cover map of the present sector (7 Km width x 12.5 Km long) provides a combination of the present state of plant cover (natural and cultivated plants) and the degree of human manipulations. Map 1 is the contour map of the study area, while map 2 is the vegetation cover map with a legend providing the dominant species and their growth forms. The different levels of land - use in different isophenic units was illustrated in map 3.

The units located and identified on land-use map provide means for quantitative analysis of relative areas for different types of land-use (Table 1).

The study revealed grazing to be the predominant land - use constituting 77.6%, while crop and orchard cultivations formed 22.4% of the total area. A more comprehensive analysis of the present state of the levels of human activities in the study sector indicated that 17.71 Km² of the area to have been under light grazing, while 45.48 Km² was under overgrazing and over - use of shrubby species. About 4.65 Km² was completely destroyed by uprooting for fuel purposes or building and preparing fallow fields.

As indicated in Table 2, 91 species were recorded in the study, 52 (57.1%) of them are perennials and 39 (42.9%) are annuals.

The most common perennial species were *Thymelaea hirsuta*, *Noaea mucronata*, *Pituranthos tortuosus*, *Echinops spinosissimus*, *Anabasis articulata* and *Anabasis oropetiorum*. Ten species have a very rare occurrence (6.66% present in one stand only).

The most common annual species were *Lobularia arabica*, *Adonis dentatus*, *Filago desertorum*, *Picris radicata* and *Cutandia dichotoma*. On The other hand, there are some annual species of a very rare occurrence (6.66%) e.g. *Brassica nigra*, *Hypecoum aegyptiacum* and *Plantago notata*.

The application of the tabular comparison technique leads to the recognition of three groups of stands.

Group A: Comprises 4 stands codominated with *Thymelaea hirsuta* and *plantago albicans*. The diagnostic species were *Echiochilon fruticosum*, *Asphodelus microcarpus*, *Launaea resedifolia* and *Launaea nudicaulis*. This group dominated the sites of relatively deep sand deposits.

Group B: Comprises 4 stands codominated with *Scorzonera alexandrina* and *Pituranthos tortuosus*. The diagnostic species were *Noaea mucronata*, *Anabasis*

oropeditorum, *Pancratium siskenbergii*, *Helianthemum lippii* and *Astragalus spinosus*. This occupied the most shallow and consolidated sites of inland plateau.

Group C: Comprises 7 stands codominated with *Gymnocarpos decandrum* and *Anabasis articulata*. The diagnostic species of this group were *Allium erdelli* and *Echinops spinosissimus*. This group occupied intermediate position between the two other groups.

Discussion

Large parts of arid regions of the earth are subject to the anthropogenic pressures of overgrazing, cultivation and harvesting of bushes for firewood. The surface in many such area is virtually bare of vegetation. Fears were expressed that the impact is irreversible, that is the vegetation might never recover (Otterman and Robinove 1983). The study sector is indeed under severe anthropogenic pressures; mainly overgrazing, uprooting, cultivation and urban land-use. Also, there are great differences in the spatial distribution of human practices and pressures. The impoverishment of the natural plant cover by overgrazing, or uprooting process is the first step of environmental deterioration. It is remarkable that about 687.84 Km² in the study area is under grazing pressure with different intensities (3¹-3⁵ ranging from light grazing to over-use of shrubby and palatable species with or without capabilities for regeneration. However, only about 0.87 Km² is rainfed cultivated land, because of building new military Hammam city and construction of the new paved inland road to Matruh. Using spot image, it was found that about 25.7 Km² of El-Hammam inland plateau is completely destroyed, and all the woody species are suffering from eradication and the surface appeared bare and disturbed due to such urban land-use. Le Floc'h (1983) reported in his study that 6.84 Km² to be under grazing pressure in the inland plateau at Omayed, and Kamal (1988) reported about 6.87 Km² of inland plateau at Alamin to be rangeland, without any type of crop cultivation or orchard plantation.

Analysis of the data indicates that the vegetation is dominated by *Thymelaea hirsuta*, *Pituranthos tortuosus*, and *Anabasis articulata*. The next important species are *scorzonera alexandrina*, *Anabasis oropeditorum*, *Noaea mucronata* and *Gymnocarpos decandrum*, each exhibited a local dominance in stands. El-Ghareeb and Hassan (1988) indicated that the species are so overlapping in their phytosociological behaviour; no distinct association could be recognized, and accordingly, we may consider the vegetation as a continuum which could be a part of a larger vegetational gradient in Western Desert of Egypt.

The application of agglomerative clustering technique in the study carried out by El-Ghareeb and Hassan (1988) was proved useful in classifying stands in Five vegetation groups. The present study was in accordance with some of these groups

e.g. *Anabasis articulata* group, *Thymelaea hirsuta*, *Plantago albicans* group and *Scorzonera alexandrina* group. A detailed study by Ayyad and El-Ghonemy (1976) on phytosociological and environmental gradients from the Mediterranean Coastal land southward distinguished between two sets of vegetation groups in relation to climatic gradients: 1) a set of a group codominated by *Convolvulus lanatus*, *Helianthemum lippii* and *Echiochilon fruticosum*: at the more arid areas and towards south and 2) a set of a group codominated by *Asphodelus microcarpus* and *Noaea mucronata* at the less arid end towards the north. The present study indicates two other groups: a group of *Thymelaea hirsuta*, *Plantago albicans* at the northern part of the plateau and a group of *Scorzonera alexandrina*, *Pituranthos tortuosus* at the most consolidated and degraded parts of the plateau.

The study carried out by Shaltout (1983) indicated a group dominated mainly by *Scorzonera alexandrina* which occupied a position representing the most shallow and consolidated sets of inland plateau. These results are in accordance with results obtained from the present study. In addition, this study indicated that *Anabasis oropediorum* (a highly palatable species with no real possibilities of regeneration) is one of the diagnostic species of this group (presence percentage 60%).

The present study also indicated a group codominated by *Thymelaea hirsuta* and *Asphodelus microcarpus* to occupy sites of relatively deep sand deposits, while a study carried out by Kamal (1988) indicated other groups of species (*Stipagrostis ciliata* and *Helianthemum lippii*) in these sites. This may be attributed to the fact that the present study covered only about 15 Km of the inland plateau, while the study carried out by kamal (1988) covered up to about 50 Km inland.

According to Zohary's geobotanical map of the Middle East (Zohary 1973 as quoted by Ayyad and El-Ghaonemy 1976), the vegetation of the study area (southern section) belongs to Saharo-Arabian desert vegetation. Analysis carried out by El-Ghareeb and Hassan (1988) indicated the vegetation to be dominated by *Thymelaea hirsuta*, *Plantago albicans* and *Anabasis articulata*. The next important species were *Asphodelus microcarpos*, *Noaea mucronata*, *Gymnocarpos decandrum* and *Scorzonera alexandrina*. All these species are rated as dominants and codominants in different isophenic units identified in the present study. In general, vegetation cover is weak and due to the different levels of human manipulations of land resources never exceeded 5%.

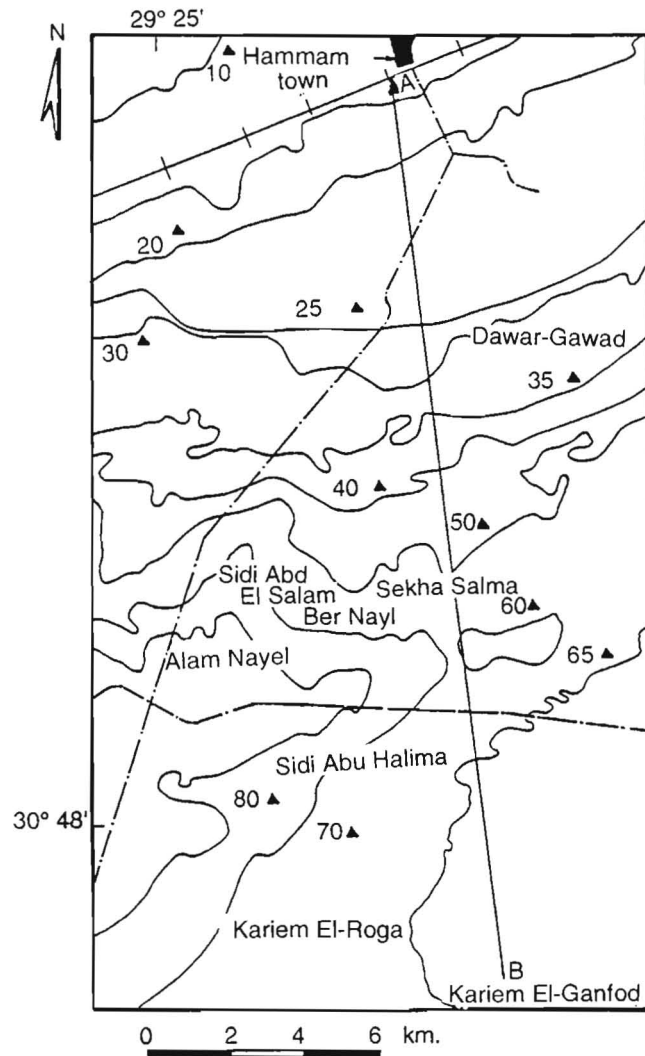
Table 1. Areas (Km²) affected by different intensities of land use in the habitat of inland plateau at El-Hammam

Intensities of Land-use	Land-Use Type					
	Rangelands		Rainfed cultivations		Irrigated cultivations	
	area	(%)	area	(%)	area	(%)
3 ¹	17.71	26.11	–			
3 ²	37.34	55.04	–			
3 ³	8.14	11.99	–			
3 ⁴	2.40	3.54	–			
3 ⁵	2.25	3.32	–			
Rainfed cultivations	–	–	0.87	100	–	
Irrigated cultivations	–	–	–		18.74	100
Total	67.84	77.57	0.87	0.99	18.74	21.43

A. Land Cover Map (Map 2)

*Codification of Existing Plant Formations

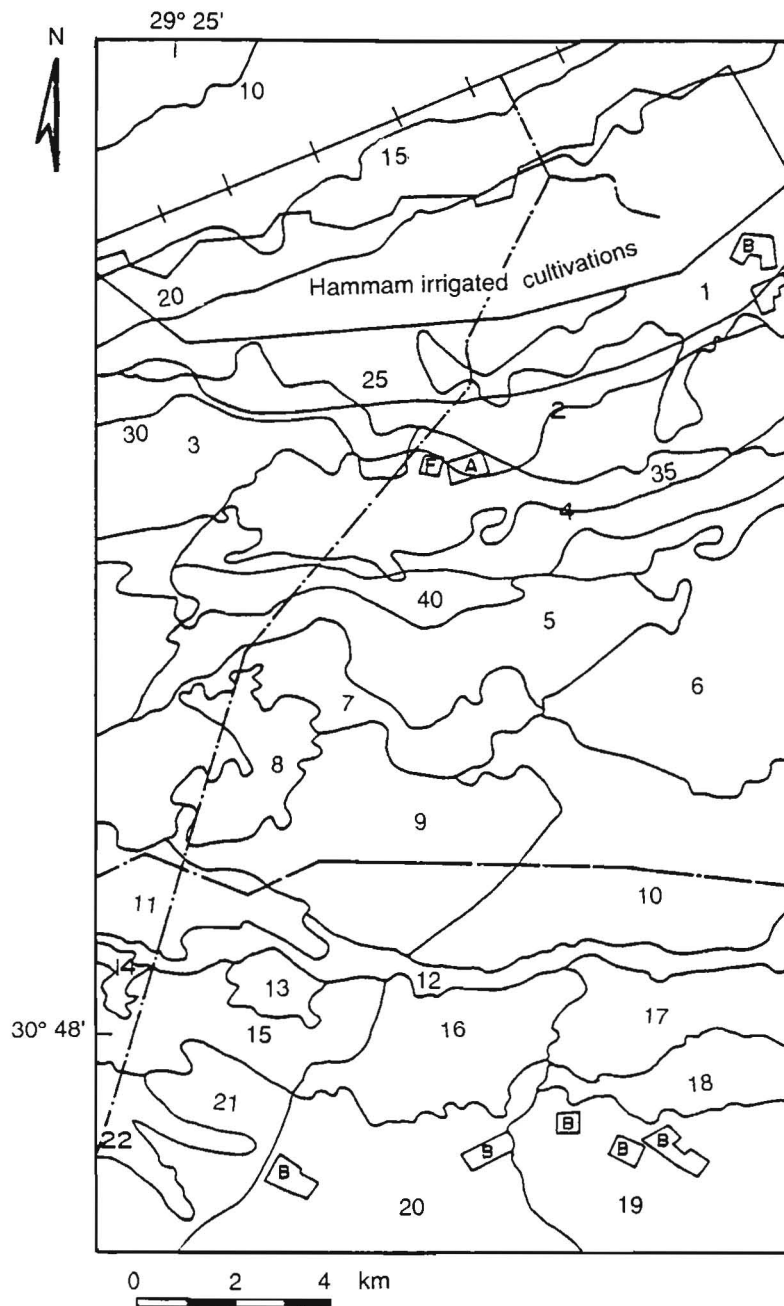
Designation of the main Plant formations	Cover in %		
	Low woody	herbaceous	
Bare units	0	0	ZN ^o
Bare soil, without vegetation or with very spare vegetation	0-1	0-1	ZN ¹
Pure Plant Formations			
Low pure woody plant formations (LB)	5-10 10-15	– –	LB ¹ LB ²
Pure herbaceous plant formation (H)	– –	5-10 10-25	H ¹ H ²
Complex Plant Formations	They are designated by combing the constituent plant formations codes.		
Codes for height classes LBI 0-25 Cm LB II 25-50 Cm H I 0-10 Cm H II 10-25 Cm			



Map. 1. Contour map indicating the transect (AB) taken along the study sector. (dotted lines indicate unpaved roads)

Description of isophenes in Hammam inland plateau (Map 2)

Number of isophene	Description
1	1B ¹ /H ³ II, II 3 ¹ aM, Th
2	LB ² /H ² II, II 3 ² Th, aM, pA.
3	LB ¹ /H ² II, II 3 ¹ Th, aM.
4	LB ¹ /H ¹ II, I 3 ¹ Th, pA.
5	LB ¹ /H ¹ II, II 3 ² Le, E, aM, cd.
6	LB ² /H ² II, I 3 ¹ Th, Es, pA, sA, aM.
7	LB ¹ /H ¹ II, II 3 ⁵ Th, Nm, aM, pA.
8	LB ² /H ² II, I 3 ³ Le, pA, aM.
9	LB ¹ /H ¹ I, II 3 ² Nm, Gd, aM, sA.
10	LB ¹ /H ¹ II, I 3 ² Aa, Ah, cd.
11	LB ¹ /H ¹ II, I 3 ² Th, pA, aM.
12	LB ¹ /H ¹ II, I 3 ² Gd, Th, sA, pA.
13	ZN ¹ 3 ⁴ Th.
14	ZN ¹ 3 ⁵ Aa.
15	ZN ¹ 3 ⁵ Nm.
16	LB ¹ /H ¹ II, II 3 ³ Aa, Nm, aM.
17	LB ¹ /H ¹ II, I 3 ² Aa, Nm, sA, Cd.
18	LB ¹ /H ¹ II, I 3 ² Gd, sA.
19	LB ¹ II 3 ³ Aa, St.
20	LB ¹ /H ¹ III, II 3 ² Th, St, aM, pA.
21	LB ² /H ¹ II, I 3 ² Th, Aa, sA, pA.
22	LB ¹ /H ¹ II, I 3 ² Aa, Nm, sA, pA.
A	LB ² IV 5 ² Ac.
F	LB ² III 5 ² FC.
B	Barley cultivations H ² , II 4 ² hv.



Map. 2. Land cover map of the study sector.

** Codification of Existing Dominant Species

Low woody species (LB)

Latin name	Code
<i>Amygdalus communis</i> (cultivated)	Ac
<i>Anabasis articulata</i>	Aa
<i>Artemisia herba-alba</i>	Ah
<i>Echinops spinosissimus</i>	Es
<i>Ficus carica</i> (cultivated)	Fc
<i>Gymnocarpos decandrum</i>	Gd
<i>Lycium europaeum</i>	Le
<i>Noaea mucronata</i>	Nm
<i>Salsola tetrandra</i>	St
<i>Thymelaea hirsuta</i>	Th

Herbaceous species

Perennial herbs		Annual herbs	
Latin name	Code	Latin name	Code
<i>Asphodelus microcarpus</i>	aM	<i>Cutandia dichotoma</i>	cd
<i>Plantago albicans</i>	pA	<i>Hordeum vulgare</i>	hv
<i>Scorzonera alexandrina</i>	sA	(cultivated)	

*** Codification of Existing Degrees of Human Impact (Map 3)

a–Rangelands

Steppic vegetation overgrazed with capability for regeneration

Overuse of herbaceous plant cover and of low palatable woody shrubs. 3¹

Steppic vegetation overgrazed without real capabilities of natural regeneration

Herbaceous cover has been almost eliminated, excess of trampling and effects of erosion are observed. 3²

Neither edible plant production, nor standing reserve for regeneration do remain. 3³

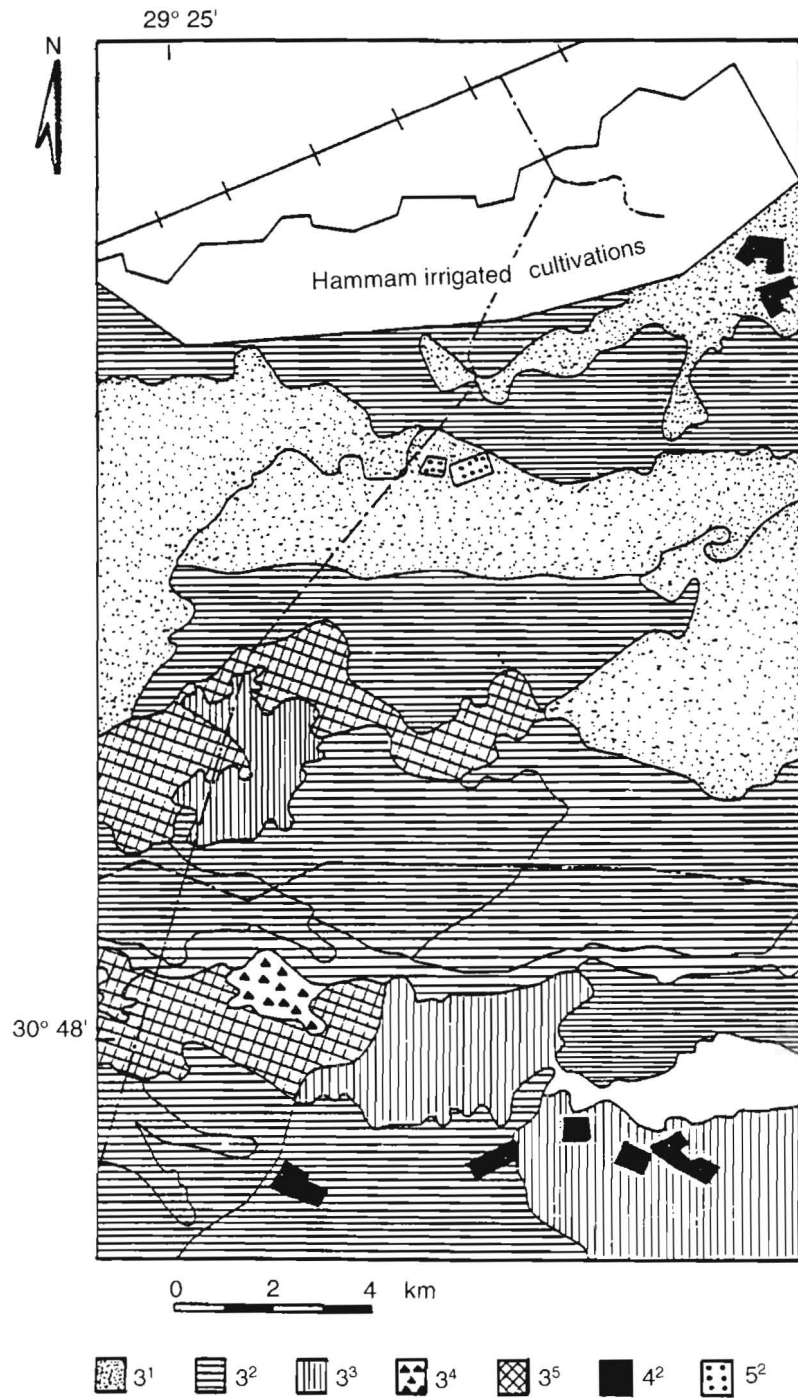
All woody species around human settlements have been destroyed. 3⁴

Fallow fields (with perennial or annual herbaceous plants) strongly grazed in rainfed cultivated areas. 3⁵

b–Vegetation introduced by man

Mechanized crops (mainly barley) 4²

Orchards (Figs, almonds) well cultivated (regular ploughing, pruning, and manuring). 5²



Map. 3. Land use map of the study sector.

Table 2.a The distribution of recorded perennial species in the studied stands

Species	Stands	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	P*%
<i>Allium eredlli</i> sub-spp rosaeum		+	+	+	+	-	-	+	+	+	-	+	+	-	-	-	60
<i>Anabasis articulata</i>		-	+	+	+	+	+	+	+	-	-	+	+	+	+	+	80
<i>Anabasis oropeditorum</i>		-	+	+	-	-	+	+	+	-	-	+	+	+	+	-	60
<i>Asphodelus microcarpus</i>		+	+	+	-	-	+	+	+	+	-	+	+	-	+	-	66.6
<i>Artemisia herba-alba</i>		-	-	-	-	+	-	-	-	-	-	-	-	-	-	+	20
<i>Artemisia monosperma</i>		-	-	-	-	-	+	-	-	-	+	+	-	+	+	-	33.3
<i>Astragalus spinosus</i>		-	-	-	-	-	-	+	-	-	+	-	-	-	-	-	13.3
<i>Atractylis carduus</i>		-	-	+	-	+	-	-	-	+	-	+	-	-	+	-	33.3
<i>Bellvalia flexuosa</i>		-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	6.66
<i>Biarum bovei</i>		+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.66
<i>Carduncellus mareoticus</i>		-	-	+	-	-	-	-	-	-	-	+	-	+	-	-	13.3
<i>Centaurea palleseens</i>		-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	6.66
<i>Colchicum rithii</i>		-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	6.66
<i>Convolvulus lanatus</i>		-	-	-	-	+	-	-	-	-	-	-	-	-	-	+	13.3
<i>Dactylis glomerata</i>		-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	6.66
<i>Echiochilon fruticosum</i>		+	-	-	+	+	-	-	-	+	+	-	-	+	-	+	46.6
<i>Echium sericeum</i>		-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	6.66
<i>Echinops spinosissimus</i>		+	+	+	-	+	+	-	+	+	+	+	+	+	-	-	73.3
<i>Erodium glaucophyllum</i>		-	+	-	-	-	+	-	-	+	-	-	-	-	+	+	33.3
<i>Erodium hirtum</i>		+	-	-	+	-	-	-	-	-	-	-	-	+	-	-	20.0
<i>Fagonia cretica</i>		-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	6.66
<i>Gymnocarpos decandrum</i>		-	+	-	+	+	+	-	+	+	+	+	+	+	-	+	73.3
<i>Helianthemum</i> spp.		-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	6.66
<i>Helianthemum lippii</i>		-	+	-	-	+	+	-	-	-	-	+	+	+	-	-	40.0
<i>Helianthemum kahiricum</i>		+	-	-	+	-	-	-	+	-	-	-	-	-	+	-	26.6
<i>Helianthemum stipulatum</i>		-	-	+	-	-	-	-	-	-	+	-	-	-	-	+	20.0

Table 2.a (contd.)

Species	Stands	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	P*%
<i>Herniaria hemistemon</i>		+	-	-	-	-	-	+	+	-	-	-	-	+	+	-	33.3
<i>Iris sisyrinchium</i>		+	-	-	-	-	-	-	-	+	-	-	-	-	-	-	13.3
<i>Kickxia aegyptiaca</i>		-	-	-	-	-	-	+	+	-	-	-	+	-	-	-	20.0
<i>Launaea nudicaulis</i>		-	-	-	-	-	-	+	-	+	-	-	-	-	-	-	13.3
<i>Launaea resedifolia</i>		+	-	+	-	+	+	-	+	-	-	+	-	-	-	-	40.0
<i>Lotus corniculatus</i>		-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	6.66
<i>Lotus creticus</i>		-	+	-	-	-	-	-	-	-	-	-	-	-	+	-	13.3
<i>Lycium europaeum</i>		-	+	-	-	-	-	-	-	-	-	-	-	-	+	-	13.3
<i>Lycium schwaii</i>		-	-	+	-	+	-	-	-	-	-	-	+	-	-	+	26.6
<i>Lygeum spartum</i>		-	-	-	+	+	-	+	+	-	+	-	-	+	-	-	40.0
<i>Noaea mucronata</i>		+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	93.3
<i>Cnithogalum tricophyllum</i>		-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	6.66
<i>Pancratium siskenbergii</i>		-	-	-	-	-	+	-	+	-	+	+	+	-	-	-	33.3
<i>Paronychia nivea</i>		-	-	-	-	-	-	+	-	-	+	+	-	-	+	-	26.6
<i>Pituranthos tortuosus</i>		+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	93.3
<i>Plantago albicans</i>		+	+	+	-	+	+	+	+	+	-	+	+	+	-	+	80.0
<i>Salsola tetrandra</i>		-	-	-	+	-	-	-	-	-	-	-	-	-	+	-	13.3
<i>Salsola tetragona</i>		-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	6.66
<i>Salsola vermiculata</i>		-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	6.66
<i>Salvia aegyptiaca</i>		-	+	+	+	+	+	-	+	-	-	+	+	-	+	-	6.66
<i>Salvia lanigera</i>		+	-	-	-	-	-	+	-	+	-	-	-	+	+	+	40.0
<i>Scorzonera alexandrina</i>		+	+	+	-	-	-	+	+	+	+	+	+	-	+	-	66.6
<i>Teucrium pollium</i>		-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	6.66
<i>Thymelaea hirsuta</i>		+	+	-	+	+	+	+	+	+	+	+	+	+	+	+	93.3
<i>Urginaea undulata</i>		-	-	+	-	-	-	-	-	+	-	-	-	-	-	-	13.3
<i>Verbascum letourneuxii</i>		-	-	-	-	-	-	+	-	-	+	-	-	-	-	-	13.3

P* = Percentage of stands in which a species occurs.

Table 2.b (contd.)

Species	Stands	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	P*%
<i>Lophocloa cristata</i>			+		+												13.3
<i>Lotus halophilous</i>								+	+								13.3
<i>Lobularia arabica</i>		+	+	+	+	+	+	+	+		+	+	+	+		+	80
<i>Matthiola longipetala</i>									+	+							13.3
<i>Medicago polymorpha</i>						+		+				+					20.0
<i>Medicago ashersoniana</i>						+											13.3
<i>Medicago intertexta</i>				+						+							6.66
<i>Malva parviflora</i>		+		+					+	+							26.6
<i>Malva aegyptiaca</i>							+	+				+					20.0
<i>Onobrychis crista-galli</i>							+										6.66
<i>Plantago crypsoides</i>		+															6.66
<i>Plantago notata</i>															+		6.66
<i>Plantago coronopus</i>										+	+						13.3
<i>Picris radicata</i>		+		+		+	+	+	+	+	+					+	60.0
<i>Polycarpea spicata</i>			+	+													13.3
<i>Reichardia tingitana</i>					+											+	13.3
<i>Rumex pictus</i>									+	+							13.3
<i>Stipa capensis</i>					+												6.66
<i>Schismus barbatus</i>				+	+							+	+				

P* = Percentage of stands in which a species occurs.

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خريطة تغطية واستخدام الأرض لمنطقة الدمام

سنية كمال و سلامة الضرير

قسم النبات - كلية العلوم - جامعة الاسكندرية
الاسكندرية - مصر

ان الهدف الأساسي لهذه الدراسة هو عمل خريطة لنسق توزيع غطاء الأرض وتقدير المستويات المختلفة لمدى تأثير الانسان على الموارد الأرضية في بيئة السهل الداخلي لمنطقة الدمام .
لقد أتضح من هذه الدراسة أن الرعي وزراعية المحاصيل والبساتين يمثلان ما يقرب من ٦, ٧٧ و ٤, ٢٢٪ من المساحة الكلية على التوالي . وقد وجد أن الأنواع :

Anabasis articulata, *Thymelaea hirsuta*, *Plantago albicans*, *Noaea mucronata* and *Scorzonera alexandrina*

تمثل أهم الأنواع السائدة وتحت السائدة في منطقة الدراسة .
وقد أوضحت الدراسة باستخدام تحليل صور الأقمار الصناعية أن ما يقرب من ٧, ٢٥ كم^٢ من السهل الداخلي لمنطقة الحمام قد خرب تماماً وأن جميع الأنواع الخشبية معرضة للاستئصال التام وان سطح التربة أصبح عارياً وذلك نتيجة للأنماط الحضارية في استخدام الأرض والتي استحدثت في منطقة الدراسة .