Millennium Ecosystem Subglobal Assessment
El Maghara, North Sinai, Egypt

A Progress Report

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Executive Summary

The present report is meant to illustrate progress made in the subglobal assessment at El Maghar, Sinia, Egypt within the last 15 month. Work conducted within that past period has followed the conceptual framework of the Millennium Ecosystem Assessment, in which the following components are major issues:

1. Identification of ecosystem goods and services
2. Identification of tends and conditions
3. Identification of drivers of ecosystem change
4. Construction of plausible scenario
5. Responses

The study has also embraced "Socio Economic Profile" and "Traditional Knowledge" as a basic element in the assessment work.

Ecosystem Goods and Services

The study has dealt with major goods and services that the ecosystem of the study area provides. Special emphases were laid on water, floral diversity and medicinal plants, mineral resources, agriculture, grazing and soil potentiality of the area. A detailed study of the water resources in the study area was made, including groundwater and surface water, with some information about per capita , water quality and others. Floral diversity and medicinal plants abundance in the study area were also studied, with information about coverage rate and threats that floral diversity is facing. Soil profile of the main segments of the study area were depicted and the likelihood of agriculture expansion in the area was ascertained.

Trends and Conditions

Prevailing trends and past conditions of some of the ecosystem services were studied in details, with special reference to water and floral diversity.

Drivers of Ecosystem Changes

Drivers of ecosystem changes, whether man – made or natural are identified. The impact of each is documented and some of these impacts were thoroughly examined. Among the studied impacts are

- The impact of mining activities on groundwater quality
- The impact of mining activities on soil pollution and microorganisms viability and count.
- The impact of gravel extraction on land use pattern and biodiversity
- The impact of mining and gravel extraction on land use pattern
- Other impacts

Different approaches were used in the study including
Laboratory analysis
GIS and remote sensing tools

Socio Economical Profile

The study has encompassed a socio economic component that focused on the inhabitants of El Zawadin village, one of the small villages in the heart of the study area. A questionnaire was made to measure a variety of social and economical issues specially those related to Human Development Index HDI. In addition, the questionnaire investigated the relationship between inhabitants and their environment and biodiversity.

Local Knowledge

Local knowledge plays a major role in the study area and is considered as one of the main traits and life supporting feature. The extensive of local knowledge in every day life has been recorded, with special reference to agriculture, conservation, health care and water management.

Future Scenarios

Plausible scenario of the study area is being studied currently. Some preliminary information are already available, however, the complete study is due to within few weeks.

1-A Background

The subglobal assessment of the Millennium Ecosystem Assessment is being conducted at El Maghara, North Sinai. Gebel Maghara anticline has been chosen for MA for a number of reasons. On the one hand, it is considered as one of the land marks in the biodiversity of Sinai and Egypt. It is also considered as one of the most important centers of medicinal plants in the Middle East. Sixty one percent of its flora are considered as medicinal. In addition to having a relatively rich and unique flora, it represents an important area anthropologically due to presence of different Bedouin tribes having a very unique traditional knowledge about medicinal plants in the area and their uses. The area is characterized also by diversity in landforms, rock units, water resources, and aridity conditions. On the other hand, poverty conditions characterizing the local inhabitants in the area give the area another importance and necessity of doing MA in such area for Human well-being. Finally, the community goods and services in Maghara area have been subjected to severe human impacts. The prevailing aridity conditions and unmanaged human impacts have been threatening the biodiversity and generally, the community goods and services of the area.

Location

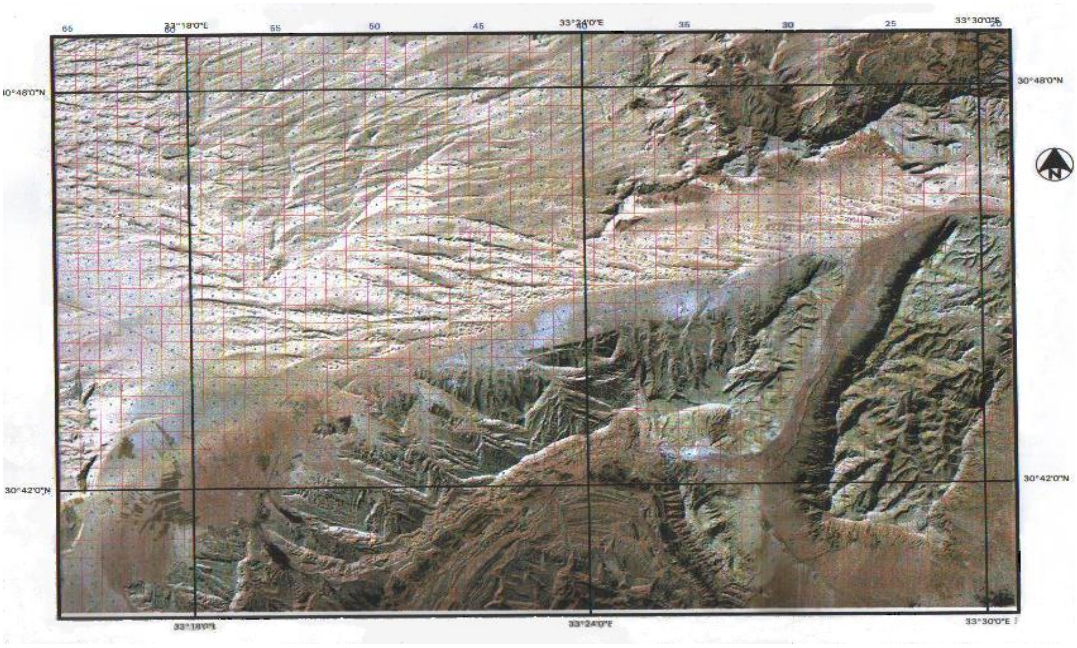
El Maghara area lies in the northern part of west Sinai Peninsula between Longitudes 33° 17` and 33° 30` East and Latitudes 30° 40` and 30° 48` North.

The site includes much of Gebel Maghara and the adjoining plains east to Risan Aneiza. Gebel Maghara itself is one of several domes, which characterize north-central Sinai. It is the largest Jurassic exposure in Egypt, being dissected by several wadis, the largest of which flows eastwards into a large sand and gravel-plain. The North Sinai dune-fields, composed of large dunes of aeolian sand, encroach upon the northern part of Maghara and the adjoining plains. The area receives between 50 to 90 mm of rain annually; falling mainly in winter and the mean maximum temperature is 27.5 C° mainly in summer, allowing fairly good vegetation cover of considerable diversity to grow on open flood plains, as well as in wadis. Dwarf shrubs (*Fagonia*, *Anabasis*) and grasses (*Stipagrostis*, *Panicum*) dominate the vegetation on the gravel-plain (W. El Shiehk Hemed). *Artemisia* is common and widespread (W. El Khrage) on fine sandy substrates. Substantial stands of *Acacia* trees are found in the larger wadis (W. El Shiehk Hemed). The vegetation on the hills of Maghara area includes many Mediterranean relicts, such as Juniperus phoenicea, which grows on the north-facing slopes and is found nowhere in Egypt outside the hills of north-central Sinai. The area is exposed to northeastern and northern winds with a mean velocity of about 11 knots.

Generally El-Maghara area is characterized by mild winter, hot summer relatively low precipitation and high evaporation.

Access to the Area

Access to the area is easy by car, where it can be reached via the Ismailia- El-Arish central high way and via the branched asphalted road from El-Hemma to the coal mine. The total distance is about 175 Km to El – Hemma and 44 Km to the mine. The area can be reached also through the new asphalt road from El-Arish – El-Hassana-Bir El-Hemma and then through the new asphalt road crossing Wadi El-Fath to the Coal Mine, whose total distance is about 90 Km.



Landsat Image of Gabal El Maghara

3-Bedouin Population, A General Profile

Sinai is principally inhabited by Bedouin communities. Bedouin means "people of the desert". Bedouin belong to seven tribes and each tribe controls a different part of Sinai. Fifty percent of Sinai's population is Bedouin. While the majority of Sinai's inhabitants are of Bedouin descent, their status has changed to urban dwellers or inhabitants with increasing urbanization and settlement. About one in seven Sinaians lives in the mountains, mostly in small settlements near reliable springs and wells. While four out of five of Sinaians live near the sea coasts. Sinai is a coastal region with a mountainous hinterland. The subregional difference in the Bedouin percentage of the population reflect both the proximity to the rest of Egypt and the urban build up of the subregion.

The Uplands, subregion, where the Assessment is conducted, is most remote, remains almost exclusively Bedouin.

In the southwest and southeast subregions Bedouin constitute 70 % of the population. Increasing non grazing activity brings in outside, non Bedouin workers and increases Bedouin population concentration as traditional employment shifts from livestock to service and construction. In the Northwest and Northeast subregions, access from non Sinai Egypt is far easier, allowing a greater influx of investment and both Bedouin and non Bedouin urban workers.

Unlike non Bedouin, who are concentrated in the Northeast, and to a lesser extent on the Southwest coast, the Bedouin population is spread relatively evenly over the whole of Sinai.

The dispersion of Bedouin population is dictated by their primary occupation, which is livestock grazing. Historically, distinct areas of grazing rights became established for each of Sinai's Bedouin tribes. Though less important today than in the past, the 27 existing tribal land divisions still constitute the primary habitat and grazing areas for each respective tribe.

4-Representation of Results

Data were organized in a uniform manner for the study area as a pilot study. It would speed up generation of new data/information layers and will be integrated from diverse resources. In addition, it should serve visually analysis using the Geographic Information System. The system has both the vector and raster data that representing the analysis of the satellite images of the Maghara, Sinai, Egypt, as a pilot study.

The system has customized using Arcview 3.1 Software. It comprises Geographic User Interface (GUI) to facilitate users to navigate the Vector and Raster data in the Views.

The system has included different categories of data organized as Menus. Each Menu opened in separate View. Each View displays the thematic layers of the selected category. Each Thematic layer has its organized legend.

The system is enables users to display, Edit (modify, add, delete) data. Users can make analysis and generate the pre-designed layout to extract a map from the system.

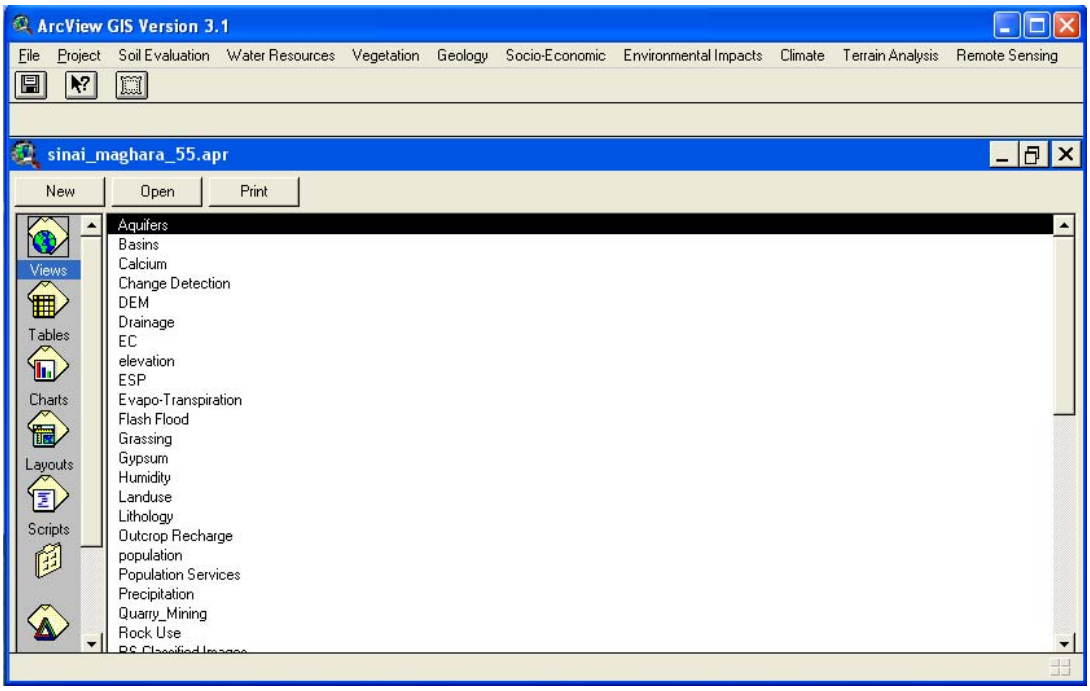


Figure (1) Data Categorization in a GUI

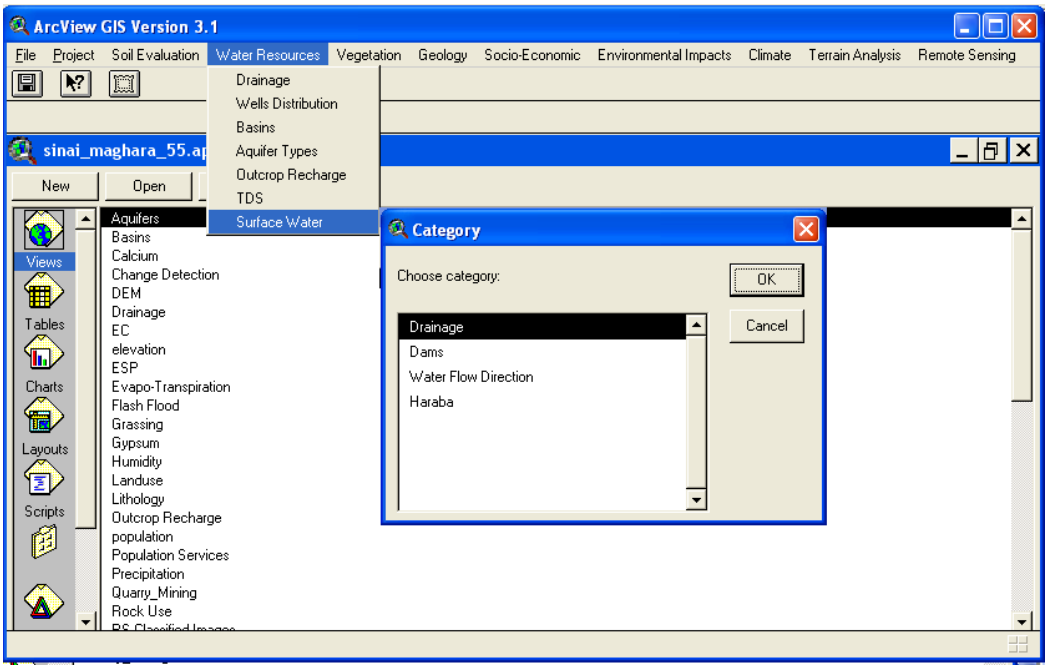


Figure (2) Sub-menu appeared one selected of main menu.

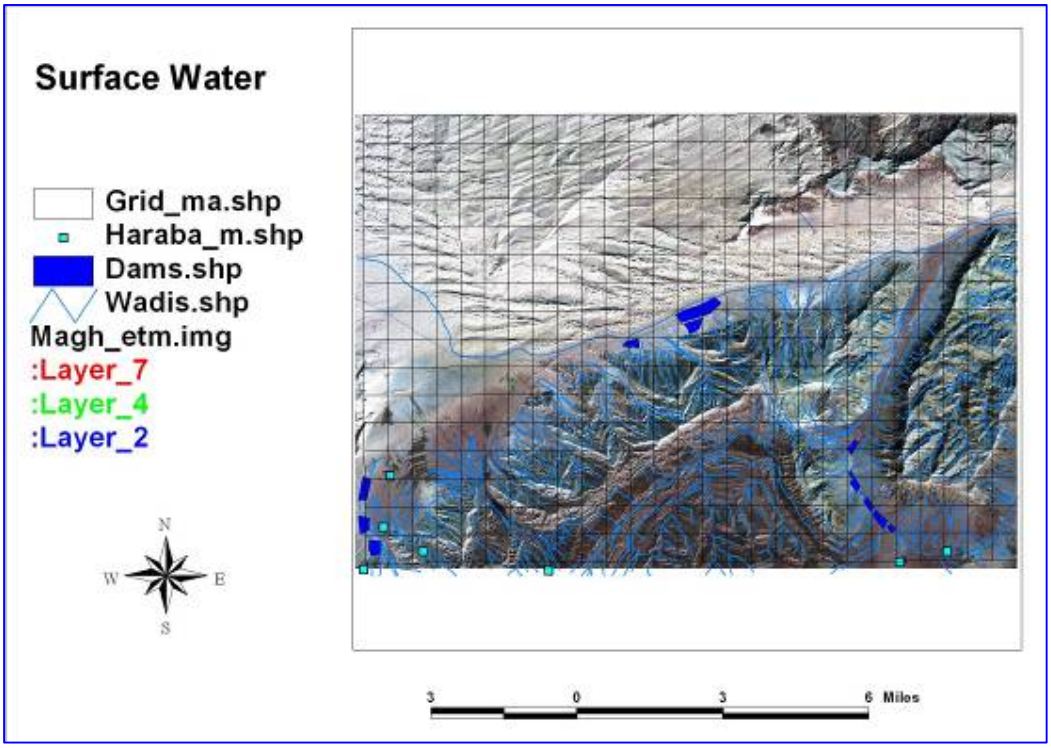


Figure (3) the layout generated after selection from the Sub-menu window.

Remote Sensing, Image Analysis Systems and GIS and Change Detection

Remote Sensing (RS) image analyses systems and GIS show great functionality for the integration of a wide variety of spatial information supporting tasks such as natural resources management, regional planning and environmental monitoring. (RS) technology and GIS offer the ability to facilitate ecosystem change investigations leading to a more complete understanding of human impact on the ecosystem. This research gives the approaches of deriving temporal ecosystem change. Furthermore, this study analyses the process of natural and human induced landscape transformation on El-Maghara area. Climatic condition, geographical situation, unfavorable winds and the influence of sand activity and movement, salinity and waterlogging are of the broad indicators of desertification monitoring. According to the satellite image enhancement, analysis, interpreted and the field verification the land cover of El-Maghara area show that it is influence by human activates and natural hazards due to environmental impacts.

Many types of image enhancement techniques are used in the present work such as image classification, change detection and post - classification comparison techniques. The enhanced unsupervised classification image has been verified in the field before the sampling location has been selected to cover all the suggested classes. However, the enhanced supervised classification image has been used to cover all the suggested classes of the land cover units of El-Maghara area. In the present study, the best three ETM – band combination have the highest covariance among the ETM-bands. There are two methods have been used to select the optimum three band combination that is depend on the use of variance covariance matrix for a scene. The second method that is based on the amount of total variance and correlation within and between various band combinations. Both methods are shown that best band combination is (2, 3 and 4) assigned as (Red, Green and blue) to increase the discrimination between some land cover units.

Change detection is the process of identifying differences in the state of an object or phenomena by observing it at different times. It is useful in such diverse applications as land use change analysis, monitoring of shifting cultivation, assessment of deforestation and so on. It is essential for studying change on the earth's surface. In the Post-classification technique, two independently classified images will be compared holding promise of minimizing the effect of normalizing for atmospheric and sensor differences between the two dates by using histogram matching and projected into same projection type to prevent any fuzziness of data. The accuracy of the change images produced is likely to be the product of multiplying the accuracies of each individual classification. It has been used in change detection in semi-arid environments.

In the current work, our analysis, post-classification, image differencing change detection techniques were applied. Post-classification change detection involved computing the area covered by each of the two unsupervised classified images from the two data sources independently and comparison made first of the 1986 data and then between 2000 data sets from the RGB images. Images overly based on the classification of 1986 and 2000 RGB images involved analyzing the temporal extent of the classes separately with the RGB 1986 as background image. Specifically areas classified developed in 1986 and 2000 and in both years i-e, areas

of no change are highlighted and this was repeated for the other classes namely transition and reserved. On the other hand, image differencing using the 1986 and 2000 simulated image were employed based on the intensity bands generated by transforming the RGB data sets into IHS color space.

The results of interpretation and images analysis of El-Maghara area are show there are temporal ecosystem changes and environmental impacts in soil, water, bio-diversity and soci- economics features that are related to the effect of sand dunes encroachment, flash flood, quarrying, mining, agricultural activities, and salinization of water.

5-Some Highlights of Progress Made

The Assessment team was involved in field work through last year according to pre set plans. Work was performed in line with the conceptual framework of the Millennium Ecosystem Assessment that include:

Identification of goods and services
Conditions and trends
Drivers of ecosystem changes
Scenarios
Responses

The following is a summary that highlights the Assessment team's accomplishments.

Goods and Services

A number of goods and services were identified in the study area. Among the most important of these are the following:
Provision of Water
Floral Diversity and medicinal plants
Minerals
Agriculture

Water

Water resources were studied, as one of the major goods of the study area. The Assessment team has made special efforts to depict the prevailing conditions of water resources and their availability.

El- Maghara area has an extremely arid climatic condition with scarce water resources. These are supplied from groundwater, rainfall and flash flood-water. Sinai coal mining company has exploited coal reserves from the study area in the last fifteen years. This has encouraged the research for water resources and development

of groundwater resources. Prior to the discovery of the coal in the study area, the available water resources were enough to sustain the sparse population of nomads and their domestic animals. After operating the coal mine the available information about groundwater resources has increased. Nevertheless, water resources have been stressed and the total water demand has increased to supply the domestic and drinking purposes for mine workers and sustain mine operation. Moreover, dewatering processes for coal seems has increased the total discharge from the groundwater reserves. The most serious problem from coal mining activity is the formation of Acid Mine Drainage that has negative consequences on the surrounding environment. Mining activities has stopped now and lift the abandoned coal piles behind. The study area is inhabited mainly by Bedouins whom are scattered in 14 communities along wadi El-Khariq, Wadi El-Massajid and Wadi Mazeri. They have used their local knowledge to benefit from the available water resources from their ecosystem. They have built small earth dams and cisterns to harvest rainfall and floodwater. Moreover, they have dug shallow wells to exploit fresh groundwater.

Water resources

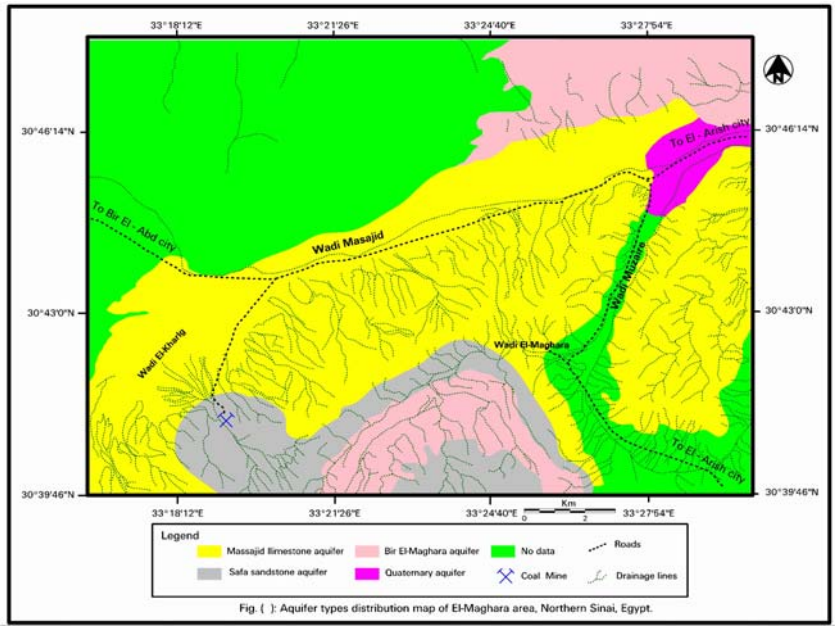
Rainfall and flood water

Rainfall and floodwater represent an important water supply for both domestic and irrigation purposes. Nevertheless, rainfall over the study area varies greatly spatially and temporally. The map of average annual rainfall on Sinai (fig. 1) exhibits large spatial changes in relatively small distances across the region. The average annual rainfall reaches about 200 mm/y at Rafah near the Egyptian borders and decreases to about 10 mm along the Gulf of Suez. Rainfall at El-Maghara area is recorded about 43.7 mm/y at year 1966.

Groundwater

Groundwater exists in the pores and fractures of the water-bearing rock units (aquifers) and is commonly exploited from wells and springs. The volume of the openings and the other water-bearing characteristics of the aquifers depend on the mineral composition, texture, and structure of the rocks. Groundwater generally moves very slowly and follows the least resistive (most permeable) pathway from the point of recharge (where water enters the aquifer) to the point of discharge (where water leaves the aquifer). The flow of groundwater may be inhibited by non-water bearing rock units (Aquitards) that consist of clay, silt, or shale which do not transmit water readily, although they may hold much water in pore spaces. The importance of an aquifer as a source of water may change from one area to another because of changes in demands for freshwater, variations in groundwater quality, and differences in the hydrogeologic characteristics.

The study area has four productive aquifers. These are Quaternary, Massajid, Safa and Bir Maghara aquifers. The distribution of these aquifers is shown in figure 6. The Quaternary aquifer is composed mainly of sand and gravel in the wadi beds and is exploited mainly in wadi El-Fatah. The Massajid aquifer is composed mainly from fractured limestone. It is exploited in Wadi El-Massajid, and wadi El-Khariq. The Safa Aquifer is composed of sandstone and is exploited mainly in wadi El-Safa. Bir Maghara aquifer is composed from loamy fractured limestone. It is distributed mainly in wadi El-Maghara, Safat mouwereb and Gebel El-Raghaway. The productivity of these aquifers are generally low and of different water quality.



The distribution of aquifers in the study area.

Floral Diversity and medicinal plants

As an integral part of the goods and services, floral diversity and medicinal plants were focused on as they constitute a landmark of the area. A field study was performed to record the highlights of the floral profile of the study area, with some emphases on

Prevailing species
Abundance of flora
Coverage

Generally, the average vegetation cover of Maghara area is 10%. This percentage decreases in sandy dunes and non fractured slopes to <1% and increases to more than 20% in wadi channels, gorges, and alluvial fans.

Three main different habitats are recognized in this area; sandy plains, wadis, and anticlines with limestone, chalk, dolomite, and marl outcrops. The first type is similar to the undulating sandy plain and sandy dunes characterizing the Mediterranean coastal area. In this type of habitats, large open sandy plains are located surrounding the mountainous area. The dominant species characterizing these habitats include *Anabasis articulata, Panicum turjidum,* and *Artemisia monosperma.*

The second type of habitats are wadis mainly originated from the anticlines, then split and convert till pour in the plains surrounding the mountainous area. *Retama raetam, Acacia tortilis, Acacia pachyceras* var. *najdensis* and *Tamarix nilotica* or *Tamarix aphylla* grow in large wadis, e.g., W. Masaged.

The third type of habitats are several anticlines with limestone, chalk, dolomite, and

marl outcrops. Extensive erosion in Gebel Maghara is a sequence of Jurassic limestone, shale and sandstone. Large outcrops of smooth-faced limestone and dolomite are found at Gebel Maghara. The syncline valleys are filled with sand-covered alluvium. The dominant plant species characterizing slopes and gorges of these anticlines include *Zygophyllum dumosum, Reseda arabica, Retama raetam, Lycium shawii,* and *Juniperus phoenica* that forms large communities at Gebel Maghara.

Botanical and Ecological Survey

Field survey and vegetation sampling were carried out in Gebel Maghara in the following main localities; W. Masajid, W.Maghara, W. Aroseyat, W. Sheikh Hekaid, W. Sayila, W. Safa, and El-Khareiq Plain. In these localities 25 sites were selected for vegetation survey. From 5 to 10 quadrates were selected randomly in each site. These sites covered the habitat diversity (wadis, sandy plains, wadi channels, gravelly plains, alluvial plains, sandy dunes, alluvial fans, and slopes and Gorges) and rock units Diversity (Limestone, sandstone, and shale).

Plant cover as a canopy cover of each species was measured in each plot. Species richness, the total number of species in certain area within a community, was determined in each site and in each locality. Geographic location (latitude and longitude), and altitude were recorded in each site using GPS receiver.

Flora and vegetation of the region

Floristic composition of Maghara area include 93 species belonging to 76 genera and 35 families. The common representative families are: Compositae (10species), Zygophyllaceae (9species), Chenopodiaceae (8species), Leguminoseae and Cruciferae (7 species), and Labiatae (6 species).

The recorded species in the area include 19 annual species, 23 perennial species, 27 frutiscent species, 20 shrub species, and 4 tree species (Table 3).

The 93 species recorded in the area include 56 medicinal species (60%). More than 61% of the flora are grazed species (57 plant species), and 51 woody species (55%) used as fuelwood for energy source.

Vegetation varies between less than 1% in in sandy dunes and non fractured slopes to more than 20% in wadi channels, gorges, and alluvial fans. The average vegetation cover in the study area is 10%.

The main dominant species in the area are:

Acacia pachyceras O. Schwartz var. *najdensis* (Chaudhry) Boulos
Anabasis articulata (Forssk.) Moq.
Artemisia monosperma Delile
Haloxylon salicornicum(Moq.) Bunge ex Boiss.
Juniperus phoenicea L.
Retama raetam (Forssk.) Webb&Berthel
Stipagrostis scoparia (Trin.&Rupr.) deWinter
Tamarix nilotica (Ehrenb.) Bunge

Thymelaea hirsuta (L.) Endl.
Zilla spinosa (L.) Prantl
Zygophyllum dumosum Boiss.

Medicinal plant species recorded in Maghara Mountain, North Sinai.

Species	Growth form	Vernacular name	Biological Activity	Folk Medicine	Toxic	Active Components	Trade	use in medicine
Acacia pachyceras O. Schwartz var. Ital (Chaudhry) Boulos	Tree	Sayal سيال				*		
Acacia tortilis (Forssk.) Hayne	Tree	Sayal سيال				*		*
Achillea fragrantissima (Forssk.) Sch. Bip.	Frutescent	Qaysoum قيسوم	*	*		*	*	
Agathophora alopecuroides (Delile) Fenzl ex Bunge	Frutescent	H'emd حمض				*		
Anabasis articulata (Forssk.) Moq.	Shrub	A'gram, Tarteer / عجرم طرطير		*		*		
Anastatica hierochuntica L.	Annual	Kaf Mariem كف مريم	*		*	*	*	
Artemisia herba-alba Asso.	Frutescent	Sheih الشيح	*	*		*	*	
Artemisia monosperma Delile	Frutescent	Aader عادر	*	*		*	*	
Asclepias sinaica (Boiss.) Muschl.	Shrub	Hargal, Laban El-Hamier / حرجل لبن الحمير				*		
Asparagus aphyllus L.	Perennial	Agool gabal عاقول				*		

		الجبل						
Asparagus stipularis Forssk.	Shrub	Shouk شوك		*				
Ballota undulata (Fresen.) Benth.	Perennial	غصة Ghassa	*	*		*		
Chiliadenus montanus (Vahl) Brullo.	Frutescent	Heneda هنيده		*			*	
Citrullus colocynthis (L.) Schrad.	Perennial	Handal حنظل	*	*	*	*	*	*
Cleome amblyocarpa Barratte & Murb.	Annual	Magnuna مجنينة	*	*		*		
Colutea istria Mill.	Frutescent	Yessr يسار				*		
Convolvulus olifolius Desr.	Frutescent					*		
Cornulaca monacantha Delile	Shrub	Shoaked-deeb شوك الديب	*	*		*		
Deverra tortuasa (Desf.) DC.	Frutescent	Shabat el-gabal شبت الجبل		*		*		
Diplotaxis harra (Forssk.) Boiss.	Annual	Harra حارة	*	*		*		
Species	**Growth form**	**Vernacular name**	**Biological Activity**	**Folk Medicine**	**Toxic**	**Active Components**	**Trade**	**use in medicine**
Echinops spinous L.	Perennial	Shoak el-gamal شوك الجمل	*	*		*		
Fagonia arabica L.	Frutescent	Wraqa وراقة				*		
Fagonia glutinosa Delile	Perennial	Showeika شويكه، شوكه				*		
Fagonia mollis Delile	Frutescent	Showeika شويكه، شوكه	*	*		*		
Farsetia aegyptia Turra	Shrub	Gerba جربه	*	*		*		

Globularia arabica Jaub.&Spach.	Frutescent	Handaquqحندقوق	*	*		*		
Gypsophila capillaris (Forssk.) C. Chr.	Annual to perennial	Errafiah الرفيعه				*		
Haloxylon salicornicum (Moq.) Bunge ex Boiss.	Perennial	Remh, Bolbol رمح، بلبل	*	*		*		
Haloxylon scoparium Pomel	Shrub	Remth رمث				*		
Haplophyllum tuberculatum (Forssk.) Juss.	Perennial	Shagaret er-rih شجرة الريح Magnuna مجنينة		*				
Hyoscyamus muticus L.	Perennial	Sakaran سكران	*	*		*		*
Juncus rigidus Desf.	Perennial	Samar سمار	*	*		*		
Juniperus phoenicea L.	Shrub or tree	Ar'ar عرعر	*	*		*	*	
Lavandula pubescens Decne.	Perennial	Attan, 'Attani عطان، عطانى	*	*		*		
Lycium shawii Roem. & Spach		Awseeg عوسج	*	*		*		
Malva parviflora L.	Annual	Khobbeiza خبيزة	*			*		
Mesembryanthemum nodiflorum L.	Annual	Ghasool غسول				*		
Noaea mucronata (Forssk.) Sch.Bip		Thirr صر	*	*		*		
Ochradenus baccatus Delile	Shrub	Qordi قرضى		*				
Panicum turgidum Forssk.	Frutescent	Bou rekba أبو ركبة	*	*		*		

Peganum harmala L.	Perennial	Harmel حرمل	*	*		*		
Pergularia tomentosa L.	Frutescent	Ghalqa غلقه	*	*		*		
Phoenix dactylifera L.	Perennial	Nakhl نخل		*				
Species	**Growth form**	**Vernacular name**	**Biological Activity**	**Folk Medicine**	**Toxic**	**Active Components**	**Trade**	**use in medicine**
Reaumuria hirtella Jaub. & Spach	Frutescent	Molleih مليح				*		
Retama raetam (Forssk.) Weeb & Berthal.	Shrub	Ratam رتم		*				
Salvia aegyptiaca L.	Frutescent	Ghobbeisha غبيشه	*	*		*		
Stachys aegyptiaca Pers.	Frutescent	Qortom قرطم	*	*		*		
Stipagrostis scoparia (Trin. & Rupr.) de Winter	Perennial	Sabat السبط		*				
Tamarix aphylla (L.) H. Karst.	Tree	Athal ألاتل	*	*		*		
Tamarix nilotica (Ehrenb.) Bunge	Tree	Moor, Maathoola / المر معثولة	*	*		*		
Teucrium leucocladum Boiss.	Perennial	Ja',ada الجعدة	*	*		*		
Teucrium polium L.	Frutescent	Ja',ada الجعدة	*	*		*		
Thymelaea hirsute (L.) Endl.	Shrub	Metnan متنان		*				
Tribulus terrestris L.	Annual or Biennial	Hassak, Ders El-'Agooz الحسك، ضرس العجوز	*	*		*		
Zilla spinosa (L.) Prantl	Shrub	Silla سلا	*	*		*		
Zygophyllum	Perenni	Ratrayt				*		

album L. f.	al	رطريط						
Zygophyllum dumosum Boiss.	Shrub		*	*		*		

Soil Pedological, Geomorphology, Classification and Evaluation Studies

This investigation aimed to study the pedogenic characteristics of soils of the El Maghara area, inculding their geomorphology, classification and land suitability for a better agricultural use. The present study constitute a base for any future developmental work in the field of agriculture.

Thirteen soil profiles were selected to represent the main geomorphic units of the studied area, the location of the study area. These soil profiles were morphologically described according to F A O (1970). The collected soil samples were prepared for physical and chemical analyses. Particle size distribution will be carried out by the pipette method for the fine textured samples. Total carbonates are estimated volumetrically using Collin's Calcimeter . Soil reaction (pH), electrical conductivity (EC), soluble cations and anions, gypsum content, and cation exchange capacity (CEC) are determined. Organic matter (OM) are also determined. Total P, K, Fe, Mn, Zn and Cu in soils are extracted. Total P contents will be measured. Total nitrogen were also determined. Soil classification will be carried.

After field study and profiles description was observed the all soil profiles in study area lied in young stage of the soil development, because do not detected any diagnostic horizons on the studied soil profiles.

7-Social and Economic Profile

The socio economic profile was a real challenge for the Assessment team. The Assessment team had to bridge a number of barriers to approach the Bedouins

community living in the area in order to establish some dialogue that would help building the socio economic profle.

Human Development Index

Since 1990, the **U**nited **N**ation **D**evelopment **P**rogram (***UNDP)*** introduced the **H**uman **D**evelopment **I**ndex ***(HDI***) as a composite indicator which would more fully reflect the main dimensions of development in society. The HDI is composed of three sub-indices: (i) the education index, which relates to improvement in the quality of life by giving access to knowledge and is a strong contributor to employment opportunities. (ii) The life expectancy index which combines indicators of longevity and health and (iii) the **G**ross **D**omestic **P**roduct (***GDP***) index, which gather together various aspects of economic conditions affecting people's lives **(**Egypt Human Development Report 2003).

A simple questionnaire that bears the main traits of HDI was constructed in order to ascertain the economic and social profile of the Bedouins in the study area.

Among the main components of the questionnaire are the following issues.

Socio Economic Profile Questionnaire

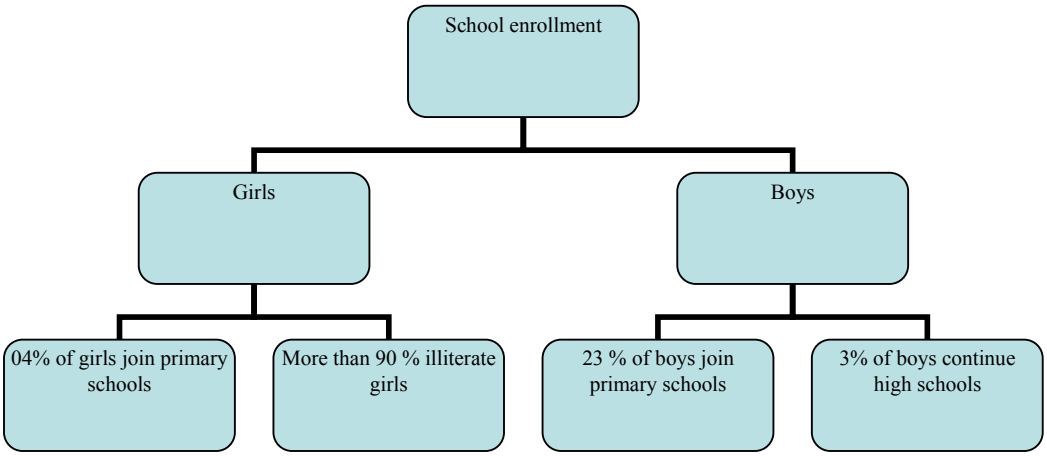
number	Questions	Answers	Notes
	age		
	gender	Male / female	
	Place of birth	City / village/ no idea	
	Type of place of birth	Urban /rural/ no idea	
	Type of educational certificates	Illiterate Read & write Primary school Prep-school Secondary scho University graduated	
	Married status.	Single Married Widower	

		Divorced Separated	
	How many persons of family		
	How many boys and girls enroll schools		
	How far is the school		
	Do the kids go regularly to schools		
	What are the reasons behind stoppi the kids to go schools?		
	How do the kids study the lessons		
	Do allow the girl to continue h education		
	How much do you earn monthly		
	What are your expenditures		
	What is your job		
	What is wife ' job out the house		
	Do you smoke		
	How many room in the house		
	How many persons live in the house		
	What is water resource	In /out the house/ other	
	Type of lavatory in the house	In/out the house	
	Do you have Diabetes Kidney problem Hyperion blood	YES/NO	
	Any change in skin color	Yes/no	
	Do you have any chest problem	Yes/no	
	Do you have any medication treatme	Yes/no	
	Do you have blood transfer	Yes/no	
	Do you utilize medicinal plants		
	What is most important utilization		

	Are medicinal plants in your income		
	decrease using medicinal plants		
	Young people use medicinal plants same as old people		
	What are the most things needed		
	Do governmental people visit the plac		
	What is future vision in next ten years		
	What is the best thing to improve t place		
	What is the duty of Bedouin in the are		

The socio economic profile has also delineated on

- Level of Education
- Gender Issues
- Labour Force
- Water shortage
- Housing and sanitation
- Medicinal plants and their role in the community
- Health conditions
- Governance and local community



Education Chart of the Study Area

8-Local Knowledge

Local knowledge is one of the significant factors in the present Assessment. Several efforts were made to record some of the deeply inherent traits of the inhabitants and to depict the role of LK in various walks of life.

The MA approach links human well-being to the state of ecosystem services. There are a variety of ecosystem services which support the human life on earth. The conceptual framework of the MA divided them to provisioning, regulating, culture, and supporting services. In turn, humans are directly dependent on ecosystems for air, water, food and other basic needs. Such relation is often more apparent in rural communities whose lives are directly supported by the available resources. The situation is more severe in case of desert inhabitants who have less than the minimum levels of resources to service and withstands the harsh conditions of the desert. Modernization approaches in dealing with poverty, inability of science and technology to improve living standards of poor creates an interest in the value of indigenous knowledge (Escobar, 1995).

9-Drivers of Ecosystem Changes

Soil Degradation and Groundwater Pollution

One of the striking features of the area is the extent of degradation that the area suffers. Degradation is manifested in the quality of soil, crop productivity and human well – being. Degradation is caused by a number of factors that include:

El Maghara Mine

Al Maghara charcoal mine is one of the main features of the area. The mine is located in the proximity of a number of villages and is providing jobs for a large number of the Bedouins in the area.

Wastewater effluent with heavy residues of charcoal particles, hydrocarbons and some heavy metals is released in the open in the vicinity of the assessment area. Wastewater discharge is left to spread on a vast area. Contaminants are affecting the soil quality to a significant extent, with a cover of thick layer of deposits. The influence of such deposit on faunal and floral diversity is evident. There is no available studies on the impact of such wastewater on biodiversity and biologic organisms.

It is also likely that groundwater, despite its depth is affected by these contaminants through percolation and other movement forces. Part of the salinity of groundwater is probably caused by such contaminants.

Moreover, activities related to coal mining and gravel extraction are causing some serious damage to the services supplied by the ecosystem. Among the trade offs are:

- Dying trees in the area of the gravel quarries.
- Soil compaction as a result of the heavy trucks loading gravel.
- Air pollution as a result of particulate matter emission
- Soil and groundwater pollution as a result of the wastewater emitted from the mine.

Extraction of Gravel and Marble

The area is considered one of the main sources of gravel and marble used in construction and similar activities. A large number of quarries are extensively visited by heavy trucks to load gravel every day. Heavy truck traffic, along with gravel extraction activities have severely affected some of the most well known trees of that area to a serious extent. Large number of the trees (Acacia sp.), are dying as a result of stone cutting around their trunk and roots. The compaction effect of the trucks heavy traffic, along with emanating dust have also caused serious damage to the vegetative cover in the area.

Air Pollution

Gravel extraction and charcoal mining is emanating large volume of particulate matter that often affect the quality of air in the area. Particular matter could be of adverse health effect on human and can also have some effect on faunal and floral diversity in the area

Visual Impact

The mining and gravel extraction activities are causing some significant visual damage to the area. Impacts are affecting the picturesque value of the area to a great extent.

Impact of Mining on Water Quality of Adjacent Wells

The impact of mining and related activities on the quality of water in the nearby wells was investigated. Water samples were analyzed for the concentration of Iron, Stranchium, Arsenic and cadmium. Results are shown in the following table

Groundwater Contamination with Heavy Metals

Well No. Name	Fe ppm	Sr ppm	As ppm	Cd ppm
Well 12	<0.0054	3.071	<0.0001	<0.001
Well 5	<0.0054	4.22	0.0055	<0.001
El Mangam	<0.0054	3.255	0.0085	<0.001
El Masoura	<0.0054	1.041	0.0247	<0.001
El Fath	0.0357	0.948	0.0041	<0.001
El Soutia	0.0520	5.53	0.0111	<0.001
Wadi El Hanna	<0.0054	6.56	<0.0001	<0.001

10-Scenario

Work in building scenario for the plausible future of the study area is already underway. In the preliminary stages of the study, a list of variable has been identified. The list was based on the experience of the Assessment team. Each member of the team was allowed to suggest the most important variables according to his own view. Eventually, scenario experts were able to come up with one main list.

LIST OF VARIABLES

1. Employment (Employment)
2. Agriculture (Agricultur)
3. Remoteness (Remoteness)
4. Educa/Training (Educa/Trai)
5. Indus. Invest. (Indus. Inv)
6. Services (Services)
7. Sustainability (Sustainabi)
8. Participation (Participat)
9. Health (Health)
10. Migration (Migration)
11. Poverty (Poverty)
12. Equity (Equity)
13. Water Avail. (Water Avai)
14. Land use change (Land use c)
15. Pollution (Pollution)
16. Overgrazing (Overgrazin)

The list of variables were used to elucidate the matrices of entries that include

I-MATRIX OF DIRECT INFLUENCES (MDI)

The Matrix of Direct Influence (MDI) describes the relations of direct influences between the variables defining the system

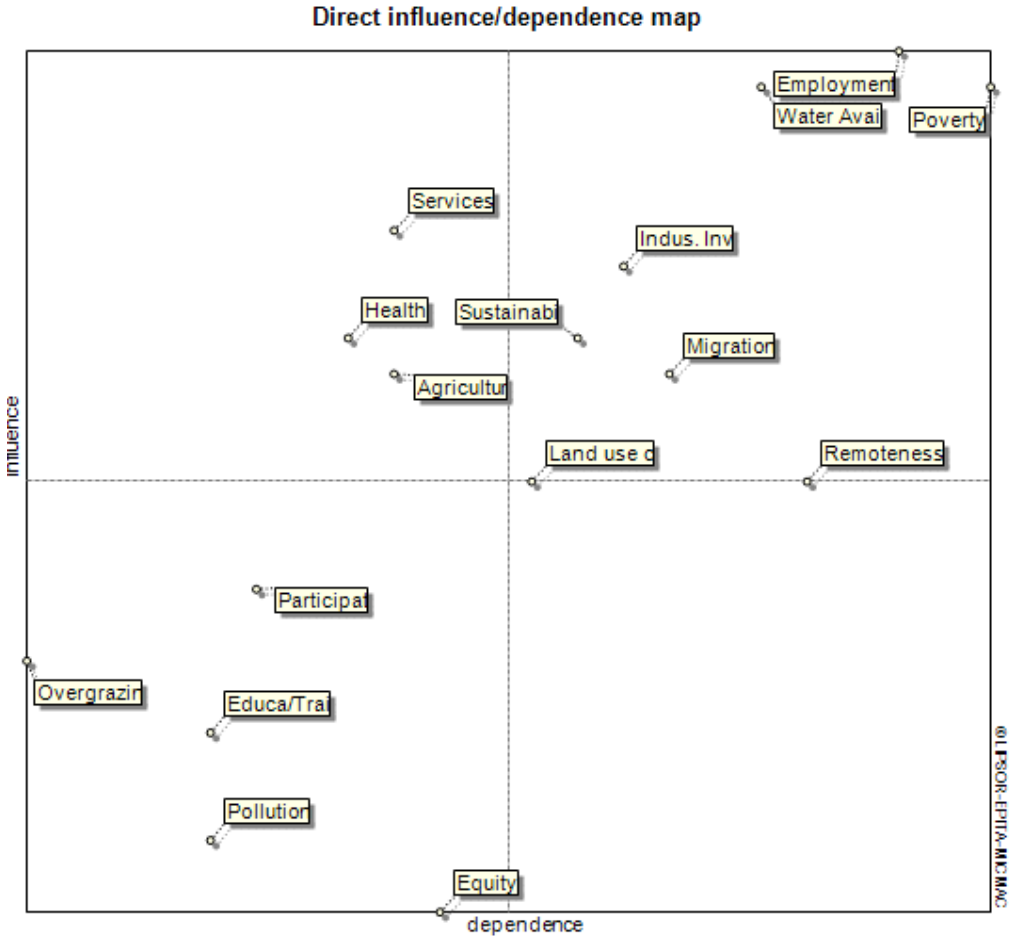
	1 : Employment	2 : Agricultur	3 : Remoteness	4 : Educa/Trai	5 : Indus. Inv	6 : Services	7 : Sustainabi	8 : Participat	9 : Health	10 : Migration	11 : Poverty	12 : Equity	13 : Water Avai	14 : Land use c	15 : Pollution	16 : Overgrazin
1 : Employment	0	3	3	3	3	1	1	1	2	3	3	3	2	1	0	1
2 : Agricultur	3	0	3	0	1	1	1	0	0	2	3	1	3	2	0	1
3 : Remoteness	2	0	0	1	2	3	2	1	2	2	2	1	0	0	0	0
4 : Educa/Trai	3	0	0	0	1	0	0	1	0	1	2	0	1	2	0	0
5 : Indus. Inv	3	2	3	2	0	2	1	0	2	2	2	0	2	2	1	0
6 : Services	3	1	3	2	3	0	2	1	2	2	2	3	0	1	0	0
7 : Sustainabi	1	2	3	1	2	0	0	1	0	2	1	2	3	2	1	1
8 : Participat	1	0	2	0	0	0	2	0	0	1	1	3	0	2	2	1
9 : Health	1	1	2	2	1	3	1	1	0	1	2	1	2	1	3	0
10 : Migration	3	0	2	0	2	2	1	1	0	0	3	1	3	1	1	1
11 : Poverty	3	2	3	1	2	2	1	1	3	3	0	1	3	1	2	1
12 : Equity	1	0	0	1	1	0	0	1	0	0	2	0	0	0	0	0
13 : Water Avai	2	3	0	0	1	3	3	0	2	3	3	1	0	3	2	3
14 : Land use c	0	2	2	0	3	0	2	2	0	1	2	0	3	0	1	0
15 : Pollution	0	0	0	0	0	0	2	2	3	0	1	0	0	0	0	0
16 : Overgrazin	2	1	0	0	0	0	2	1	0	0	1	1	3	2	0	0

II-MATRIX OF POTENTIAL DIRECT INFLUENCES (MPDI)

The Matrix of Potential Direct Influences (MPDI) represents the present and potential influences and dependences between the variables. It complements the MDI by also considering the foreseeable future relations.

	1 : Employment	2 : Agricultur	3 : Remoteness	4 : Educa/Trai	5 : Indus. Inv	6 : Services	7 : Sustainabi	8 : Participat	9 : Health	10 : Migration	11 : Poverty	12 : Equity	13 : Water Avai	14 : Land use c	15 : Pollution	16 : Overgrazin
1 : Employment	0	3	3	3	3	1	1	1	2	3	3	3	2	1	0	1
2 : Agricultur	3	0	3	0	1	1	1	0	0	2	3	1	3	2	0	1
3 : Remoteness	2	0	0	1	2	3	2	1	2	2	2	1	0	0	0	0
4 : Educa/Trai	3	0	0	0	1	0	0	1	0	1	2	0	1	2	0	0
5 : Indus. Inv	3	2	3	2	0	2	1	0	2	2	2	0	2	2	1	0
6 : Services	3	1	3	2	3	0	2	1	2	2	2	3	0	1	0	0
7 : Sustainabi	1	2	3	1	2	0	0	1	0	2	1	2	3	2	1	1
8 : Participat	1	0	2	0	0	0	2	0	0	1	1	3	0	2	2	1
9 : Health	1	1	2	2	1	3	1	1	0	1	2	1	2	1	3	0
10 : Migration	3	0	2	0	2	2	1	1	0	0	3	1	3	1	1	1
11 : Poverty	3	2	3	1	2	2	1	1	3	3	0	1	3	1	2	1
12 : Equity	1	0	0	1	1	0	0	1	0	0	2	0	0	0	0	0
13 : Water Avai	2	3	0	0	1	3	3	0	2	3	3	1	0	3	2	3
14 : Land use c	0	2	2	0	3	0	2	2	0	1	2	0	3	0	1	0
15 : Pollution	0	0	0	0	0	0	2	2	3	0	1	0	0	0	0	0
16 : Overgrazin	2	1	0	0	0	0	2	1	0	0	1	1	3	2	0	0

Eventually the Direct Influence / Dependence Map DIM was depicted


Direct influence/dependence map
Employment
Water Avai
Poverty
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Overgrazin
Educa/Tra
Pollution
Equity
influence
dependence
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Activity	Date	Location	Direct Beneficiaries	Related Document Available
Establishment of the advisory committee and the Assessment team	March – April 2005	Suez Canal University, Ismailia	Assessment implementation	Photos
User identification and user needs	June, July 2005	El Maghara area	Assessment area inhabitants	photos
Assessment plan and implementation process	June, July 2005	Suez Canal University, Ismailia	Assessment works	Text
Identification of ecosystem goods and services	September, 2005	El Maghara, North Sinai	Local community	Photos
Conditions and trends studies	March, 2006	El Maghara, N Sinai	Local community	Text
Drivers of ecosystem changes	One part was completed by March 2006. Other parts are being concluded	El Maghara, N Sinai	Local community	Photos, GIS and remote sensing documents
Socio economic profile and health survey	April, 2006	El Maghara, N Sinai	Local community	Photos and questionnaires
Visit of experts	April, 2006	El Maghara N Sinai	Local community	
Local knowledge and bridging epistemology	May, 2006	El Maghara N Sinai	Local community	Photos, text and some records
Presentation of results	Running	CEDARE, Cairo	Assessment team	Database
Scenario	Running	Centre for Future Studies, Cairo	Local community	Text
Response	Started		Local community	

Projects Results and Impacts, Some Highlights:

The project has had a good list of accomplishments that include:

1- The provision and for the first time of information about the potential water resources, minerals supply, medicinal plants, soil quality and suitability for agriculture.

2- The impact of mining, gravel and marble activities on biodiversity and environmental setting has become a public issue and national concern***. In this respect, the Egyptian influential newspaper Al Ahram has depicted the situation in the "Environment Page" , published on May 3rd, 2005. The article has promoted lot of interest in the area and sent a general message of concern.***

3- The project has for the first time supplied GIS and remote sensing material for the study area. Some of these images clearly indicate the impacts inflected on the area within the last two or three decades, as a result of industrial activities and other man – made impacts.

4- The project has completed the first ever socio economical studies on a random sample of the study area through a well designed questionnaire. Information extracted from the study are quite useful for further development of the area and for a better understanding of the local community. The project has also investigated the relationship between local knowledge and conservation and biodiversity.

5- The project is currently working on future outlook of the area under study and how such plausible future would unfold, considering the variety of influential factors dominating in the area.

6- The project has made a strong connection between the local community and decision makers at governorate level through the regular meeting and workshops. Such meeting proved very useful as a viable venue for local community to speak out their problems, trying to find the proper solution at decision makers level.

7- The project has produced a set of database in which ERDAS IMAGINE 8.5, ARC GIS 8.2 and PC ARC INFO 3.5 software and partly Surfer 7 and Auto cad software have been using to construct the geographic database for the project area. Several techniques and procedures have been applied to setup the geographic database that include:

IMAGE PROCESSING OF THE SATELLITE DATA.

Digitizing raster, analogue and other ancillary data by using data automation

Converting the digitized data into coverages (Digital layers).

Constructing a grid layer over the area of study.

Input the descriptive and interpreted data into the database dgital layers

Displaying, overlaying, analysis and integrating the produced coverage.

REMOTE SENSING AND GIS METHODS

The present study based on the processed satellite data and field validation as well as

laboratory analyses to construct the geo-environmental geographic database of El-Maghara area.

Traditional (Analogue) maps are difficult to integrate with other data sources, such as satellite images
and to convert the data into digital vector layers. Automatically updating of the database can be done be
more readily integrated with other data sources when new data are input.

8- The project through a variety of resources is supplying all hardware needed for the provision of clean potable water to the local community in El Zawading village in El Maghara. A submerged pump along with a water desalination unit are supplied to produce clean water

Activity	Output	Results / Impact
User identification	Deciding on whom to consider and consult in the study as main stakeholders	Establishing some good relation with major stakeholders
Identification of ecosystem goods and services	To ascertain the value of the ecosystem to stakeholders, to identify trade offs	Better understanding of the value of the ecosystem and the part it plays to stakeholders
Conditions and trends analysis	How the current situation of some of the goods is like and how it compares to the past	A good background on how to improve the situation and maximize the value of goods and services of the ecosystem
Drivers of the ecosystem changes	Discovering what man – made activities have inflected on the environmental setting and ecosystem goods and services. To determine the magnitude of loss the area has paid as a result of negligence and poor management of the natural resources	An attempt is being made to improve the quality of environment through a better governance Public interest in the area and how to improve its environmental conditions after one of the most influential newspaper has illustrated the volume of damage in the area
Communication with decision makers and stakeholders	Better interest in the study area and better understanding of the local community needs and aspirations Regular meetings between community representatives and decision makers	The provision of clean potable water to one of the communities in the area is being performed. The provision of water and electricity services is being expedited by the project Regular meetings between community representatives

		and decision makers is helping in building a better mutual understanding and trust
Health, Socio Economic Profile	Depicting a clear picture of the local community needs, most prevailing health problems and how local community react to environment and environmental issues	Understanding local community needs helped in prioritizing the measures that should be taken to address urgent issues at community level and to provide medical care and help
Scenario Building	The process of scenario building is still under investigation. The output of the study should provide a better planning of the area	The results of the scenario are expected to have some significant impact on the future planning of the area. It also should provide decision makers with a good vision of how the area would develop, considering the influential variable and the actors dominating in the area

Problems Encountered

The project was faced by a number of problems that varied in their impact and repercussions. Most serious problems were those related to communication with some of the decision makers and their reluctance to respond or to provide positive participation.
Security is a very limiting factor in the present study. Because of the recent security turmoil in the study area and the presence of some of terrorists either hiding or on the run in the area . Accessibility to the area was not always that easy. Moreover, local community used to react sometime into a hostile manner to the assessment team. Problems encountered in this area has caused some significant delay in performing some of the pre determined tasks.

Other technical problems were mainly related to the scarcity of data, and the inaccessibility to any information that might be available.

Revised Implementation Plan

Work Plan for Remaining Activities

No.	Activity	Timeline and date of completion	**Expected Outputs**
1	Future Scenarios	November – December 2006	A better vision of how plausible future of the study area would unfold, giving an ample opportunity for sound planning
2-	Training programme for local inhabitants	January - February	Promoting sustainability concepts and the ability of the local community to take advantage of the local natural resources with special reference to medicinal plants
3-	Responses	February – March 2007	Decision makers to grasp information provided through scenarios and other segments of the study. The provision of some services to the local community to help improving the quality of life in the area and to achieve sustainability
4-	Production of draft report	April, 2007	The report should document all the activities of the study
5-	Workshop for professionals	April, 2007	To highlight the main outcome of the assessment and to take into account views and comments on the final report
6-	Production of final report	May – June 2007	The report should sum up all finding of the Assessment