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*International Centre for Science
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International Environment Institute of the
Foundation for International Studies

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**Workshop on Environmental Impact Assessment and
Siting of Industrial Activities through Geographic
Information Systems (G.I.S.)**

2-6 October 1995
Gozo, Malta

Final Report



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ICS
International Centre for Science and High Technology

International Environment Institute of the
Foundation for International Studies

FINAL REPORT

Title: Workshop on Environmental Impact Assessment and Siting of Industrial Activities through Geographic Information Systems (G.I.S.)

Dates: 2-6 October 1995

Venue: Gozo, Malta

Organizers/Directors: Mr. Louis Cassar, Executive Coordinator, International Environment Institute, Foundation for International Studies, University of Malta, Valletta, Malta.

Prof. Enrico Feoli, ICS-UNIDO, Trieste, Italy.

PURPOSE

The Workshop was organized with the aim of improving the capacity of the management of the industry/environment interface in developing countries of the Mediterranean region by introducing the geographical information system (G.I.S.) technology and remote sensing techniques. In particular, the Workshop was addressed to face problems related to environmental impact assessment (E.I.A.) of industrial and/or related activities in Mediterranean developing countries (See Annex I).

TOPICS AND PROGRAMME

The Workshop was opened by Prof. Ugo Leone, ICS Project Leader, who outlined the aims of ICS and gave general information on the relevance of the Workshop topic.

Opening speeches were delivered by Prof. Ugo Leone and Prof. Salvino Busuttil, Director-general of the Foundation for International Studies. The Workshop was inaugurated by the Hon. Minister for Gozo, Mr. Anton Tabone. Following the official inauguration session, the Workshop was addressed by Prof. Enrico Feoli of ICS and Mr. Louis F. Cassar of the International Environment Institute, both of whom welcomed the participants on behalf of their respective institutions, and then brief the participants about the expected outcome of the Workshop.

The Workshop started with the presentation of various country papers concerning the situation of G.I.S. applications for E.I.A. and siting of industrial activities.

Some of the participants presented the state of the art in their country (See Annex II):

- Mr. G. Berlenzi: Priority Actions Programme in Split, Croatia.
- Mr. F. Fabrizi, ENEA, Rome, Italy: Applications of G.I.S. and related Activities in ENEA.
- Mr. N. Taspinar, Izmir, Turkey: An Application to Izmir Bay and Cesme Peninsula.
- Mr. R. M. Sansur, West Bank: Environment and Development Prospects in the West Bank and Gaza Strip.
- Mr. A. Touzani, Rabat, Morocco: Study of the Pollution of Sea Coast between Kenitra and Safi Using the Satellite Images.
- Ms. A. Attard Montalto, Valletta, Malta: Presentation of the Euro-Mediterranean Centre on Insular Coastal Dynamics.
- Mr. M. M. Sarbaji, Sfax, Tunisia: The Situation of the Application of G.I.S. for Industrial Environmental Problems in Tunisia.
- Ms. S. Canna-Michaelidou, Nicosia, Cyprus: The Environmental Impact Studies: the Cyprus Experience.
- Mr. K. A. Moussa, Alexandria, Egypt: Development and Environment in Egypt.

Mr. Mario Galea made an introduction to G.I.S. After that a lecture programme by Prof. A. Fabbri and Dr. A. Patrono on Applications of G.I.S. both theory and case studies were given following the enclosed programme (See Annex III).

They introduced the use of G.I.S for E.I.A. and decision support systems for siting industries in the coastal areas. Furthermore, they also showed examples of measuring coastal changes. The principle of multi-objective decision support for environmental management was illustrated by examples and was the basis of the discussions among the participants. The programme finished with a lecture by Prof. E. Feoli on the use public domain software for G.I.S. and image processing systems and with a description of real case studies on E.I.A. in the coastal area of Trieste (paper mill industry settlement).

The discussions during the Workshop were extremely thorough, open, even provocative. Many delicate points were dealt with at length. Unrealistic expectations from the technology were debated and discouraged. It was stressed that technology should be commensurate to the needs and the financial-technological capabilities of the country where technology is to be transferred.

PARTICIPANTS

Thirteen experts coming from Mediterranean countries attended the Workshop.

The final list of participants is enclosed (See Annex IV).

CONCLUSIONS AND RECOMMENDATIONS

The participants have expressed the interest on such kind of initiatives and suggested to activate a process of training in G.I.S. at different levels.

It has become clear that G.I.S. and E.I.A. are still far from being standard methodologies or conventional tools. It was envisaged that in future it will be possible to have a smoother transition between G.I.S., RS, E.I.A. and CZM and was recommended that:

1. basic G.I.S. workshops should be organized initially, consequently to be followed by topic-specific workshops covering: RS, E.I.A. and Coastal Zone Management;
2. more practice-oriented workshops should be specially organized for managers;
3. more workshops should be prepared in cooperation with ICS, ITC and UNEP at national level with the specific developing country directed towards scientists or decision makers and planners;
4. workshops similar to the one organized at regional level should be repeated for promoting the diffusion of knowledge among different states and the creation of a network to be used for information and manpower exchange.

FUNDING

The total budget for the Workshop amounted to a total of US\$ 35,638 as of the enclosed financial statement (See Annex V).

Annex I



*International Centre for Science
and High Technology*

**International Environment Institute of the
Foundation for International Studies**

AIDE-MEMOIRE

Workshop on Environmental Impact Assessment and Siting of Industrial Activities through Geographic Information Systems

*Gozo, Malta
2-6 October, 1995*

*International Centre for Science and High Technology (I.C.S.H.T.)
Via Grignone 9, P.O. Box 586, 34114 Trieste, Italy
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University of Malta, Old University Building,
St. Paul Street, VLT 07 Valletta, Malta.
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BACKGROUND AND JUSTIFICATION

The progress of science and technology, which includes the availability of highly sophisticated systems for data acquisition (based on air borne and space borne remote sensing) together with the widespread use of personal computers and powerful workstations, has made possible an integrated study of the physical, chemical, and biological processes of the air, land and water systems of the planet.

Field observations and other direct measurements at the earth's surface, however, must be integrated with the results of careful photo interpretations and be of guidance in subsequent image processing for image enhancement and information extraction.

The complementary nature of remotely sensed data and of ancillary data from maps and ground verification is the key to computer modelling for environmental impact assessment using geographic information systems (G.I.S.).

Industrial Development in Mediterranean areas concerns mainly the coastal zone and involves a lot of infrastructure buildings. It affects the landscape in a heavy way and can create contrast between different land uses.

Mapping and modelling should be seen as inseparable tasks for information and knowledge representation. Relational database, computer aided design (CAD) techniques, image processing systems (IPS) and geographic information systems (G.I.S.) and decision support systems (DSS) have to be interfaced in a unique system. This system will constitute a necessary scientific and technological interface between the industrial development and the environment. It provides the possibility to compare different scenarios of industrial development and thus the possibility to investigate on different alternatives as the techniques of environmental impact assessment suggested.

AIMS OF THE WORKSHOP

The main objective of the workshop is to improve the capacity of the management of the industry/environment interface in developing countries of the Mediterranean region by introducing the geographical information system technology and remote sensing techniques. In particular, the workshop will be addressed to face problems related to environmental impact assessment of industrial and/or related activities in Mediterranean developing countries.

STRUCTURE OF THE WORKSHOP

This workshop is intended as a training workshop, and it is planned for dissemination of information about the use of public domain software in G.I.S. and remote sensing data processing.

The Workshop will be organized as a round-table (with a high training component) in which the participants will present their own experience in the use of G.I.S. and remote sensing. Their experience will be discussed and compared with the experience of G.I.S. applications of the invited demonstrators who will show how to integrate G.I.S. and remote sensing techniques on the basis of selected cases studies.

PARTICIPATION

The workshop will bring together for the period of one week experts, technologists and researchers in contact with the industry. Participation is by invitation. A maximum of 30 participants will be admitted to the Workshop coming from Mediterranean countries. Participants are asked to prepare in advance a short report on the situation of the application of G.I.S. for industrial environmental problems in their home country. This report will be presented and discussed during the Workshop.

EXPECTED OUTPUTS

The Workshop will be the occasion to reinforce and strengthen the network already established by ICS with the Mediterranean countries to deal with problems related to coastal zone management. The output of the Workshop will be the collection of presentations and discussions made by the participants.

PROGRAMME

The workshop will deal with a general evaluation methodology with a wide range of potential applications in the studies of EIA, basically oriented to the ecological protection and conservation of the landscape. The innovative approach of this workshop lays in the development of three **connected stages in EIA:**

- 1) the integration of ecological factors with spatially-distributed data;
- 2) the use of spatial data analysis techniques to extract environmental indicators;
- 3) the formulation of multi-objective/multi-criteria decision processes.

The key point of the method used is to develop environmental impact evaluation techniques. The magnitude of problem is partly lessened by introducing techniques, such as remote sensing, RS, and geographic information systems, G.I.S. which provide spatial-temporal coverage and faster ways to process the data. The implementation of existing methodologies for mapping environmental variables and for automated

classification of the land use allows to combine field observations with existing data on maps and with the results of image processing.

The G.I.S. represents in this workshop a critical tool for supporting numerical modelling of spatially-distributed ecosystem processes.

Software tools

A G.I.S., ILWIS (ITC, 1993) combined with a spreadsheet, EXCEL (Microsoft, 1990) and a decision support system (DEFINITE, 1994) will be mainly used to provide an effective tool for partitioning space for any kind of spatial model calculations, for storing information and for displaying the results of the analyses. However software of wide diffusion such as MapInfo, GRASS will be also presented.

Spatial analysis and modelling is carried out also with the help of some special-purpose software, external to the G.I.S. and to the spreadsheet, which was programmed ad-hoc. Some FORTRAN programmes were written to communicate with the G.I.S. to analyze and combine the data layers stored in the G.I.S. (satellite data, digitized topographic data, etc.) and the data from field observations with the data obtained from published sources.

DOCUMENTATION

The documents available for the meeting will be:

- 1) Aide-mémoire of the workshop.
- 2) Workshop programme and list of participants.
- 3) Country papers prepared by the participants which will be discussed during the meeting.

LANGUAGE

The workshop will be conducted in English and no translation facilities will be available. It is expected that the participants have a good command of English.

TIME AND VENUE

The workshop will be held at the Ta'Cenc Hotel, Gozo, Malta from 2 to 6 October 1995.

FINANCIAL ADMINISTRATIVE ARRANGEMENTS FOR UNIDO-ICS FINANCED PARTICIPANTS

For those who will be invited by UNIDO-ICS to participate in the workshop, round-trip air-economy transportation from the airport of departure will be arranged and prepaid tickets issued where necessary.

Room and board at the workshop venue plus a daily allowance and terminal expenses will be provided upon arrival to Gozo. Reservation will be made for all participants at the Hotel Taz' Cenc Hotel, Gozo, Tel.: 00356-556819 Fax: 00356-558199.

The participants will be required to bear the following costs:

All expenses in their home country incidental to travel abroad, including expenditures for passport, visa, and any other miscellaneous items. UNIDO-ICS will not assume responsibility for any of the following costs which may be incurred by the participant while attending the meeting:

- (1) compensation for salary or related allowances during the period of the workshop;
- (2) any costs incurred with respect to insurance, medical bills and hospitalization fees;
- (3) compensation in the event of death, disability or illness;
- (4) loss or damage to personal property of participants while attending the workshop.

VISA ARRANGEMENTS

Participants are requested to arrange for their visa as early as possible at the Maltese Embassy in their home country. In case of difficulties, please advise the contact person mentioned below.

CONTACT PERSON

For additional information, please contact Mr. L. Cassar. Further details about the workshop and travel instructions will be provided upon request.

Mr. L. Cassar
Executive Coordinator
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Annex II



*International Centre for Science
and High Technology*

International Environment Institute of the
Foundation for International Studies

***Workshop on Environmental Impact Assessment and
Siting of Industrial Activities through Geographic
Information Systems (G.I.S.)***

2-6 October 1995
Gozo, Malta

Programme



MONDAY, 2 OCTOBER 1995

- 09:00 - 10:00 **Registration of the participants**
- 10:00 - 10:30 **Opening Ceremony**
- Welcome to the participants by:
 - the Representative of the Government of Malta
 - the Director General of the International Environment Institute of the Foundation for International Studies, Prof. Salvino Busuttill
 - the ICS Project Leader, Prof. Ugo Leone
- 10:30 - 10:45 *Coffee Break*
- 10:45 - 12:30 **Presentations by the participants**
- 12:30 - 14:00 *Lunch Break*
- 14:00 - 18:00 **Continuation of presentations by the participants**

TUESDAY, 3 OCTOBER 1995

- 09:00 - 10:30 **Introductory session to G.I.S.: Mr. Mario Galea, International Environment Institute of the Foundation for International Studies, Malta**
- 10:30 - 10:45 *Coffee Break*
- 10:45 - 12:30 **Demonstrations: Prof. A. Fabbri and Dr. A. Patrono, ITC, The Netherlands**
- 12:30 - 14:00 *Lunch Break*
- 14:00 - 15:30 **Continuation of Demonstrations: Prof. A. Fabbri and Dr. A. Patrono, ITC, The Netherlands**
- 15:30 - 15:45 *Coffee Break*
- 15:45 - 17:30 **Discussions**

WEDNESDAY, 4 OCTOBER 1995

- 09:00 - 10:30 **Continuation of Demonstrations: Prof. A. Fabbri and Dr. A. Patrono, ITC, The Netherlands**
- 10:30 - 10:45 *Coffee Break*

- 10:45 - 12:30 **Continuation of Demonstrations: Prof. A. Fabbri and Dr. A. Patrono, ITC, The Netherlands**
- 12:30 - 14:00 *Lunch Break*
- 14:00 - 15:30 **Continuation of Demonstrations: Prof. A. Fabbri and Dr. A. Patrono, ITC, The Netherlands**
- 15:30 - 15:45 *Coffee Break*
- 15:45 - 17:30 **Discussions**

THURSDAY, 5 OCTOBER 1995

- 09:00 - 10:30 **Continuation of Demonstrations: Prof. A. Fabbri and Dr. A. Patrono, ITC, The Netherlands**
- 10:30 - 10:45 *Coffee Break*
- 10:45 - 12:30 **Continuation of Demonstrations: Prof. A. Fabbri and Dr. A. Patrono, ITC, The Netherlands**
- 12:30 - 14:00 *Lunch Break*
- 14:00 - 15:30 **Continuation of Demonstrations: Prof. A. Fabbri and Dr. A. Patrono, ITC, The Netherlands**
- 15:30 - 15:45 *Coffee Break*
- 15:45 - 17:30 **Discussions**

FRIDAY, 6 OCTOBER 1995

- 09:00 - 10:45 **Continuation of Demonstrations: Prof. A. Fabbri and Dr. A. Patrono, ITC, The Netherlands**
- 10:45 - 11:00 *Coffee Break*
- 11:00 - 11:30 **Closure of the meeting:**
- the Director General of the International Environment Institute of the Foundation for International Studies, Prof. Salvino Busuttill
- the ICS Project Leader, Prof. Ugo Leone
- the Minister for the Environment of Malta
- 11:30 - 12:30 **Demonstrations: Prof. E. Feoli**
- 12:30 - 14:00 *Lunch Break*

14:00 - 15:30

Continuation Demonstrations: Prof. E. Feoli

15:30 - 15:45

Coffee Break

15:45 - 18:00

Final discussions

Conclusions and recommendations

Lecture Program: Fabbri & Patrono

Tuesday, October 3, 1995

10:45-12:30	15m	Introduction [AGF]
	30m	Theory [AGF+AP]
14:00-15:30	30m	Case Study [AP]
	30m	DSS Introduction [AGF]
	30m	CIS & ILWIS [AP]
	60m	EIA hands-on (ILWIS)
15:45-17:30	45m	EIA hands-on (ILWIS)
	60m	EIA hands-on (ILWIS)
evening	optional	EIA hands-on (ILWIS)

Wednesday, October 4, 1995

09:00-10:30	60m	EIA hands-on (ILWIS)
	30m	EIA hands-on (EXCEL tutorial)
10:45-12:30	45m	EIA hands-on (EXCEL)
	60m	EIA hands-on (EXCEL)
14:00-15:30	30m	DEFINITE introduction [AGF]
	60m	EIA hands-on (DSS)
15:45-17:30	45m	EIA hands-on (DSS)
	60m	EIA hands-on (DSS)
evening	optional	EIA hands-on (DSS)

Thursday, October 5, 1995

9:00-10:30	30m	Coastal Change Study
		Introduction [AGF]
10:45-12:30	60m	Coastal Change hands-on
	45m	Coastal Change hands-on
	60m	Coastal Change hands-on
14:00-15:45	45m	Coastal Change hands-on
	60m	Coastal Change hands-on
evening	optional	Coastal Change hands-on

Friday, October 6, 1995

9:00-10:45	45m	Industrial Siting Demo [AP]
	60m	Industrial Siting Demo [AP]

An Introduction to

Geographic Information Systems

Mario Galea

Lecture presented at Ta' Cenc Hotel, Gozo - October 1995

Introduction

The concepts for storing and organising geographic data on a computer system was introduced more than 30 years ago. However it is only during the past 12 years that Geographic Information Systems have made rapid advancements both in the technological development and application growth. As computer processing power continues to drop in costs more and more people are becoming aware of new possibilities to exploit their data to produce better, smarter solutions. GIS is one of those application tools that has a unique way of organising and presenting data to the user. People can observe or track specific patterns in their data and understand their spatial relationships. Such an understanding is the basis for more sensitive and intelligent decision making. In today's world, where all of us are becoming aware of the environmental issues, it is becoming more important to study the physical variables and the consequential effects when these are altered. In this respect GIS has been used in several applications such as land planning, natural resource management, environmental assessment and planning, tract mapping and ecological research. Apart from these applications GIS has also found a strong market in facilities management such as electrical and water utilities, municipalities, emergency vehicle dispatching, crime analysis, market research and several similar applications.

Recent studies has shown that 85% of the data collected by organisations every year have a geographical nature or requires a geographical reference. The most common example is an address which is a geographical reference of a distinct place on earth. Other examples are postal codes, specific landmark and boundaries, co-ordinates of sampling points and so on. It is clear therefore that most of our everyday decisions are influenced by a geographical element. The scope of GIS is help people visualise this element thus enabling better understanding

What is a Geographic Information System?

Due to the fact that for many years GIS remained as an in-house application of universities and research organisations before being offered to the public as a commercial product, it is not uncommon to find different definitions of GIS. These generally range between two extremes from a purely theoretical definition of a special type of computer-based information system to a more practical approach whereby the application is looked upon as a tool that perform a specific function. A general definition which falls somewhat halfway between the two extremes is

"A GIS is an integral collection of databases which directly reference or are related to geographical data along with the computer hardware and software to support it and the personnel which designs, organise, update and manipulate the data within the information system"

This definition establishes the fact that a GIS is an information system. One would promptly ask "So what's different with a GIS than other information systems?" In fact a GIS application is an information system with the additional capability to perform spatial operations.

Spatial Operations

Spatial operations, or geographical analysis, means that the data is manipulated in terms of a geographical reference. For example suppose we have two tables enlisting the population of countries and another table with languages spoken in each country. If we want to know how many people speak English then it only takes the database application to select those countries which have the value English in the Language field of the

LANGUAGE table then picks up the population values from the other table for the chosen countries and adds the values

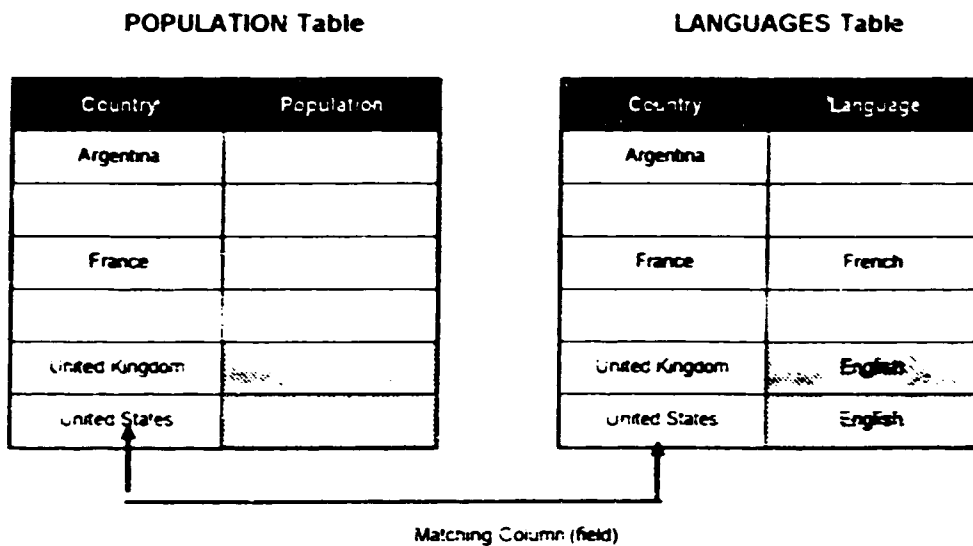


Fig 1 An example of aspatial operation

Such an operation can be performed by any database management system since the linkage between the two tables was performed on the by matching a particular field within records of one table to another exactly similar field within records of another table. This is called an aspatial query and can be handled by any tabular Relational Database Management System. A GIS however uses a geographical reference to match records within tables. Apart from the tabular database system a GIS has also a spatial database. For example we would like to find the percentage of urban land in the region shown below.

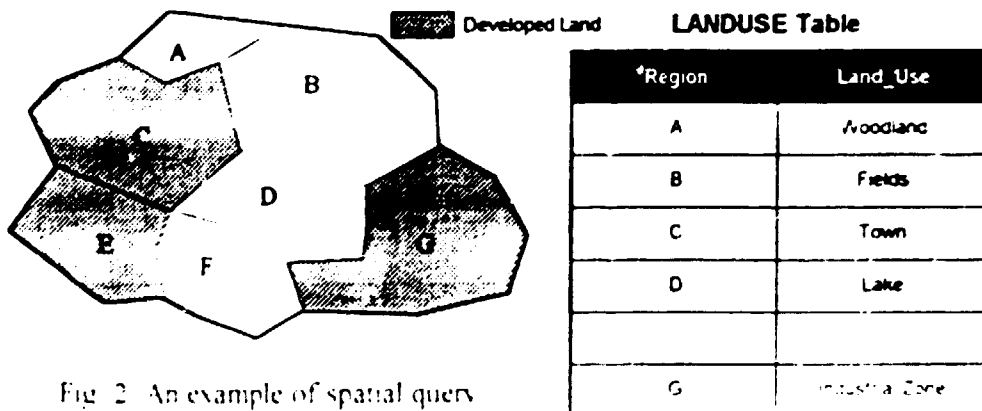


Fig 2 An example of spatial query

The first step is to look into the LANDUSE Table and select those regions which satisfy the criteria (in this case C, E and G). Next the spatial database is brought up which contains the boundaries of all the regions and the area computed from the co-ordinates and the knowledge of the Earth's surface. The boundary co-ordinates can be of any type such as longitude and latitude degrees, as long as the GIS knows the relationship between the chosen co-ordinate system and the Earth's surface.

The above example shows that like any other information system a GIS organises databases in tables with an additional form of table to keep record of the geographical reference that links the other tables. Spatial operations are performed using these tables and its inherent knowledge of the Earth surface.

Hierarchical Matching

The previous example involved simple operations since the selection exactly matched an entire region. It could be argued that if the areas of the regions were included in the LAND_USE table then it would not be necessary to use a GIS. True, but this was only an example of exact matching. Many times data is sampled in more detail and therefore more operations are required to arrive at a selection.

To continue on the above example, suppose we need to know the average number of people living per household in region C. We do have a POPULATION table for all regions, but the number of households is available as land-parcel boundaries shown in Fig. 3. The first step is to identify which parcels fall within the boundary of Region C. This implies checking the parcels co-ordinated and see if they fit entirely within the co-ordinates of the larger region. The rest of the operation is easy since the population is available in tabular form. This operation is called hierarchical matching since the resulting region is the aggregate of smaller areas, i.e. region C was built up from all the parcel boundaries that fit into it.

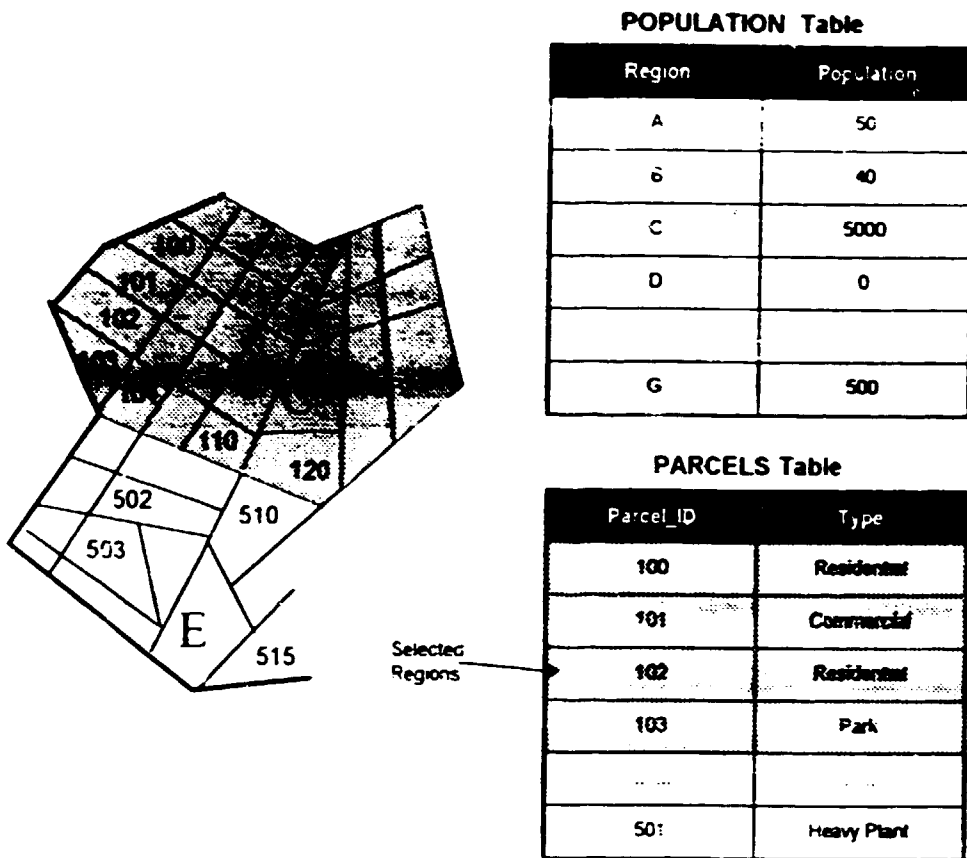


Fig 3 Hierarchical Matching

An analogy to exact and Hierarchical matching is a jigsaw puzzle. When a single piece exactly matches a missing shape in the puzzle we say there was an exact fit. On the other hand an unfilled shape might require more than one piece to be filled. This example is demonstrated in Fig.

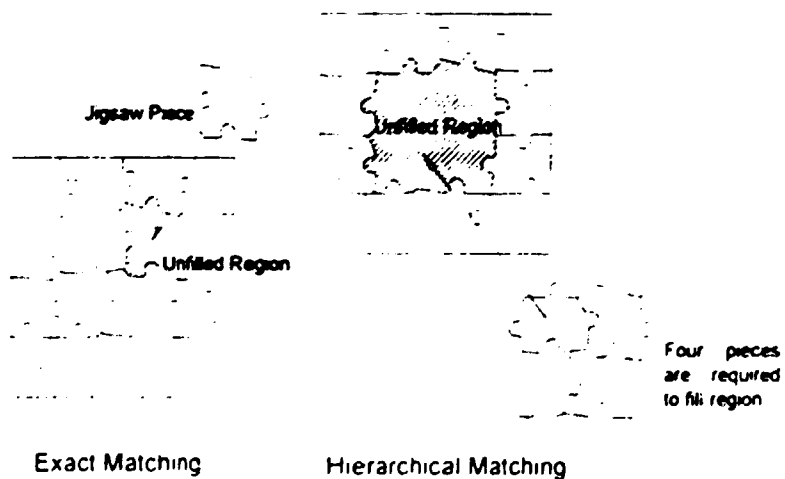


Fig 4 Analogy of exact and hierarchical matching

Fuzzy matching

A GIS is able to perform more complex spatial analyses. Perhaps the most complex and useful is that of joining two or more spatial tables, based on some criteria, to form another table. Many times the boundaries defined by one table do not match larger ones. In this case a GIS will overlay the boundary layers and produce a new layer which is a characterisation of the others. This process often occur in environmental data since datasets are collected at different frequencies and sampling points. Fig 5 demonstrates fuzzy matching - here we want to know which land parcels are likely to be most badly hit during a flood. The data available is the land parcel boundaries and the flood zones scaled at different danger levels.

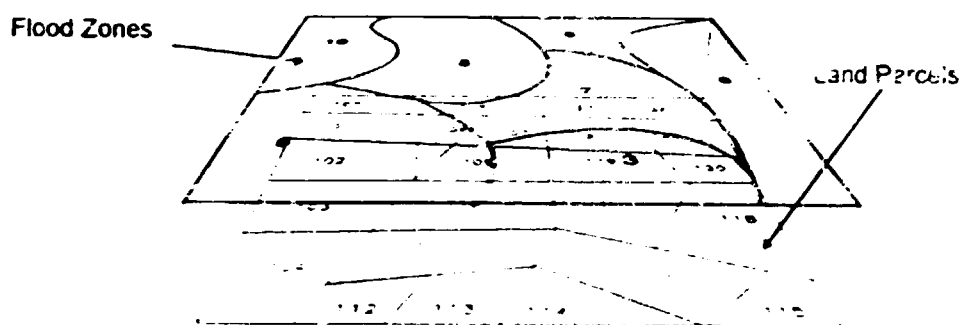


Fig Layering of non-matching boundaries

Summary

The widespread of information technology has brought data to the desktop in quantities far more than ever before. Even though our task are being made easier by the high processing speeds of today's computers the huge amount of data stored in them require tools that are smarter than common database management systems. GIS is a step towards intelligent analysis and visualisation of data bringing a higher level of understanding.

GIS can be described as a tool with the ability to integrate different data sets through a common feature that is their geographical location.

This makes GIS a powerful tool for people who have management roles. They can analyse the data visually thus entering into new dimensions such as observing patterns and trends. Location of resources can be quickly identified as well as their distribution.

GIS plays a vital role in many situations where decisions have to be taken quickly and effectively such as in cases of oil spill emergency response, dispatching fire trucks during forest fires and organising salvage teams during floods. In less catastrophic situations GIS is used to manage resources, facilities and utilities, decision making, planning, zoning, environmental impact assessments and environmental research.

GIS Basics

In this section we will see how a GIS extends the concepts of a tabular Database Management System by incorporating a digital map database. In a GIS there are two types of map information:

1. Geographical information specifying the location, size and shape of an object as well as its relationship to other objects
2. A description of the object

Geographical information is recorded by map features that describe the object. Like tabular databases these require a set of data types to represent the features such as roads, district boundaries, houses etc. The three most important data types are:

Point This describes a feature whose area is negligible, such as electrical poles, boreholes and manholes. It is also used to mark locations that have no area, for example elevation points and bathymetric values. Because a point is a featureless entity it is often displayed as a icon or symbol depicting the feature it represents.

Line This is a set of sequential co-ordinates which are joined together to describe an object that has a linear feature, but too narrow to have an area. Examples of lines are roads, streams and rail tracks. The term line is very misleading since it gives the impression that the feature is one straight line. Effectively a line is made from a number of linear *segments* attached to each other. Instead of line, the terms *arc* or *open polyline* are more frequently used.

A line can also be used to describe features which have no width such as contour lines.

Area These describe closed objects that cover a given area. Examples of area features are district boundaries, lakes, and

countries

Fig 6. shows how points, lines and areas are used to represent map features

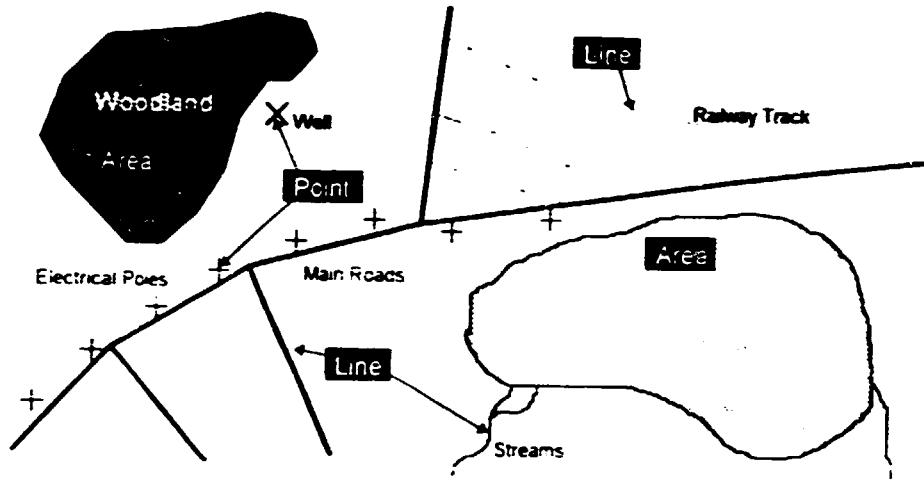


Fig 6 A map made from points lines and area datatypes

Sometimes these data types are referred to as *vector primitives* because they can be used to build up more complex objects. The term vector refers to the manner by which the computer stores and displays the data types.

Storing Data Types

Apart from describing spatial objects by points lines and polygons, we also need to specify where these are located. This is done by mapping the Earth surface onto a flat Cartesian (x,y) co-ordinate system. Each point is recorded as a single x,y location. Polylines are recorded as a series of ordered x,y co-ordinates and areas are defined by an ordered set of co-ordinates which define their boundary. Figure 7 illustrates how map objects are referenced to ground locations

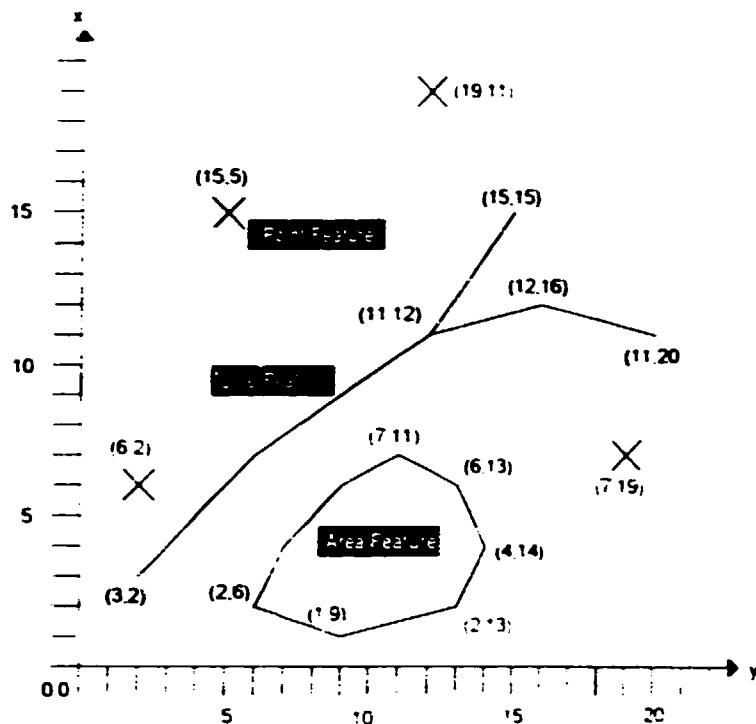
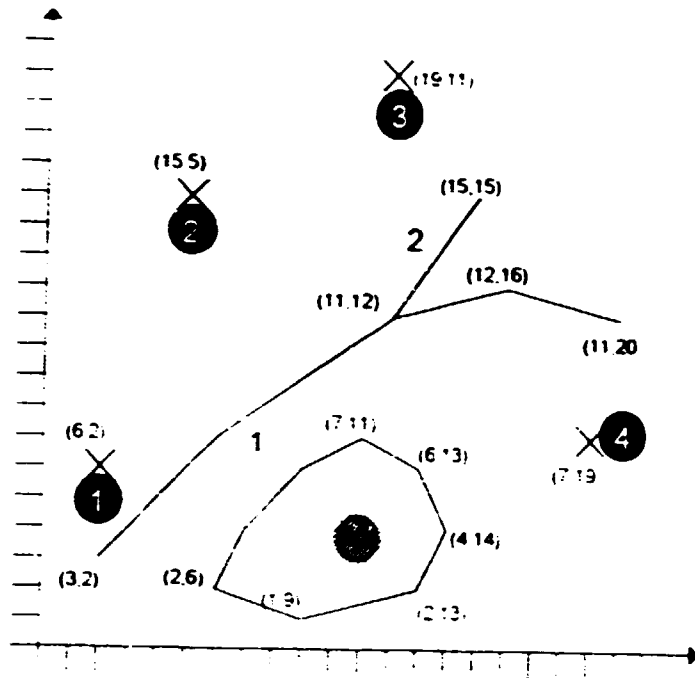


Fig 7 Map Objects represented as co-ordinate pairs

Unfortunately the Cartesian co-ordinate system is only suitable for objects that require uniform units such as metres. When geographical features are presented on a map they have to be transformed from a spherical globe onto a flat map. This transformation is a mathematical procedure known as a *projection*. The only problem with projection is that they introduce distortions such as stretches and shifts. Because of this different projections are used for different parts of the world, to minimise the distortions as much as possible. The most popular projections are Universal Transverse Mercator (UTM), Lambert Conic Conformal and Albert Conic Equal-Area. Longitude and Latitude are not a co-ordinate system because they measure features in degrees from the Earth's centre, rather at the Earth's surface.

The GIS organises the co-ordinate in a tabular database by first assigning each map feature a unique identification which is stored in one column of the table. Another two fields are used to store the x and y co-ordinates. In the case of polylines and areas the field is extended to contain all the x,y pairs. Figure 8 shows how figure 7 is stored in a tabular database. Note that in the AREA table, the first and last point are the same since it is closed



Points Table

Point_ID	X Y
1	6 2
2	15 5
3	19 11
4	7 19

Line Table

Line_ID	Type
1	3,2,11,12 12,16,11,20
2	11,12,15,15

Area Table

Area_ID	Type
1	2,6,7,11, 6,13,4,14, 2,13,1,9,2,6

Fig 8 Tabular database of map features

PREFACE

This document is an extract from the course notes of the GIS lectures presented to the Environmental Planning M Sc Course, organised by the International Environmental Institute of the Foundation for International Studies, University of Malta

Those who wish to obtain more information on the course or would like a full copy of this document please contact Mario Galea at the above Institute

Annex III



*International Centre for Science
and High Technology*

International Environment Institute of the
Foundation for International Studies

*Workshop on Environmental Impact Assessment and
Siting of Industrial Activities through Geographic
Information Systems (G.I.S.)*

2-6 October 1995
Gozo, Malta

**Presentations by the
participants**



GRASS

(Geographical Resources Analysis Support System)

is:

- a raster and a vector GIS (Geographical Information System);
- an Image Processing System (IPS).

GRASS was developed by the USACERL (U. S. Army Construction Engineering Research Laboratory, Champaign, IL) and is updated with the contribution from other agencies or individual users. For this reason GRASS is to be considered an open software.

GRASS is coordinated by OGI (Office of GRASS Integration) which provides:

- General Information;
- 2 E-mail lists;
- Annual GRASS User Meetings;
- the GRASSCLIPPINGS Newsletter.

GRASS

-is written in C Language;

-is a software development environment for C programmers.

GRASS interfaces with Unix shells (C-shell, Bourne-shell, Korn-shell), e.g. through X-Windows.

The shells provide programming flow control, user input and output, and use other Unix programs as subroutines.

GRASS programs can be used with Unix programs like "awk", "sed" and "sort".

Distr.
GENERAL

UNCTAD/SCDC/SEU/8
21 April 1995

ENGLISH ONLY

**ENVIRONMENT AND DEVELOPMENT PROSPECTS IN
THE WEST BANK AND GAZA STRIP**

Study prepared by Dr. Ramzi M. Sansur, UNCTAD consultant*

* This study constitutes the contribution of Dr. Ramzi M. Sansur (Bir-Zeit University, West Bank) to the intersectoral project of the UNCTAD secretariat on "Prospects for sustained development of the Palestinian economy in the West Bank and Gaza Strip". The opinions expressed in this study are those of the author and do not necessarily reflect those of the UNCTAD secretariat of the United Nations. The designations employed and the presentation of the material in this document do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, city or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries.

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State of the Environment in Palestine

Ramzi Sansur
CEOHS - Birzeit University
Palestine

The geographical area of Palestine (now Israel and Palestine) lies in the eastern part of the Mediterranean basin bordered North by Lebanon and Syria, East by Jordan, South by Egypt and West by the Mediterranean Sea.

The West Bank and Gaza strip which are under Israeli military occupation constitute what is expected to be the State of Palestine.

The two regions are approximately 6,000 Km² in area. The mountain range lies mostly in the West Bank. Military occupation suppressive measures led to a serious of deterioration in environmental quality over the past 28 years. Examples are overexploitation, by Israel, of Palestinian limit fresh water resources through overpumping with more than 80% of the water being diverted to Israelis. The building of Jewish settlement without environmental planning or impact assessment has caused massive damage to the fragile environment, its fauna and flora.

The lack of adequate environmental awareness, as a result of the struggle for survival, has aggravated the environmental situation and further led to the deterioration in the quality of life evidenced by poor urban and rural planning, improper waste disposal and overexploitation of mineral resources, mainly to supply Israeli massive building endeavours.

The use of GIS is in its infancy. Its limitations are a result of the lack of data and poor training in GIS techniques. With time the situation is expected to improve as there is an interest from the Palestinian Government (PNA) through the establishment of a Geographic Information Center and endeavours by some NGOs and Palestinian Universities.

Currently very few projects, if any, pass through an EIA prior to final approval. The interest in environmental affairs among some Palestinians is expected to have a positive effect and turn the tables around, in the long term, in favour of the environment.

**Study of the Pollution of Sea Coast
between
Kenitra and Safi
Using the Sattelite Images**

The development of industrialisation town planning and the energetic loss are primary factors for natural damage. Therefore, it is time to reduce or to stop these problems from growing.

The largest area of Casablanca located between Kenitra and Safi, in which 80% of Moroccan Industry is present (Chemical Industry, Phosphate Industry, Oil Industry, Skin industry and others) can be seen as the main location of pollution due to industry and human activities.

The National Center of Coordination and Planification of Scientific and Technical Research (CNR), in collaboration with the Ministry of Environment and other organisms, is planning to study the pollution of sea coast between Kenitra and Safi.

Thus, first there will be an accurate evaluation of damage caused by throwing industrial waste to the ocean. Second will be done a complete inventory of harmful effects and their origin. Finally will be prepared a program of monitoring the evolution of pollution and limit the influence of human activities on the quality of Moroccan coast.

A good way to study such problem is to use remote sensing completed by some investigations in situs. By appropriate computer processing satellite data will help in measuring the atmosphere transparency, water deposit, and soil erozion. Futhermore, the periodic sattelite scanning of area of interest will permit the evaluation of damage according to time and space.

One approach is to use the **Remote Sensing and Gengraphical Information System (GIS)** means to determine the different coastal water masses, their spatial distribution and temporal evolution.

The preliminary analysis by developping the linear regression model, we can show:

- The distribution of the water masses along the coast,
- The construction of transportation charts for salinity and suspended matter along the coast,
- The distribution of the temperature of water along th coast

**Development of the Soft Interface
between
A Geographical Information System
and an Image Processing System
for Urban expansion**

Analysis the expansion of these cities by

- The scanning of the aerial photographs of these cities on several decades,
- Generation of the **Digital Terrain Model (DTM)**, because it constitutes one of the most important information layers in the GIS.
- Results from remote sensing data analysis form additional input and output data layers in the GIS, typically as thematic map.

**EURO-MEDITERRANEAN CENTRE
ON INSULAR COASTAL DYNAMICS**

I C o D

ICoD is involved in a number of training courses in coastal zone management and marine science which aim, amongst other objectives, to give the participants a background in GIS - based applications as well as Remote Sensing and other monitoring systems capable of building data sets over wide geographic areas.

April 1995: in collaboration with IOC and MCST:
10 day course for Mediterranean participants involved in coastal and marine data management; topics dealt with included GIS-based environments such as Seaplot and Remote Sensing .

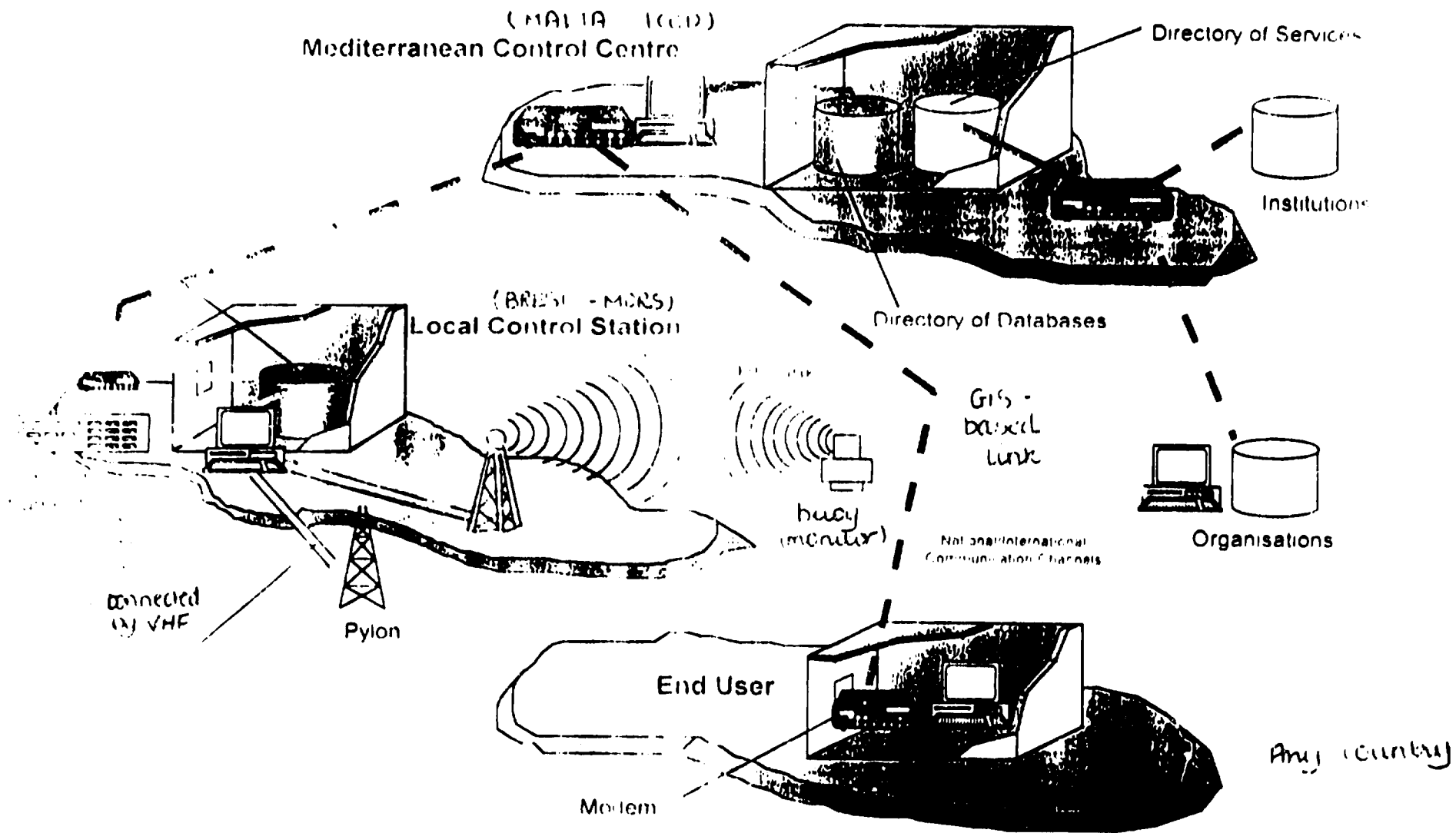
Programmes for 1996:

Training Course on Beach Management involving, amongst other topics, lectures on the management of coastal zone data using GIS-based techniques.

Data Processing for a Mediterranean Automated Environmental Monitoring Network - MEDNET

The project:

- **Development of a network of autonomous coastal buoy- or pylon- monitoring stations for measuring sensitive parameters concerning water quality.**
- **Data collection by sensors mounted on the floating stations, with a particular buoy capable of measuring various physico-chemical parameters over set sampling time frames.**
- **Collected data transferred to the local control station (LCS) - Brest either by a radio or satellite link.**
- **Processed data from LCS made available to Mediterranean control centre (MCC) - Malta; which will act as central directory of services.**
- **End users will be connected to MCC via appropriate software which may be GIS-based.**



The MEDNET Project

ICoD's role in the project is that of production of the relevant software and interfaces for the establishment of data communications network between the various nodes.

Therefore MEDNET is essentially a client/server database and will require the following components:

1. End-user interface:

IBM compatible PC with Windows for Workgroups + Modem; software will include a GIS package which incorporates items equivalent to Visual Basic and SQL development packages as well as further functions for the end user

2. Mediterranean Control Centre (MCC):

100mHz Pentium Server with a serial communication over a V.34 modem for high speed transfer. The server will run Windows NT and SQL server.

3. Local Control Station (LCS):

has already been set up in Brest by MORS.

Data Processing for a Mediterranean Automated Environmental Monitoring Network - MEDNET

The MAREL project consists of the development of a network of autonomous coastal buoy- or pylon- monitoring stations for measuring sensitive parameters concerning water quality. Data is collected by sensors mounted on the floating stations, with a particular buoy capable of measuring various physico-chemical parameters over set sampling time frames and the collected data will be transferred to the Control Station either by a radio or satellite link. The MAREL configuration is a combination of networks whose nodes are the monitoring stations, the Regional centres, the Processing Centre and the end-users. Physical links between nodes vary from radio links to public telephone lines. Data will be stored in both the Regional Centres and the Processing Centre. ICoD's role in the project is that of production of the relevant software and interfaces for the establishment of data communications network between the various nodes.

Two phases are envisaged.

1. Short term objective - connect Malta & Brest to establish prototype link
2. Long term objective - connection to all other countries participating in the project, medium used will depend on the facilities available in each country and also on the european telecommunications technology available (VSATs, Modems)

Therefore MEDNET is essentially a client/server database and will require the following components:

1. End-user interface:
IBM compatible PC with Windows for Workgroups + Modem; software will include a GIS package which incorporates items equivalent to Visual Basic and SQL development packages as well as further functions for the end user
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has already been set up in Brest by MORS

REPORT

ON

THE SITUATION OF THE APPLICATION OF G.I.S. FOR INDUSTRIAL ENVIRONMENTAL PROBLEMS IN TUNISIA

Mohamed Moncef SARBAJI
Environmental Sciences and Research Laboratory
National Engineering School at Sfax (TUNISIA)

ABSTRACT:

Efforts are progressing in Tunisia to develop at some governmental institutions and at university, studies and researches related to environment based on the application of Geographic Information Systems "G.I.S.", remote sensing and ground based information.

The purpose is to provide information to decision makers, environmental planners and community investors concerning industrial environmental problems. Such studies are interesting for industrial activities management, environmental impact assessment and control of pollution. During several years ago, economy of Tunisia is based on industrial activities which are using frequent process not clean enough to prevent environmental pollution. With the creation of the Ministry of Environment in 1992, new laws related to environmental protection were adopted. Thus, environmental impact assessment and siting of industrial activities are now studied through many projects.

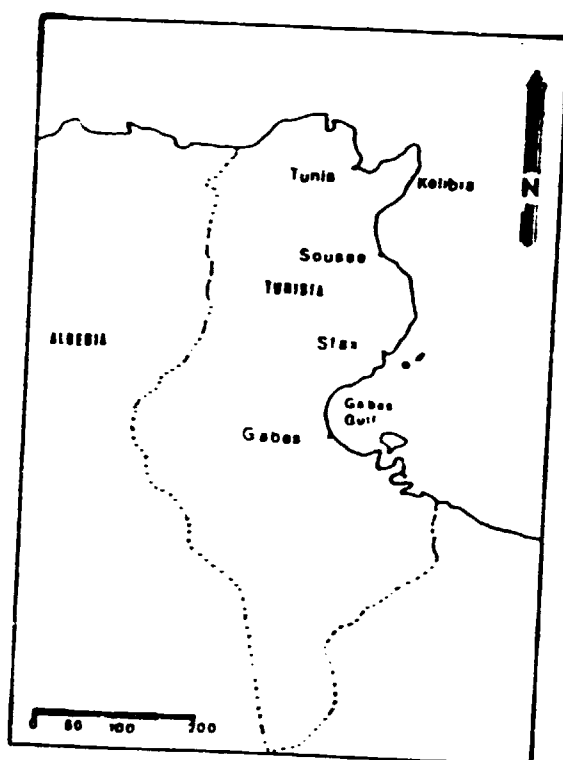
The main goal of these projects is to reduce pollution caused by industrial activities and to help industrials to find out specific solutions. A clearer understanding of environmental impact of industrial activities is urgently needed by researches, policy makers and citizen as they seek solutions for sustainable development of Tunisia through optimum utilization of natural resources and control of pollution.

BACKGROUND:

Tunisia has a population exceeding 8.5 millions. Due to its location, surrounded by mediterranean sea, many industrial activities are established such as chemical industries, refineries, petrochemical complexes, steel complexes, textiles, tanning industries...especially along coastal zones. Dumping of industrial waste water into the sea and underground water will

continue at increasingly high rates unless strictly controlled by direct monitoring and penalizing.

As the population increases, urbanization expands. Expansion has strated without monitoring and periodic assessment. This have placed parts of some highly populated coastal regions at the risk deterioration of public health conditions.



SYNOPTIC MAP

Some studies related to the application of G.I.S. and remote sensing on industrial environmental problems will be presented here:

(1) Marine pollution:

Problems of industrial waste dumping in the marine environment have become very serious in the last few years. The Gabes Gulf in Tunisia is the main area under consideration.

A multidisciplinary project was conducted, mainly by the National Center of Remote sensing, to study the impact of phosphogypsum discharge (50 million tons discharged over twenty years). The phosphogypsum is generated by chemical factories using phosphate as main raw material. Analysis of remote sensing data combined with field measurements were used to describe actual and historical states and begin understanding

alteration mechanisms. Drastic changes have occurred in the Gabes Gulf. The seagrass beds and Caulerpa fields that covered most part of the Gulf are now restricted to some areas upwards of 10m depth.

(2) Application of G.I.S. in coastal zones:

In order to establish a data base for landuse in coastal zones, a project called "MEDGEOBASE" has been undertaken by the Ministry of Environment. Aerial photographs, Spot images and topographic maps are used for this study. A geographic Information System is built including layers of:

- landcover/landuse
- topography
- industrial locations
- soil and agricultural resources

It is planned that information will be updated regularly as data becomes available.

The system will help decision makers concerning site selection of new projects, optimum use of resources and better control of pollution and management of environment. This hopefully will lead to sustainable development of our environment.

(3) The National Observatory for Environment:

Because of the urban growth and the development of industrial and agricultural activities, the environment problems are becoming more and more complex.

However, the Ministry of environment is going to put into service a National Observatory for Environment and Development called "OTED". It will be a permanent device of supervision, observation and valuation of environment and a principal source of information.

CONCLUSION:

Researchers working in some universities are often participating at these projects. In addition to their educational and research responsibilities, they act as advisors to various governmental authorities concerning the application of G.I.S. and remote sensing in environmental problems.

STATE GENERAL LABORATORY

Division C

Lab. of Environmental Chemistry I & Ecotoxicology

Nicosia, Cyprus. Fax 357-2-316434

The laboratory of Environmental Chemistry (I) was formally established in 1988, based on a long experience (since 1980) on the investigation of organic residues such as pesticides, PCB's, phenols etc. in food and water. In 1991 it was expanded to include an Ecotoxicology Unit (a unique one for Cyprus), with the target to develop an integrated approach (chemical and biological) for research and monitoring in the field of water pollution. Since beginning of 1995 the Ecotoxicology Unit has been moved to its own Lab.

The overall aim of the Environmental Chemistry (I) and Ecotoxicology Lab is to contribute substantially in

- preventing water pollution, and
- securing the immediate and long-term Safety and

multifunctionality of Water resources

Surface waters of the island (mainly dams and ponds), groundwater and the main Water-supply systems are under investigation.

The activities of the Lab are formulated with the goal to develop the analytical capabilities in order to:-

- identify the profile of any existing Agricultural and Industrial pollution,
- forecast future development trends, and
- to develop and support an Early Warning System in the field of Water Pollution

To this effect extensive Chemical Monitoring is implemented, supported also by toxicity testing and evaluation. Applied research with primarily preventive orientation, forms a vital component of the whole system towards early identification of newly emerging problems. Development of new methods for the

determination and ecotoxicological evaluation of pollutants is part of the research activities. To ensure the credibility of the laboratory an extensive Quality Control Scheme has been developed and applied.

The Lab has a highly qualified personnel. The total No is 7, all are university graduates and 3 of them hold doctorate degrees. Members of the staff have been trained in Europe and have long experience (up to 26 years) in the field of toxic residues. Instrumentation of the latest technology is available i.e. computerized multidetection GC (ECD, FID, PID, NPD, FID, PSD) and HPLC (PDA, UV, Fluorence, Contuctivity) with post column, column swicthing and, purge and trap devices, Gel Permeation Chromatography, GC/Mass Spectrometry, Total Organic Halogen (TOX) Analyser, ICP and Atomic Absorption.

Since 1988 various investigations on industrial and agricultural pollution have been carried out i.e. investigations of

oil spills and leakages, pollution caused by dye-effluents, and accidental pollution in the water-supply system etc.

Parameters being under regular monitoring according to their area specific importance are :

- PCB's and Pesticides: organochlorines, organophosphorous, triazines, N-methyl carbamates, 2,4 D, Alachlor etc,
- VOCs (Volatile Organic Compounds - 61 compounds i.e. aromatic, saturated, unsaturated halogenated hydrocarbons, and Trihalomethanes (THMs),
- Chlorophenols, phthalates etc.
- Polynuclear aromatic hydrocarbons (PAHs),
- Toxic Metals (e.g. Pb, Cd, Hg etc).

Investigation of polar pesticides and metabolites like Linnuron, ETU etc by column switching HPLC, is at the method development stage whilst monitoring of radionuclides will

also be included in the near future.

Bio-oriented fractionation and investigation of fingerprints and profiles improved substantially the investigational capabilities of our approach especially for diffused source of pollution.

In the field of Ecotoxicology acute toxicity testing is carried out with Microtox (*Photobacterium phosphoreum*) especially for industrial effluents and boreholes located in or near industrial areas. Sediments and sludges are directly tested for acute toxicity by Solid Phase Test. Mutagenicity testing by Mutatox is also applied. In addition, combined toxic effects of various pollutants are under investigation. As part of an on going research, various mixtures of volatile pollutants and pesticides have been studied and both simple additive and synergistic effects were observed so far.

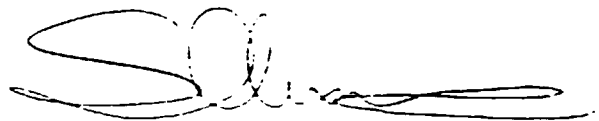
Further development of the Ecotoxicology Unit as to include

tests on algae, dafnia and fish and other tests for a more cost-effective testing will be continuously promoted.

Dr Stella Canna - Michaelidou

Senior Chemist

For Director State Laboratory



Nicosia, June 1995

Labenv.195



R E P U B L I C O F C Y P R U S

M I N I S T R Y O F H E A L T H

S T A T E G E N E R A L L A B O R A T O R Y

T H E E N V I R O N M E N T A L I M P A C T S T U D I E S :

T H E C Y P R U S E X P E R I E N C E

Presented at the UNIDO/IEI Workshop, Gozo-Malta, 2-6/10/1995

Prepared by

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September 1995

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ST.C.M/MM&AT

1. INTRODUCTION

Cyprus, is an island in the East Mediterranean Sea, with an area of 10,000 square kilometres and an estimated population of 700,000 citizens. The population consists of approximately 82% Greek Cypriots and 18% Turkish Cypriots.

Cyprus is an independent sovereign State since 1960. However, the Northern part of the island (about 37% of the total territory) is occupied by Turkey since 1974.

The economy of the island displays most of the characteristics of a developed European economy while, at the same time is preserving conditions of growth, stability and progressive welfare improvement. The economy depends greatly on the rapidly growing tourist industry and on the export of agricultural and industrial products to the European Union (E.U.) to which Cyprus has applied for full membership.

Population growth is on average 0.74% per year. Though population pressure is moderate in Cyprus, the small size of the island makes it very sensitive to issues of development and environment. During the last 20 years Cyprus has witnessed the largest increase of its urban population and the biggest growth of the tourism and the industrial and agricultural sector. These changes have brought about a number of problems namely increased pollution levels and waste production. The intensive agriculture and the use of pesticides and fertilizers, have threatened the island's fragile environment and especially its water resources.

The Government of Cyprus has endorsed the principles of sustainable development. It has undertaken a methodical effort to integrate environmental considerations into those of its economic and social development policy.

2. ENVIRONMENTAL IMPACT ASSESSMENT IN CYPRUS

2.1 Milestones in its development

Since 1988 and despite the lack of Legislation, it has been the Government's declared policy for environmental impact assessments to be carried out for all major public development projects. This was considered as an essential step towards the target of Sustainable Development.

Many projects were subjected to the Environmental Impact Assessment process. The most significant studies were the following:-

- The construction of Kourris Dam : Impacts on the downstream Akrotiri Salt Lake, and on the watersheds of Dhiarizos, Ezousa and Limnatis rivers.
- The Installation and Operation of the Central Sewage Treatment Plant of Limassol-Amathus: Impacts on the sea environment.
- The Construction and Operation of the Vassilikos Power Station: Impacts on the surrounding area.

In addition, simplified environmental impact assessment procedures proposed by the Priority Action Plan of UNEP, were first tested in Cyprus on two pilot projects, namely the Lar-

naca Sewerage System (sea outfall) and a Marina in Paphos.

In June 1991 an Integrated System for Environmental Impact Assessment, based on the EEC Directive 85/337 was approved by the Council of Ministers (Decision 35.700 of the 20th June, 1991). This decision followed a relevant Decision for the examination of requests for mining and quarrying licences (Decision 33.485 of the 9th of May, 1990).

The overall aim of the Decision for EIA is to promote Sustainable Development in Cyprus and pollution prevention. Special emphasis is given to the :-

- protection of habitats and natural heritage,
- prevention of environmental pollution, and
- prevention of effects on the coastal and the marine environment.

Specific provisions for EIA are included in the Framework Law on the Environment which is expected to be adopted in 1996. This Legislation will be the backbone of the EIA implementation and will improve its effectiveness.

2.2. Institutional and Legislative Framework

Pending the adoption of the above mentioned Law, the EIA concept is implemented within the framework of three existing Laws: a) the Town and Country Planning Law and b) the two Laws on the Control of Pollution of Waters and Atmosphere from Industrial Sources. These Laws, provide the responsible authorities with the power to apply the concept by requiring EIA study prior to the granting of a permit or registration.

A Technical Committee for EIA (EIAC) has been established in 1991 with the mandate to implement the Ministerial Decision of 1991 and to promote further the EIA concept. This Committee is a Technical arm of the Inter-ministerial Environment Committee. Members of this Committee are representatives of various Ministries, Departments and Services (Appendix I).

2.3 EIA: The process

The EIA process is a three tiered approach. In the first tier, Tier I, screening of projects to be subjected to the EIA process is done by the Authorities implementing the above mentioned Laws. Projects falling in one or more of the following categories have to be subjected to the EIA process:

- Large projects of the public and the private sector with an estimated construction cost exceeding 1,7 mECUs,
- Projects located outside local plans, village development boundaries, animal husbandry areas and industrial zones of limited degree on annoyance, .
- projects developed in state property, and
- specific projects which were judged by their nature, to cause impacts to the environment independently of their location and /or size (Appendix II & Ref EEC/85/337)

In the Tier II, a Preliminary EIA (PEIA) is requested for projects falling in one or more of the above categories. This is prepared by the proposer and the competent Authority and submitted for evaluation to the EIA Technical Committee (EIAC).

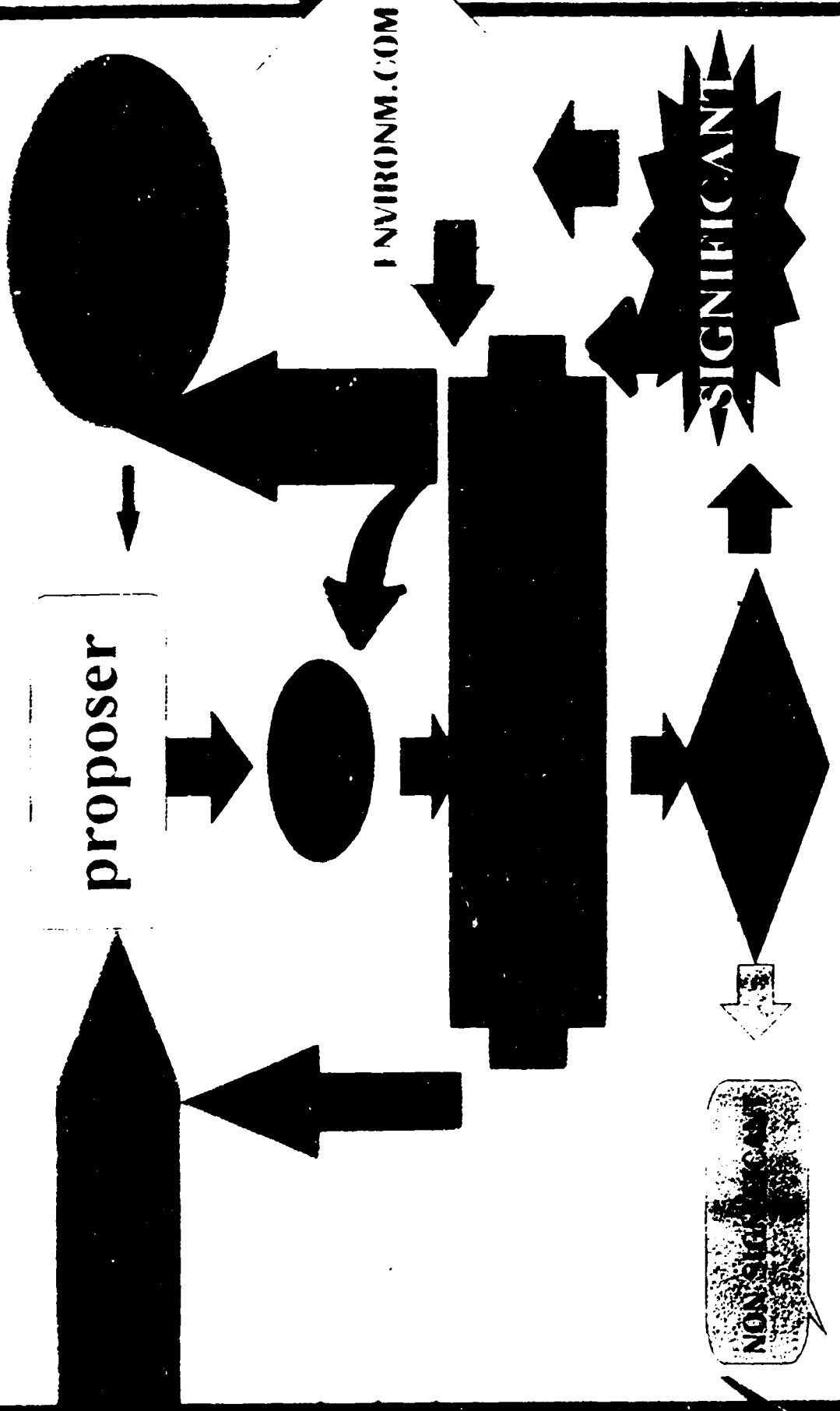
The PEIA has to be prepared at an early stage of the project's design as part of its overall feasibility study. More specifically the PEIA:

- a) for a private project has to be incorporated in the licensing procedure prior to the issuing of Town Planning Permit or any other permit necessary for the project operation,
- b) for a governmental/public project it has to be submitted at the stage of the proposal of the relevant budget prior to its approval.

Following the evaluation by the EIAC, the PEIA can either be accepted as it is or after amendments. The project is then released to proceed further.

For those projects the execution or operation of which is judged to inflict considerable impacts on the environment, the PEIA is submitted by the EIAC to the Environment Committee for further consideration, with suggestions for either substantial amendments or for preparation of a full Environmental Impact Assessment Study. In the latter case, terms of reference or a table of contents for the required EIA are prepared by the EIAC based on relevant EC guidelines. The process is schematically shown in Fig.1

EIA: the process



ENVIRONM.COM

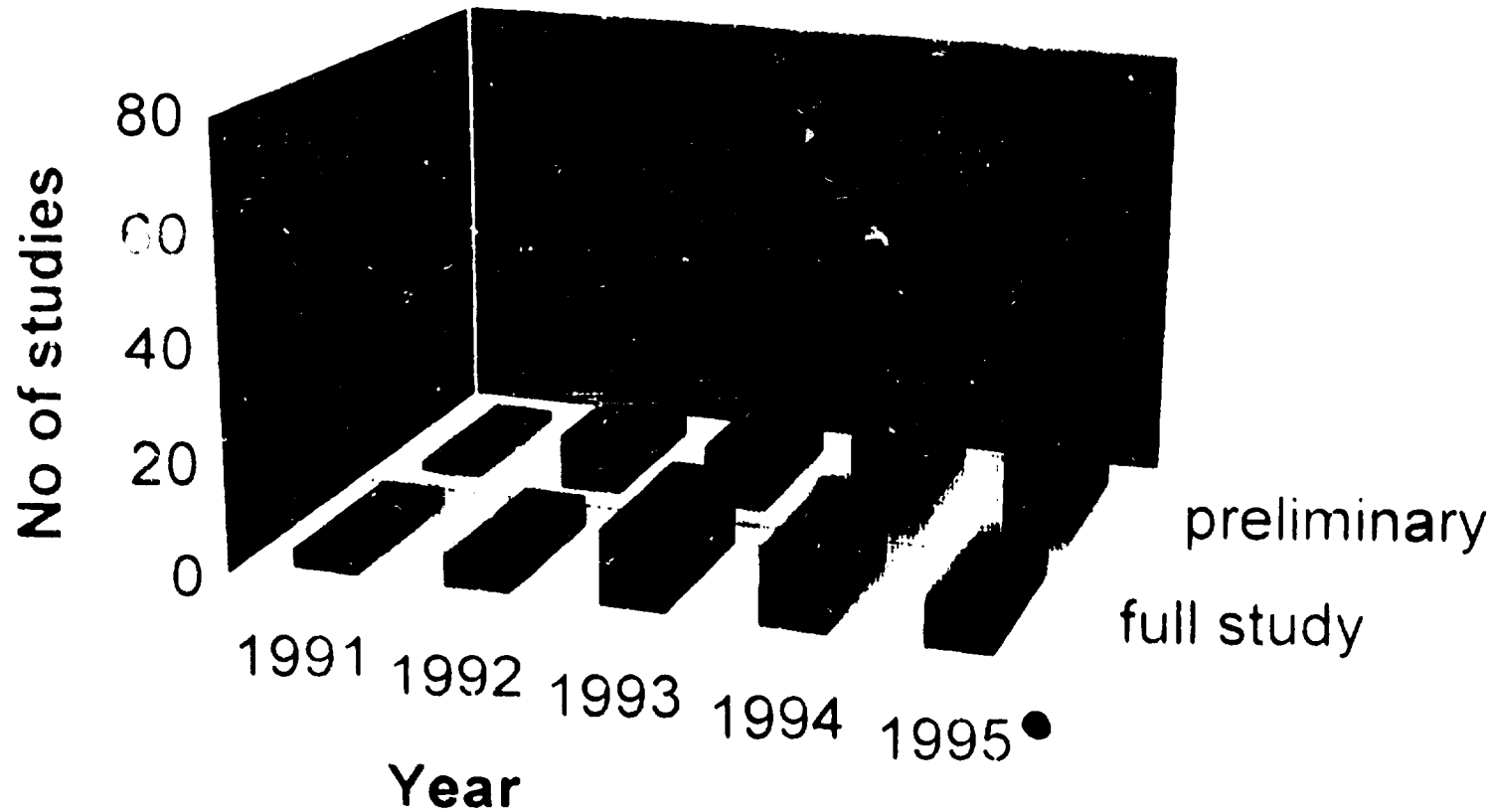
2.4 The implementation of EIA in Cyprus 1991-1995: Progress and needs for further development

Numerous projects related to industrial, animal husbandry and tourism establishments, Dams, Electrical Power Stations, Marinas, Treatment Plants etc. have been subjected to the EIA process. Since 1991, 165 studies have been evaluated 124 of which had the status of a preliminary EIA and 41 the status of full EIA. As it is shown in Fig. 2, the yearly No. of studies has increased tremendously from the year 1994 reflecting the growing importance given to the implementation of the EIA concept. The average annual No. of studies is 47 and corresponds to 1 study per 15.000 inhabitants. This figure is favourably compared with similar figures from EU countries. (Ref. 8).

Despite this progress, we believe that the implementation and the effectiveness of the EIA concept has not yet reached its full potential. Based on our experience the following are considered as key elements to be further developed.

- 1) Strengthening of the Legislation, with specific provisions.
- 2) Development of an Integrated Information Management System (IIMS) and more Objective Assessment Methodologies. The IIMS should provide information on the status of the environment, existing trends, bearing capacities of various sectors and capabilities for forecasting future developments and alternative scenarios. Computerized data collection, and retrieving (i.e. via GIS system)

EIA STUDIES IN CYPRUS: 1991-1995



• 8/95

will also allow the identification of interactions, synergistic or secondary impacts and will support eventually a more rational, holistic and objective assessment.

- 3) Integration of Health Criteria into EIA and strengthening of Health component of the EIA. The risks of adverse health effects and the costs of avoiding such risks has to be incorporated into the EIA process. A practical model proposed by WHO can be effectively applied to this end in particular for screening secondary and higher level health impacts. (Appendix III, from WHO 1987, Ref12). The EIA in Cyprus has not taken so far a sufficiently broad view of the effects on health of the proposed developments mainly due to the lack of sufficient data.
- 4) Promotion of problem-oriented research to fulfil gaps in existing information
- 5) Development of an effective monitoring, re-evaluation post-audit and feedback mechanism. The lack of this mechanism constitutes at the present one of the weakest point in our process, and
- g) Continuous training of all those involved in the process.

In addition to the above practical measures, the implementation of EIA has to be gradually shifted towards the level of policy making and strategic planning. This will be a step forward for a more integrated assessment and sustainable development. The concept of the so called Strategic Environ-

mental Assessment is already promoted within the European Union and a new Directive is expected as an outcome.

3. CONCLUDING REMARKS

During the last years 5 years it has been a remarkable development in the implementation of EIA in Cyprus, which despite its deficiencies can be favourably compared with what is going on in other european countries. The State General Laboratory as a Member of the EIA Committee, is contributing towards continuous development of the EIA, particularly of its components related to the assessment and prevention of environmental pollution and impacts on Public Health. In addition, the State General Laboratory with its broad range of expertise, research and monitoring activities is an essential source of information for EIA studies.

The Protection of Public Health and Environment is not only a national priority, but is also an international one. The aim of sustainable development of our planet and the dream for a Healthy Universe are difficult but achievable tasks. International cooperation and understanding are essential prerequisites for their achievement.

Cooperation in the field of EIA, promoted and reinforced by international Organizations (like UNIDO, UNEP, WHO etc) will promote mutual understanding, transferring of knowledge, and at the same time will bring about a more cost - effective

use of resources. I believe that this Workshop on the implementation of GIS systems as a tool for EIA , organized by the ICS of UNIDO and the International Environment Institute of Malta, is a step forward to this target.

I will end my presentation with an abstract taken from a UNEP publication on EIA, in 1987.

"EIAs mean better, more successful projects; they are a good investment in the future for both the developer, the economy, the environment and the society."

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APPENDIX I

Members of the BIA Committee

1. Environmental Conservation Service (Secretariat)
2. Ministry of Health 3. Ministry of Commerce and Industry
4. Ministry of Labour and Social Insurance
5. Ministry of Public Works
6. Ministry of the Interior
7. Planning Bureau
8. Department of Town Planning and Housing
9. State General Laboratory
10. Cyprus Tourist Organisation

APPENDIX II

Type of projects subjected to EIA

Independently of their size and/or location)

- Tourist installations and residential building complexes covering an area of more than four hectares
- Aquaculture projects
- Coastal camping sites
- Recreation areas and sporting facilities covering an area
- Coastal improvement and protection structures
- Ports, marinas, fishing shelters and breakwaters
- Wastewater and sludge treatment plants
- Solid and liquid disposal areas
- Toxic and hazardous wastes disposal areas
- Animal husbandry areas
- Hospital installations

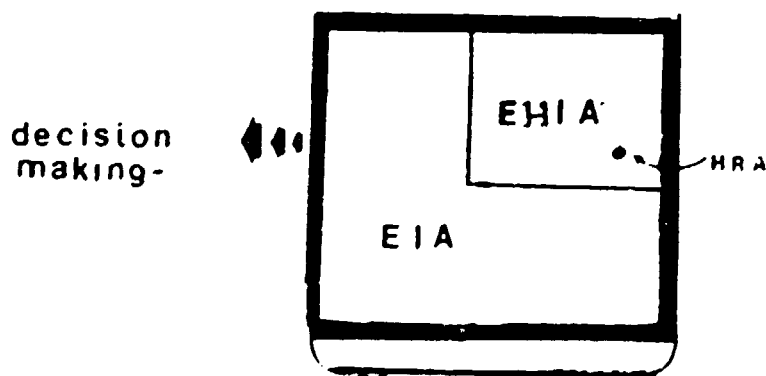
APPENDIX III

Health and Safety Component of Environmental Impact Assessment

One of the fundamental considerations in the approval of projects, plans and policies should be the health of the communities affected by them.

The E H I A model by WHO

1. Assess direct impacts on environmental parameters.
2. Assess indirect impacts on environmental parameters.
3. Screen environmental parameters which have a health significance (environmental health factors).
4. Assess increase of exposure.
5. Assess increase in risk-group populations.
6. Assess health impacts (mortality and morbidity).



Development and Environment in Egypt

Khaled A. Moussa
National Institute of Oceanography
& Fisheries
Alexandria, Egypt

In a country with a rapidly growing population of about 65 millions, development is a must that cannot be escaped. On the other hand, it is the role of academia and research centers to maintain balance and find solutions for contradictions between development needs and environment protection requirements. These two facts have been realized since the early 1980's in Egypt and have resulted in a progressively increasing collaboration between different institutions at all levels toward the achievement of the national goal of "enhancing development and saving environment". This has culminated in 1994 through the issue of Environment Law (Law Nr. 4, 1994) and its executive rules. This Law has given authority in all matter relevant to environment to the Egyptian Environmental Affairs Agency (EEAA) located in Cairo with local affiliated boards in all governorates of the country. In fact, the EEAA has been established and acting since the early 1980's. Under the Environment Law, all new projects are obliged to conduct EIA in advance for licencing. The EIA's are evaluated on scientific bases and modified, if necessary, to comply with the rules and regulations set by the law. The existing firms has been allowed three years to re-adjust their situations according to the law. Criminal penalties have been set for violation of the law.

In 1989, the National Institute of Oceanography and Fisheries has been re-organized to include the Mediterranean, Red Sea and Inland Water Branches. By law, it is a non-profit research organization and is the national expertise house in ail matters relevant to the maintenance and development of the aquatic environments of the State. In fact, the National Institute of Oceanography and Fisheries, Alexandria has been established and working with the aquatic environments since 1918. With the beginning of the 1990's, however, it has reoriented its activities to be more consistent with development requirements and the new approaches in CZM. Thus, about 30 EIA studies have been conducted during the period 1990-1995. These comprised activities ranging from tourism through oil exploration and production, to harbour's installation. In order to enhance its capabilities. It has established PC platform for image processing and GIS application in CZM. Such an approach would be very useful in a country with coastlines of about 2.500 Km long that are almost exclusively non-developed yet.

Although RS techniques have been introduced into Egypt since the mid 1970's, it was until very recently when the GIS techniques have been introduced. In a study for the potential impacts of accelerated sea level rise on Alexandria Governorate, El-Raey et al. (1994) obtained the following results.

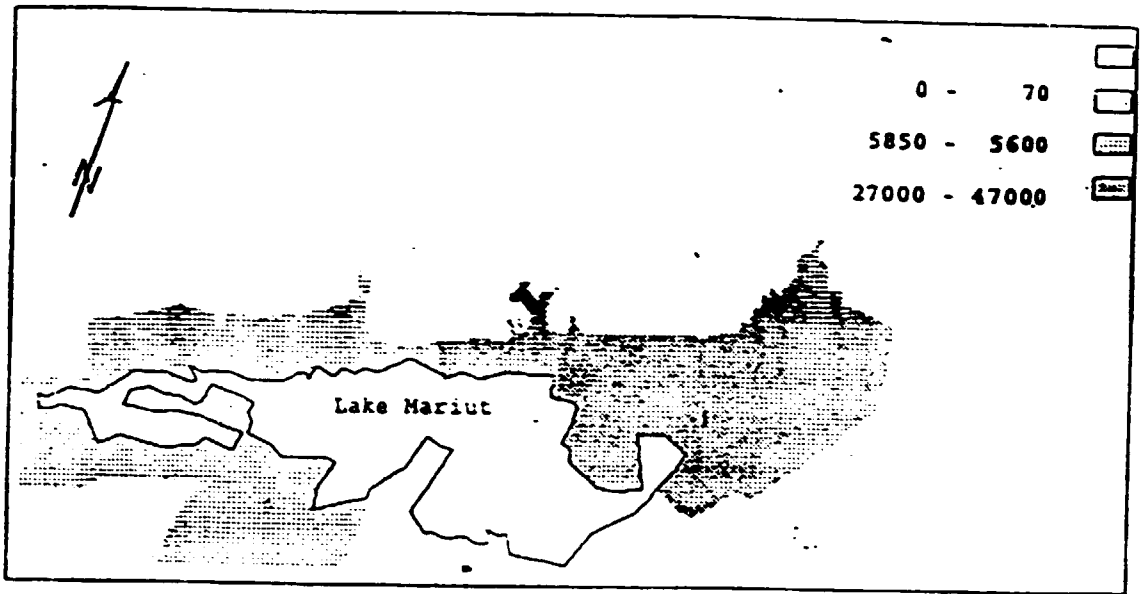


Fig. (3) Population density per km² in various districts of the governorate of Alexandria (Census, 1986, as displayed by GIS.

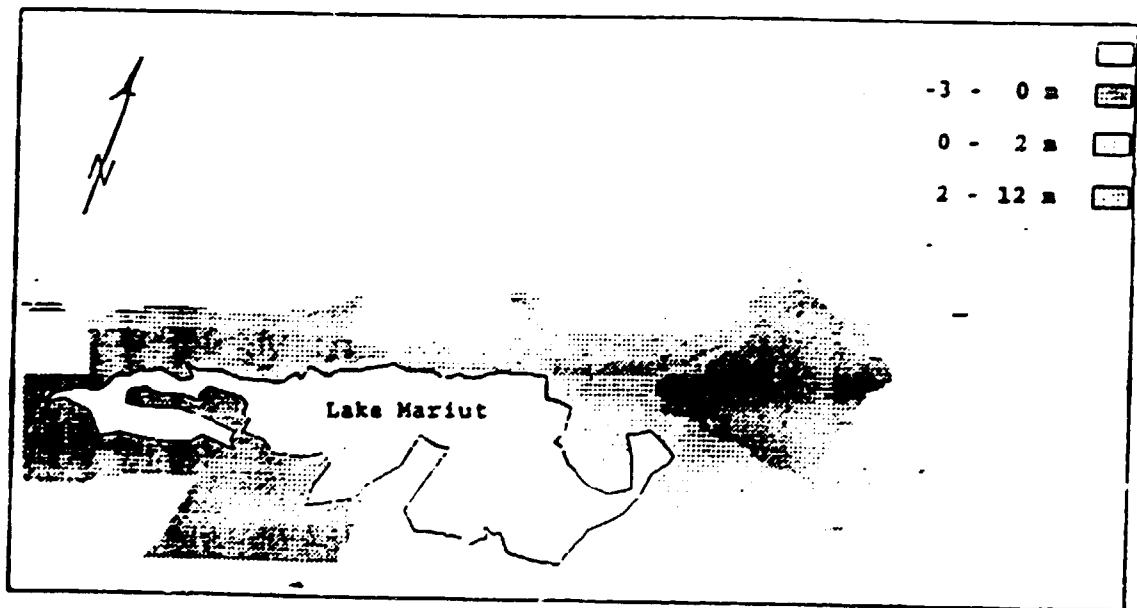


Fig. (4) Topographic map of the governorate of Alexandria at 1.0 meter contour interval as displayed by GIS, scale of 1:100,000.

Table (1) Areas, population estimates and percentage of landuse classes above various elevations of Alexandria Governorate.

Elevation	Above -3m	Above -2m	Above -1m	Above sea level	Above 0.5m	Above 1.0m	Above 1.5m	Above 2.0m
Area Km ²	2009.59 100%	1982.93 98%	1618.09 81%	1309.16 65%	992.33 49%	771.84 38%	632.6 31%	498.9 24%
Population	3,176,299 100%	3,155,007 99%	2,483,065 78%	1,994,715 63%	1,574,509 50%	1,143,567 36%	921,125 29%	689,705 21%
Agricultural Km ²	1031.7 100%	825.36 80%	154.8 15%	103.2 10%	72.2 7%	51.6 5%	-	-
Industrial Km ²	29 100%	28.7 99%	28.3 70%	14.5 50%	10.1 35%	6.7 30%	5.6 20%	2.9 10%
Residential Km ²	51 100%	45.9 90%	40.8 80%	35.7 70%	28.1 55%	25.5 50%	20.4 40%	12.8 25%
Municipal services Km ²	10 100%	9 90%	8 80%	6.5 65%	6 60%	5 50%	4 40%	3 30%
Commercial area Km ²	6 100%	5.38 90%	5.7 95%	5.1 85%	4.8 80%	4.5 75%	4.3 70%	3.9 65%
Communal facilities Km ²	4 100%	3.96 99%	3.92 98%	3.6 90%	3.4 85%	3.2 80%	3.15 76%	2.9 70%
Archeologic. sites Km ²	5 100%	5 100%	3.75 75%	3 60%	2.6 52%	2.35 47%	1.65 33%	1.5 30%

ENEA (Italian National Agency for New Technology, Energy and the Environment)

ENEA is the Italian government agency responsible, under Law 282 of 25 August 1991, for the areas of new technology, energy and the environment. Its two fundamental tasks are to conduct research in these areas and to diffuse the results nationally.

More particularly, ENEA's activities involve:

- * research, development and testing of innovative technologies and equipment, and transfer of innovations to industry and agriculture;
- * development of technologies, equipment and components designed to exploit renewable energy sources and to save energy, and stimulation of demand for them; design, construction and testing of demonstration plants;
- * research and testing of innovative nuclear reactors possessing greater inherent or passive safety; dismantling of fuel cycle systems in earlier generation nuclear power plants;
- * research on nuclear fusion in extensive collaboration with the Italian and international scientific communities;
- * environmental surveying and monitoring; research and assessment of the impact of productive activities of the human and natural environments; development of advanced technologies and new products with low environmental impact.

In addition, ENEA is responsible for the licensing and control of all operations involving the peaceful use of nuclear energy; these activities are conducted by the Department of Nuclear Safety and Health Protection (DISP).

The Agency, which has a staff of around 5000, is present throughout Italy, operating nine major Research Centres and a number of smaller facilities.

ENVIRONMENT - The purposes of ENEA's activities in this area are to:

- * characterize the morphological and functional aspects of the environment in relation to local human activities;
- * study the effects on man and the environment of harmful substances resulting from economic activities;
- * develop and promote innovative technologies for the health and environment sectors;
- * assess and reduce environmental impacts in industrial and residential areas, in part by developing advanced technologies;
- * help plan actions aimed at recuperating ecosystems or safeguarding areas under by environmental threat;
- * ascertain the status of the Mediterranean marine environment, in part by testing advanced technologies;
- * contribute to research, particularly in the Mediterranean area, on the effects of the energy cycle on global climate.

ENEA ENVIRONMENTAL SERVICES
(Technical-scientific services for public administrations and industries)

* EIA and SITING

- Studies and intervention of specialized equipe.
- Production of software.

* AIRBORNE REMOTE SENSING

* DEVELOPMENT OF SYSTEM FOR CONTROLLING AND SUPPORT TO DECISION
(Atmosphere)

* ECOAUDIT and ECOLABEL

---> land knowledge ---> SW for siting and GIS (sintesi)

---> activities control ---> for managing flux of matters and goods (proper)

---> environmental resources recovery ---> SW for optimizing

APPLICATIONS OF G.I.S. AND RELATED ACTIVITIES IN ENEA (Knowledge)

CONTROLLING (MONITORING AND ANALYZING ECOSYSTEMS)

- * Coastal lakes and lagunes:
 - Analysis (soil, water, air, vegetation, fauna, etc.) by direct on-site measurements.
 - Modelling of typical phenomena (pollutants diffusion in the ecosystems); eutrophication of lake and cyclical anoxic crisis; coastal erosion; hydrodynamic of water movements, etc.).
 - Monitoring main environmental parameters (in real time) in order to control systems and to support decisions.
 - Remote sensing and operation of remote monitoring stations technological development
 - Examples: Venice, Comacchio/Delta of Po river/Caprolace (Latina)/Orbetello (Grosseto)/[New activity: coastal lakes in Puglia region].
- * Seas and coasts:
 - Analysis (---) by direct measurements.
 - Modelling (Hydrodynamic for great masses and for close coast systems, /---/)
 - Monitoring by cyclical measurement campaign;
 - Technologies development
 - Examples: studies of erosion and pollution for various Italian coasts/data base on Mediterranean Sea water all a round Italy.
- * Parks and territories of particular biotopical and naturalistic value:
 - Analysis (---)
 - Modelling
 - Monitoring
 - Examples: Brasimone area, Pollino park, etc.
- * Urban Areas:
 - Modelling and analyzing phenomena (air pollution, vehicular traffic, warming-up and local climate) of interest;
 - Monitoring (Big problem!!! Measurements in real time mixed with statistical model and algorithms [i.e. air quality --> meas pollutants, level of traffic, emissions by vehicles and heat/freezing plants/sodar meas. Classification of climate and air stability condition, meteorological prediction for local area --> knowledge of environmental matrix and possibility of control and mitigation])
 - Monitoring urbanization and modification of towns (more sophisticated form of G.I.S.)
 - Controlling and mitigating of effects of human activities:

INTERVENING AND MITIGATING EFFECTS (BUSINESS)

- * G.I.S. for management of productive activities (transport, waste disposal, goods and materials fluxes over a specific basin)
- * G.I.S. for control and support to decision for public authorities (traffic, ecosystems, natural emergency).
- * G.I.S. for E.I.A. and SITING
(landfills and incinerations plants siting [main problem now in Italy], energy production plants, commercial centers, etc.).

- * G.I.S. and ecobalance for ecosystems and activity (industrial/antropic) districts.
- * G.I.S. and remote sensing data base x following the development of human activities and their impact on environment.

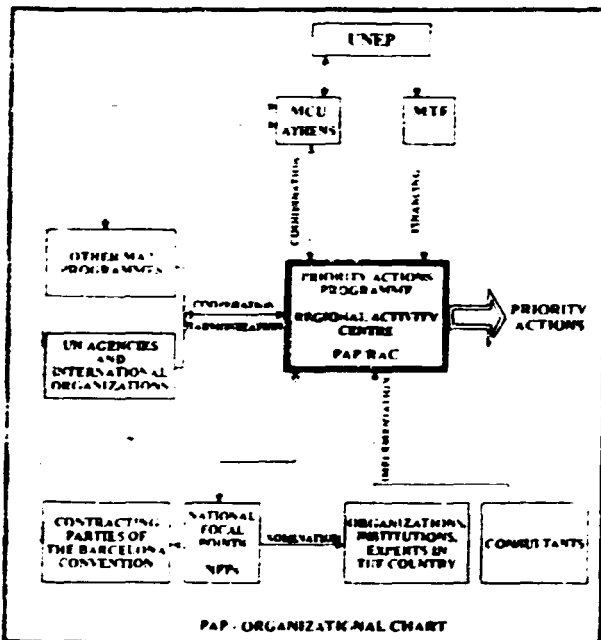


PAP ACTIONS

The Priority Actions Programme (PAP), implemented by the Regional Activity Centre (RAC) in Split, Croatia, is part of the Mediterranean Action Plan (MAP) of the United Nations Environment Programme (UNEP). Although PAP acts as one of the MAP Centres since 1978, it is a national institution with the budget and mandate to carry out a certain number of MAP activities in coastal areas of the Mediterranean Sea.

implementation of various activities in the Mediterranean region.

The principal activity of PAP is integrated Coastal and Marine Areas Management (ICAM) within which, over the past ten years, a clear methodological approach has been defined, and a large number of plans, projects and studies prepared. The interdisciplinary and multidisciplinary nature of ICAM, as defined by PAP, was strengthened by the complementary elements of PAP expertise, composed of several priority actions implemented in the entire Mediterranean with the participation of almost all Mediterranean countries in each, as well as of relevant UN agencies and numerous international organizations and highly renowned experts.



PAP is an action-oriented organization aimed at carrying out practical activities which are expected to yield immediate results contributing to the protection and enhancement of the Mediterranean environment, and to the strengthening of national and local capacities for integrated coastal zone management. PAP cooperates with a large number of organizations in the UN system (UNEP, FAO, IMO, UNESCO, FOC WHO, IAEA, WTO, UNDP), financial institutions (World Bank, European Investment Bank), other international organizations (European Union, Council of Europe, IUCN, etc.), as well as international institutions and consultancy companies. PAP is also successful in attracting funds from other sources outside UNEP/MAP which are used for the



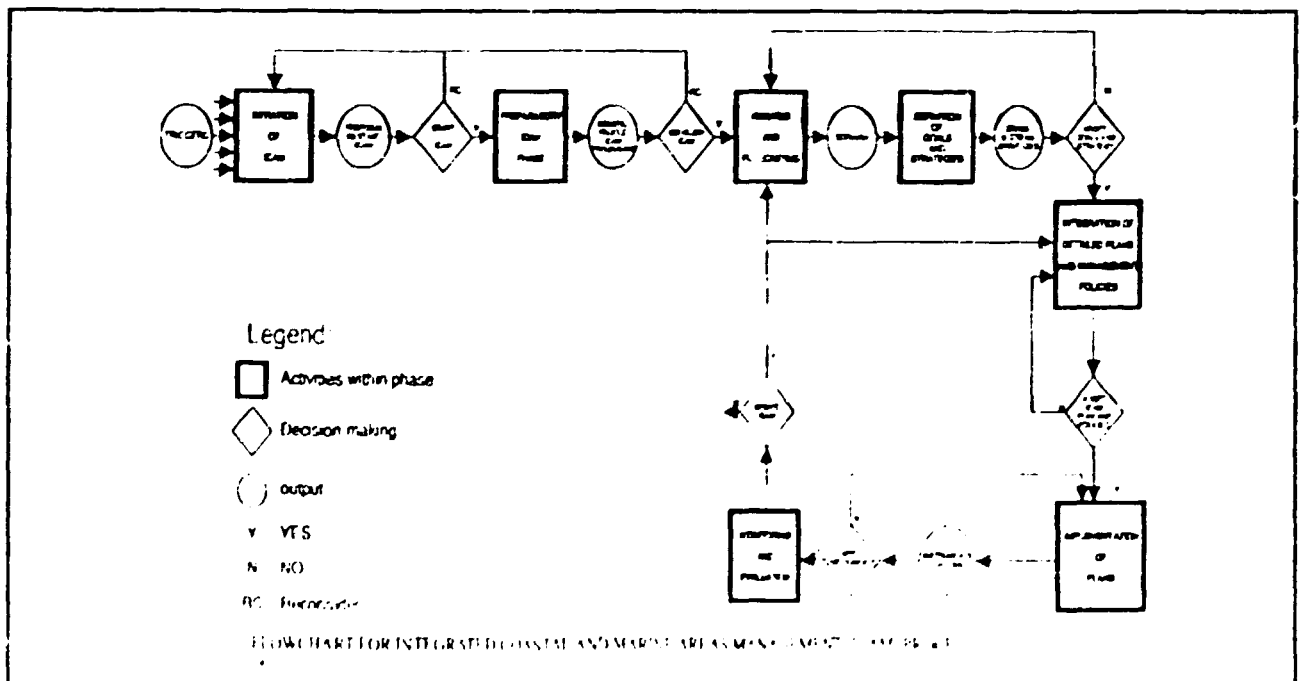
A medieval palace in the historic center of Split (Croatia) now housing PAP/RAC offices

Priority fields	Priority actions
Human settlements	1 Integrated planning and management of Mediterranean coastal zones
	2 Rehabilitation and reconstruction of Mediterranean historic settlements
	Land use planning in earthquake zones
	4 Solid and liquid wastes management
Water resources	5 Water resources management in Mediterranean islands and water deficient areas
Soil protection	6 Promotion of soil protection as an essential element of the environmental protection of Mediterranean coastal zones
Tourism	7 Development of Mediterranean tourism harmonized with the environment
Aquaculture	8 Environmentally sound management of Mediterranean aquaculture
Renewable sources of energy	9 Application of renewable sources of energy in Mediterranean coastal areas
	10 Application of a practical procedure of Environmental Impact Assessment

PAP's work is characterized by an integrated approach to the solution of complex problems of the coastal zones, and is carried out by multidisciplinary teams of experts which cooperate with the local institutions and experts, and contribute to the strengthening of the institutional capacities of the countries in which PAP operates. A valuable methodological tool prepared to this end are the Guidelines for Integrated Management of Coastal and Marine Areas prepared for the Ocean and Coastal Areas Programme Activity Centre of UNEP. Other tools used to facilitate the preparation of ICAM programmes, plans and projects are Geographic

Information System (GIS), Environmental Impact Assessment (EIA), Carrying Capacity Assessment (CCA) for tourism, economic instruments, etc. These tools are adapted to the conditions prevailing in the majority of Mediterranean countries.

The PAP's integrated approach has been successfully tested in Coastal Area Management Programmes (CAMPs), a specific and advanced form of cooperation of all MAP components with national and local authorities and institutions in selected coastal areas



MAP COASTAL AREA MANAGEMENT PROGRAMMES (CAMPs)

Definition:

A form of advanced collaboration with national and local authorities and institutions based on principles of sustainable development and integrated coastal area management

Main objectives:

Mediterranean coastal areas

- to introduce or develop the process of integrated planning and management of
- to contribute to a sustainable development and environment protection
- methodological framework
- pilot areas
- wider application of results and experiences obtained in pilot areas

"Bottom-up" approach:

CAMP phases:

1. Preparatory:

- data collection
- upgrading of capacities
- environmental knowledge (assimilative capacity, identification of problems, climatic impacts)
- programme formulation

2. Implementation:

- data base
- training
- coastal area scenarios (development, climatic changes)
- integrated planning and management studies (resource evaluation, impact assessment, development outlook, immediate and long-term mitigation

measures)

3. Follow up:

- programme of an integrated plan
- preparation of an integrated plan
- implementation
- monitoring
- re-evaluation

Over the period 1990-1995, PAP has been involved in the following CAMPs: "The Kastela Bay" (Croatia), "The Bay of Izmir" (Turkey), "The Island of Rhodes" (Greece), "The Syrian Coastal Region", and "The Adriatic Coast". Another two ("The Area of Fuka" - Egypt, and "Sfax" - Tunisia) have been recently launched.

The Kastela Bay is located at the eastern coast of the Adriatic Sea, in the immediate vicinity of the town of Split. It is one of the Adriatic areas which have suffered intensive degradation due to uncontrolled development of industry, and fast growth of surrounding villages and the town of Split, as well as to a total absence of adequate measures for the reduction of urban and industrial pollution. The principal objectives of this project were: to complete the knowledge on the causes and consequences of pollution; to identify prerequisites for treatment and discharge of urban waste waters into the bay and the adjacent Brac Channel; to contribute to the solution of the water supply problems; to introduce GIS; and to develop a concept of urban waste water collection, treatment and disposal. The World Bank and METAP offered a partial support to the programme which was used for the preparation of the conceptual design of the waste water management system. The results of the MAP project, and the results achieved through the WB contribution, served as an input to a larger national project related to the rational management of the resources of the Kastela Bay area.



A view of Split and the southeast part of the Kastela Bay

The Integrated Management Study for the Area of Izmir is the final output of CAMP "The Bay of Izmir". The conurbation around the Bay of Izmir has the population close to 1.5 million inhabitants (1990 records). Numerous industrial activities impact heavily on the environment and, in particular, on the water quality of the Bay and the shore areas. Since the 1960s, the urban growth has been devouring the space of the metropolitan area regardless of the value of its natural resources, one of its most evident consequences being the indiscriminate occupation of urban land for illegal housing. Its principle objective is to help the national and local authorities to change the existing trends of growth and development, and to check further environmental degradation, resource depletion and various pollution-related damages by implementing the ICAM process aimed to achieve sustainable development in the area.

CAMP "THE SYRIAN COASTAL REGION" SUITABILITY MODEL FOR URBAN/RURAL GROWTH

LEGEND

-
-
-
-
-

CAMP "THE BAY OF IZMIR"



LAND USE OPTIONS

ENVIRONMENTAL CHARACTERISTICS

1. High population density

2. High industrial activity

3. High agricultural activity

4. High urban growth

5. High pollution levels

6. High water consumption

7. High water pollution

8. High water quality degradation

9. High water quantity degradation

10. High water quality and quantity degradation

1. High population density

2. High industrial activity

3. High agricultural activity

4. High urban growth

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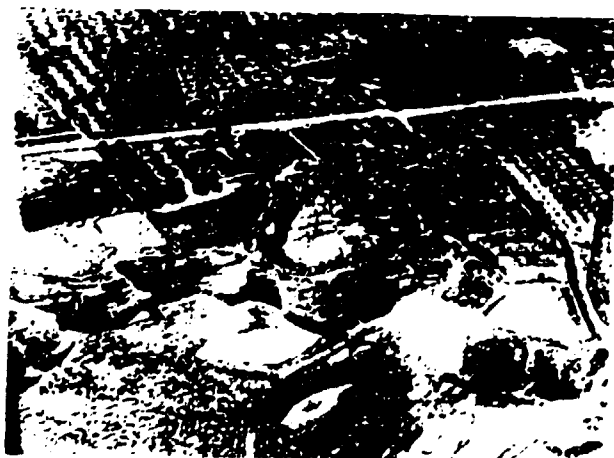
8. High water quality degradation

9. High water quantity degradation

10. High water quality and quantity degradation

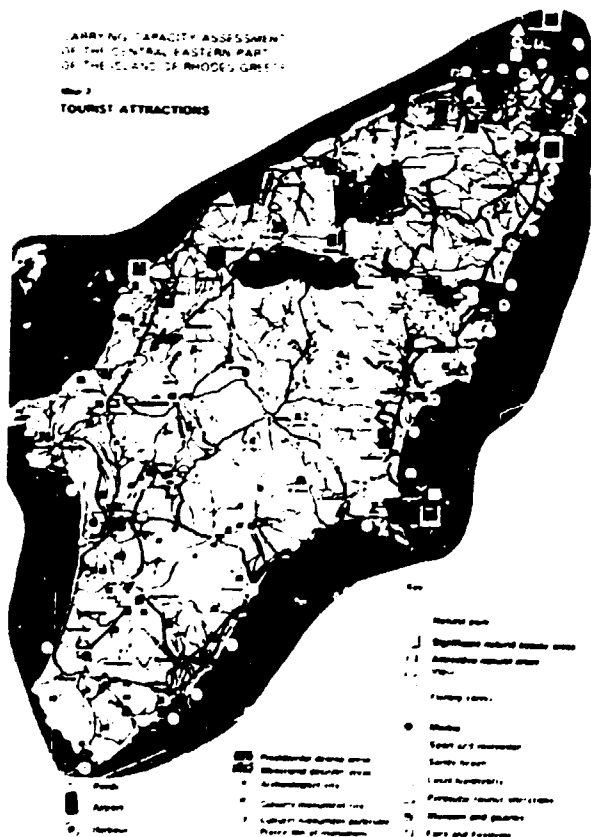
vital resources of the region (water, agricultural land, infrastructure, large urban settlements, natural and cultural values) are located in a comparatively narrow coastal zone, the Plan focuses on the sea, the coastal strip and beaches. The Plan has succeeded to introduce a planning concept which is sympathetic to the sensitivity of coastal resources. One of its objectives is to prevent ribbon developments along the coastline. Basing itself on the principles and philosophy of sustainable development, the Plan recommends the relevant management and protection measures, particularly in the domain of land and sea use, aiming to save the endangered resources and enable their property controlled exploitation.

One of the most valuable outputs of CAMP "The Syrian Coastal Region" is the Coastal Resources Management Plan based on the findings of a preliminary study which identified the main environmental problems and provided guidance for sustainable development of the region. The Coastal Resources Management Plan is addressed to the Syrian authorities, decision makers and institutions with the aim to promote the policy of rational use and protection of Syrian coastal resources. As almost all

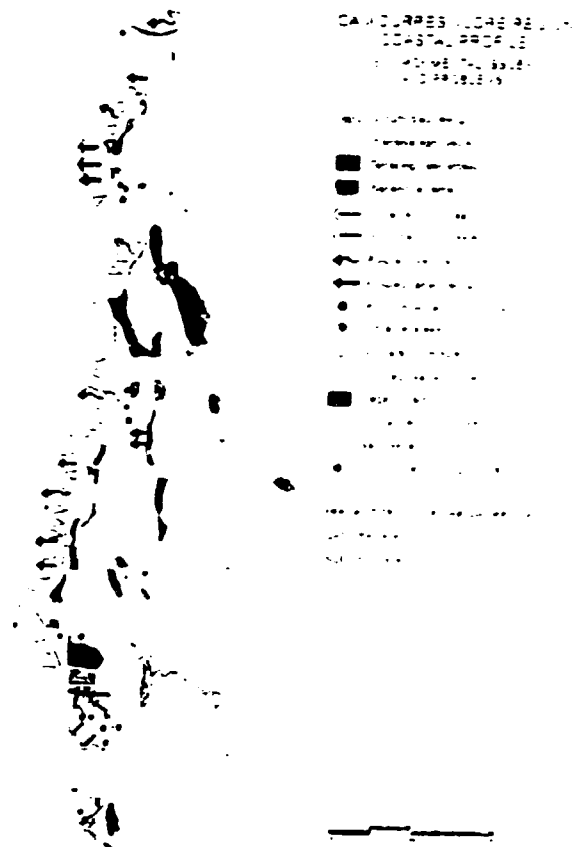


"White Cliffs" - a protected section of the Syrian coast

The island of Rhodes is one of the most important tourist destinations of Greece and of the entire eastern Mediterranean. Intensive development of tourism resulted in tourism becoming the dominant, if not the only economic activity in the island, overbuilding, and complete saturation of some parts of the island, while the plans of tourism development were oriented to a further intensive and uncontrolled development. In such a context, the MAP CAMP was given the following objectives: to prepare a sectorial analysis of all available resources (water resources, traditional and renewable sources of energy, carrying capacity for tourism, areas of special historic or natural value); and to determine the degree of environmental pollution (monitoring of the adjacent sea, liquid waste management system). The results of the project were presented in the Integrated Planning Study for the Island of Rhodes which envisages, among others, a moderate, sustainable development of tourism, and strengthening of other economic activities, and defines water resources and liquid waste management systems for the island. The second phase of this project, still in course, is entirely financed by EIB-METAP



expected to take the heaviest development pressures, and where competition over the allocation and use of coastal and marine resources, including space, is likely to be the severest. The major objectives of the Programme are to propose the management of coastal resources on a sustainable basis through the process of integrated planning and management, and to provide guidelines for eliminating the land-use and other problems this coastal region is faced with.

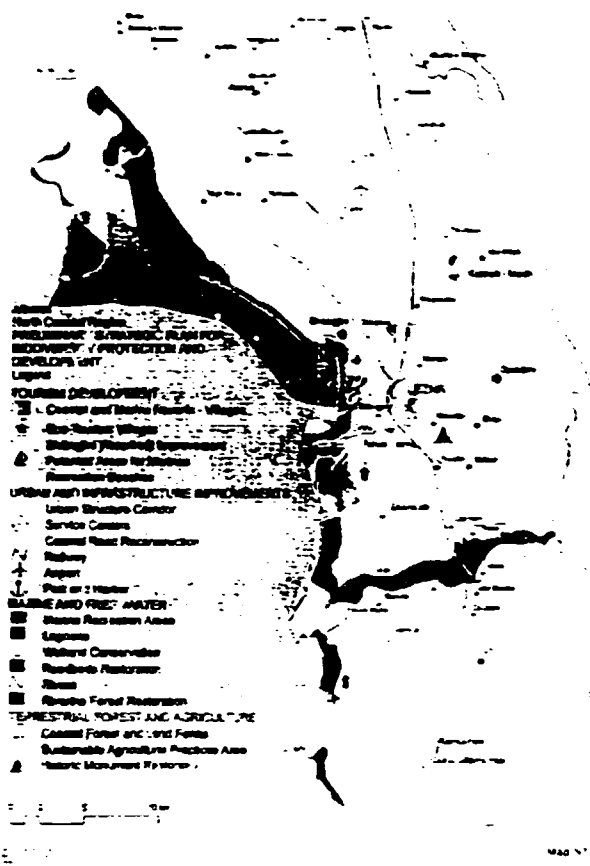


Owing to their very extensive expertise, PAP and Dobbin Milus International (DMI) have been entrusted by the World Bank to prepare, as a joint venture, an overall Coastal Zone Management Plan for the remaining two Albania's coastal regions - the North and the South Region. The principle goals of



Shengjini harbour and beach in Albania's North Coastal Region

Partly owing to Albania's long economic and social isolation, its coastal environment is still relatively intact. However, some localized coastal areas are already severely impacted by human activities which are negatively affecting both human health and degrading the productivity of marine and coastal ecosystems. CAMP "The Albanian Coast" focuses on the coastal region of Durrës-Vlora which is



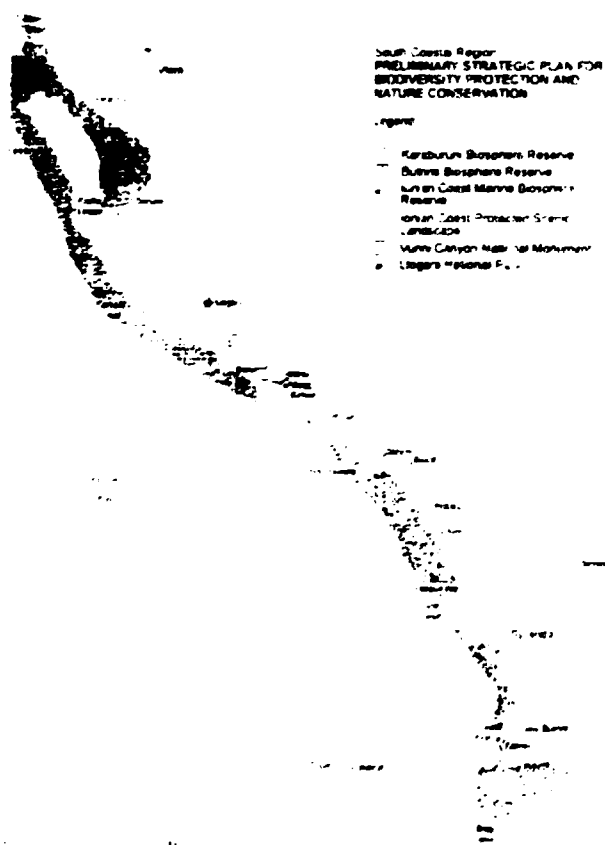
framework and specific areas and categories of protection, identifies tourism development by type and zone, and recommends actions towards the improvement of legal, institutional and capability structures.



Ksamil Bay - Albania's South Coastal Region

this Plan are to contribute to: (a) biodiversity protection of marine and terrestrial environments; (b) tourism development; and (c) institutional capacity building. The Plan proposes a general strategic

The principal advantage of PAP is its experience in carrying out ICAM projects. Small, but competent and highly efficient staff in Split proved capable of simultaneously creating, organizing and implementing a large number of various activities (projects, missions, meetings, seminars, workshops, training courses), as witnessed by high acclaim from Mediterranean countries. Also, in the implementation of large projects and complex tasks, PAP makes working connections with other institutions with commendable ease, even outside the MAP framework. PAP gained experience and proved efficiency in managing projects financed by the World Bank (Coastal Zone Management in Albania) and European Investment Bank within the METAP programme (Kastela Bay, Island of Rhodes)



On the other hand, the PAP's reputation in ICAM extends beyond the Mediterranean region, which prompted UNEP to engage it as the leading institution for the ICAM programme for the Eastern Africa (UNEP in cooperation with FAO, USAID and the University of Rhode Island, USA) and for Western Africa.



Beach rocks and sand dunes of Xai-Xai, a coastal area in Mozambique

Priority Actions Programme, Coastal Area Management Programmes, Overview of GIS Related Activities²

- 1 In the period 1989-93, the Mediterranean Action Plan (MAP) has been implementing four Coastal Areas Management Programmes (CAMPs): The Kastela Bay, The Island of Rhodes, The Bay of Izmir and The Syrian Coast. Priority Actions Programme (PAP) has been participating in activities which fall within its terms of reference. One of the most important activities within each of the above CAMPs was the preparation of the Integrated Planning Study, covering a selected coastal area. As a separate activity within the four on-going CAMPs, training was organized on GIS and pcARC/INFO. One of the outputs of this activity is the development of GIS applications supporting planning activities within the CAMPs. This report presents final synthesis of the experience gained in the training programme. Apart from the final reports for each of the four CAMPs, which were prepared using site-specific approach, in this document a topic-specific approach is used.
- 2 The pcARC/INFO software (to be used on non-commercial basis), IDRISI software, and a part of the hardware equipment in PAP GIS lab were acquired by kindness of Environmental Systems Research Institute (ESRI), Redlands, USA (manufacturer of pcARC/INFO), United Nations Environment Programme - Global Resources Information Database (UNEP-GRID), Nairobi, and United Nations Institute for Training and Research (UNITAR), Geneva. Furthermore, UNEP-GRID and UNITAR carried out the GIS training programme in Split within the CAMP "The Kastela Bay". For the training programme within other three CAMPs, PAP, UNITAR and UNEP-GRID, provided pcARC/INFO software, while local authorities provided hardware equipment.
- 3 The results of the activities within the four on-going CAMPs can be summarized as follows:
 - A GIS lab was established;
 - The local GIS team was trained on GIS and pcARC/INFO;
 - A GIS database was prepared, covering environmental, socio-economic and resource data.
 - For the needs of the Integrated Planning Study, a pilot-application was prepared and developed by local GIS and planning team.
- 4 Training programme on GIS within the four MAP CAMPs was generally carried out in the following phases:
 - Basic training course (introduction to GIS and pcARC/INFO for the leaders of local GIS teams).

¹ Priority Actions Programme/Regional Activity Center, Split, Croatia, tel. 385-21-43-499, fax 385-21-351-677

² Prepared by Gojko Berlengi, PAP/RAC Consultant for ICAM and GIS

- **First follow-up (data input and editing for the pilot-application):**
- **Second mission (training course - spatial analysis and modeling, cartographic production Work on the pilot-application):**
- **Second follow-up (spatial analyses for the needs of the pilot-application. Preparation of plotter outputs).**
- **Third mission (work on the pilot-application):**
- **Third follow-up (final work on the pilot-application):**
- **Fourth mission (training course on advanced capabilities of pcARC/INFO):**
- **Final mission (presentation of the results of the training programme and final report to the representatives of local authorities. Discussion on and evaluation of the training programme).**

5. **A number of GIS pilot applications were undertaken as a part of training programme targeting to support planners' activities within the context of the Integrated Planning Studies preparation. They were of two broad types: problem-oriented and inventory-related applications.**

Problem-oriented applications could be viewed as one-time analyses or simulations of a specific problem within the area in concern. Such applications do not always require a large database, but a greater flexibility of its use. Problem-oriented applications developed during the training programme are: **Regional Scale Urban Suitability Model for the Area of Izmir, Suitability Analysis for Tourism Development (Rhodes), Model of Attractiveness for Growth/Development and Potential Impact upon Coastal Zone Resources (Syria), Site Quality Assessment within the Historic Core of Srit (Kastela Bay), and Application of GIS for Valuation of Soils for the Study Area around Trogir (Kastela Bay).**

In that sense, the **regional scale urban suitability model for the area of Izmir was undertaken as a part of the Integrated Planning Study preparation (CAMP "The Bay of Izmir"-Turkey). The model aimed at the assessment of the land suitability for urban development within the Izmir area. Its purpose was to support the phase of the early evaluation of urban development possibilities within the area under the concern. The final result of the model is given in Figure 1.**

The basic concept of the model was defined by analysis of interactions between the three sets of mutually related factors: locations, development actions and environmental impacts. These factors may be combined in several different ways to derive at least three types of models. In this case the developmental action (urban growth) and environmental effects that should be minimized (loss of agricultural land, deforestation, water pollution) were known, so it was possible to define the criteria and then to evaluate and map the most and the least suitable locations.

The evaluation was made by means of identifying the set of spatial factors whose cumulative effect determine the degree of suitability of site for urban development. In keeping with the defined developmental action and environmental effects of the proposed model, the following factors were chosen:

- **site slope;**
- **soil fertility;**
- **terrain stability;**
- **land cover types;**
- **distance from roads and railroads;**
- **distance from the existing sewer and water supply system;**
- **water protected areas.**

Since land variables are not, in reality, all equally important in determining site suitability, so the model, in order to be more reliable, should incorporate varying degrees of their importance or weights. At the same time, it was learned that the manipulation of different weights with manual overlays would be rather cumbersome. Consequently, the suitability modeling process was completely performed within GIS framework. In this case, the usefulness of GIS was recognized through its ability to cross correlate spatially distributed factors and related attributes and to

perform with ease relatively complex quantitative measurement of site suitability. This is, among others, one of the major advantages that GIS holds over manual techniques.

The second example includes the **suitability analysis for tourism development**. This application was developed as a part of the Integrated Planning Study preparation for the Island of Rhodes, and represents a preliminary site selection analysis searching for "free" areas which are suitable in size, shape and position for tourism development. The application is illustrated in Figure 4.

The starting point for the analysis was an assumption that for any tourism development should exist some basic attraction. In the case of the Island of Rhodes, it is proximity of the natural sandy beaches. This is the case (practically with no exception) with the all tourist installations on the Island. So, the areas of the search were reduced on buffered (1km) zones around existing sandy beaches on the east coast of the Island of Rhodes. In the next step, from these zones the land categories such as built up areas, forests, fertile land, streams' beds, protected sites (buffered) etc., were excluded. The procedure described is preliminary level analysis and it should be continued with more in depth examinations of these "free" areas (e.g. field survey).

The third example is the **suitability model for the siting of industry** within the Kastela Bay. The analysis focused on less flexible industrial branches - those branches which demand large areas, generate significant incoming-outcoming traffic, etc. A limited set of criteria was used, referred to:

- the natural conditions and the value of the study area;
- the present use and the development of the area;
- the accessibility and fittings of the sites.

The first phase of analysis roughly categorized the study area into the following categories:

- occupied areas;
- naturally unsuitable sites,
- partially valuable and conserved sites,
- relatively free, naturally more or less acceptable sites, which are the potential sites for the siting of industry

The objective of this phase was to determine areas which had to be excluded from further analysis (the first three of the above categories). The following limitation factors were considered:

- Site slope of over 20%.
- Areas within 100m from the existing streams.
- Areas defined as zones for afforesting.
- Areas which constitute potential finds.
- Sites of particular natural value;
- Built-up and developed areas.
- Protective corridor of the airport.
- Areas of special use

For the rest of the study area, a linear weighted model was applied, using the following criteria

- Site slope,
- Carrying capacity;
- Land use,
- Distance from main roads,
- Distance from refraction point;
- Distance from present water supply system,
- Size of the site,

- Compactness (shape) of the site

The results of the analysis, can be summarized as follows

- The study area has the low degree of its attractiveness for the siting of less flexible industry;
- Within the potentially suitable areas (i.e. areas not excluded in the first phase of the analysis), the unsuitable and less suitable sites are dominating. Only 6% of the study area was categorized as suitable.

The fourth example includes the application of GIS for valuation of soils for the study area around Yrogir. As a tool for valuation of soil suitability for a given use, a semantic GIS model was developed in this pilot project. It was based on fuzzy set reasoning and implemented using a combination of vector and raster GIS. In the model several soil properties were chosen for evaluation (soil depth, organic matter, soil texture, content of nutrient K_2O , K_2O_5 , content of free $CaCO_3$, content of cadmium).

Since the spatial distribution of these properties is continuous, a vector GIS has been inadequate for the analysis. Namely, it is well known that borders between polygons in vector GIS layers are generally definitive and can not be smoothed, so the overlay technique based on Boolean reasoning was not the best choice for the valuation of soil suitability. For this reason, the raster GIS and fuzzy reasoning were used for the application. In few words, the fuzzy reasoning deals with sets whose members have so called "membership grade"- the number between 0 and 1, and several fuzzy quantifiers used to denote quantifiers in natural language, such as: several, most, much, not many, few etc.

Spatial distribution of soil properties was evaluated using Kriging interpolation method, and transferred in a raster GIS. A vector based GIS was used to digitize roads and other structures within the study area, which were then converted to raster format. To enable easy performing of all analyses which include fuzzy reasoning, a GIS compatible programme was written. It enables:

- calculation of fuzzy membership grades based on given membership function;
- composition of comparison clauses using logical AND and OR;
- weighted union of fuzzy sets;
- screen output for each layer etc

Inventory-related applications covered the establishment of the multi-faced GIS database to address broad socio-economic, environmental and resource questions. Such applications are: Regional GIS Database for the Area of Izmir, Regional GIS Database for the Island of Rhodes, and Pilot-Application for the Urban Information System of Split

In these cases the GIS ability to provide a framework for the flexible database design has been recognized. In that sense, GIS has proven to be very useful for a range of applications in resource and facilities management, growth management, land information storage and retrieval etc

6. For some of the above applications, user-interfaces were developed using pcARC/INFO's Simple Macro Language. Typical tasks offered by these interfaces include the following:

- drawing and removing one or more data layers with keys and scalebars;
- pan and zoom functions;
- getting attribute data or associated text files of the indicated spatial element of the layers drawn;
- performing some simple statistics on selected set of spatial elements (selection can be based on attribute or spatial criteria).

7. General framework for GIS support in planning, practically set up within CAMP GIS training programmes, is desktop planning GIS as a planners' working environment. "Desktop" here means a PC based system, affordable enough to be on the planners' desk. The core of a such a system is appropriate GIS database and a number of applications developed by and for planning team. It should be pointed out here that the role of computers in planning is always at the level of

tool (not an autonomous decision-making mechanism) offering support to the decision making but with the planner as a central figure of the overall process. It should be also noted that desktop planning GIS, besides being an immediate output of the CAMP activities, can be regarded as simple pilot projects for more complex, multi-user GIS, what is one of the long-term objective of the whole activity. That was the reason why the local GIS teams were composed of representatives from different fields (civil engineers, architects, urban and regional planners, environmental engineers, information specialists and the others).

8. Experiences gained through the CAMP GIS training programmes and presented in the four individual reports as well as in this summary report, will be the subject of the workshop proposed for the end of 1992 or the beginning of 1993. Although the analysis and the assessment of this activity will be done within the workshop, the following conclusions are proposed for further discussion:

- Local GIS teams which are established and trained in each of the four MAP CAMPs, have basic knowledge on GIS and pcARC/INFO, and are capable to prepare and develop GIS applications dealing with the process of integrated planning and management of coastal zones;
- Hardware configuration used by local GIS teams were sufficient for the training programme;
- pcARC/INFO and IDRISI software turned out to be suitable tools for the training programme;
- The applications developed within MAP CAMPs GIS training programmes proved to be practical and applicable decision support tools and were successfully used in the process of Integrated Planning Studies preparations;
- The contents and quality of the GIS databases developed as a part of training programme, were satisfactory basis for various applications developed as well as a simple resource inventory tool;
- Multidisciplinary backgrounds of the local GIS team members proved to be the best solution having in mind long-term objective of building multipurpose GIS as well as short-term goal of setting up desktop planning GIS to support Integrated Planning Studies preparation;
- As a next step in GIS database development it is proposed that the automated data layers be transferred back to the relevant institutions which made all necessary analogue data available to local GIS team. This proposal also aims to the long-term objective of setting up multipurpose GIS in places where GIS training programme was carried out;
- Some of the applications developed were far ahead of the GIS training programmes needs but came out as a useful tool in planning and management of coastal zones

PAP/RAC, preferably in cooperation with GRID-UNEP and UNITAR, is ready to transfer the experiences related to the applications described above, as well as the other ones aiming to support the process of integrated planning and management of coastal zones, to all interested Mediterranean coastal states or areas.

Mr.Chairman,Distinguished delegates, Ladies and Gentlemen

It is honour and pleasure for me to adress the "Workshop on Environmental Impact: Assessment and Siting of Industrial Activities Using Geographic Information Systems"

On behalf of the ICS Project Leader Prof.Dr.Ugo Leone

I would like on behalf of the executive Coordinator Louis.F.Cassar of International Environment Institute As well as on my own behalf to express our deepest gratitude and appreciation of the secretary Elisa Sorti de Roa.

I also take this opportunity to salute you and all the distinguished delegates attending the workshop on behalf of the ICS Secretary

Prof.Dr.Nihat Taşpınar

*Dokuz Eylül University Civil Engineering Dept
Bornova-izmir/TURKEY*

&

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**Workshop on Environmental Impact
Assesment and Siting of Industrial Activities
Using Geographic Information Systems
In Coastal Zone Management(CZM) an Application
to Izmir Bay and Çeşme Peninsula**

by
N.TAŞPINAR

Preface

The Institute of Marine Science and Technology (IMST) established in 1975. up to now the Institute had numerous govermental and indivisual project inside or outside

The Institute has an extensive data base on Aegean Sea,Mediterranean and the Black Sea as a consequence of long term monitoring programes and high level scientific interest of its members.

The Institute just decided to form a Geographical Information System (GIS) to provide a recepticle for scattered data form various sources such as data acquisition cruises,numerical modelling remote sensing,etc.

Introduction

The coastal area represents the interface between land and the sea and includes primarily the shoreline environments and the adjacent coastal waters of the exclusive economic zone (EEZ).

Today 60% of the worlds populations is living in coastal regions and by 2050 realistic estimate predict that 10 billion people will be living along the coast.

About 95% of the total population growth is expected in developing countries and by the of this centruy more than two thirds of the population in the developing countries is located coastal areas.

As it's known, the management of the coastal,natural resourses and the design of coastal engineering works demand an accurate knowledge of the wave,current and the other oceanographic parameters.

Examples of such activities are;shipping,offshore platforms,breakwaters,fisheries,oil and gas production and waste water disposal systems.

In the past,information should have been suggested only by conventional monitoring studies(in-situ measurements).But now,the new techniques are available.

For examle,the use of computerized geographical information systems (GIS) make it possible to process large volumes of geographically referenced data from multiple sources that can be integrated to produce maps.monitor changes in recources.coordinate resource uses and simulate impacts from management decisions:remote sensing systems using satallites and aircrafts make it system it possible to collect and analyze information about recources and land use over large areas:Marine buoy systems make it possible to

continuously monitor and evaluate trends in environmental parameters and pollution levels in the sea, on-line via satellite and developments in knowledge based computer systems (such as expert systems), simulating modelling techniques and analytical methods has provided managers as well as scientist with powerful decision support systems at different levels.

The nature of the issues dealt with in a coastal management programme clearly indicates that the management problem has a regional and international dimensions.

Why GIS Systems ?

As its known, the high technology is proceeding day by day. GIS is a powerful computer-based systems for collecting, storing, retrieving, analysing, manipulating (transforming) and displaying spatial data from the real world for a particular set of purposes.

In GIS, basically three type of information about geographical elements are stored (points, lines and areas representing objects on the earth's surface)

- **Data source**
 - field observations
 - existing maps
 - non-graphical information

- **Data input**
 - photogrammetric data
 - digitizing maps

- **Data storage**
 - creating and populating geographical database

- **Data analysis, processing & manipulation**
 - position
 - topology
 - attributes
 - linking graphical & non-graphical information

- **Display & reporting**
 - display
 - maps
 - tables
 - graphs
 - charts

Use of GIS in CZM

Integrated coastal zone management (ICZM) is a governmental process for achieving sustainable development of coastal areas by ensuring that the large economic and social benefits are not reduced or eliminated by destructive practices or inappropriate land or water uses.

In shortly, CZM could be defined as dynamic proces in which a coordinated strategy is developed and implemented for the allocation of environmental, socio-cultural and Institutional resources to achieve the conservation and sustainable multiple use of the total coastal area.

Shortly, GIS as a tool for land-based resource management and planning is well established. GIS applications in coastal and aquatic environments are less commen and less well defined.

GIS consist of a potential for significantly enhancing coastal management respectively purposes.

- GIS is the best tool to integrate the data collected from to the different information sources and has a utility to interface graphical and attribute data.
- GIS is useful to improve the understanding of links between the sea and land processes in coastal areas.
- Critical coastal management issues such as sensivity analysis and pollution monitoring require the ability for recourse managers to make rapid and correct decisions.
- GIS provide an increasingly sophisticated tool for decisions-makers with the capability to incorporate a wide variety of alphanumeric and graphic data including remotely sensed imaginary.
- By all means, GIS actually create new information rather than just retrieve previously encoded information.

In order to supply data exchange between The Mediterranean countries and scientest GIS may be improved through the network systems for the associated project (like MEDPOL... etc.) and following five reasons.

- **Very large of geographic data,**
- **Creation sharing of information,**
- **Equal sharing of information.**
- **Integration of diverse geographic information,**
- **Increasing the efficiency of managing and monitoring activities.**

GIS can answer five kind of questions;

1. question concerning the location: What is at...?

This qestion shows the location of the place which indicated on the map.

2. conditional qestions: Where is it?

This qestion requires spatial analysis to answer.

3.question concerning trends:What has change since...?

This question might involve aforementioned previous two questions.

4.question concerning repeating spatial relations and associated conditions.

What spatial patterns exists?

This is a more sophisticated questions,we may ask this question to determine whether a certain kind of illness occurs among residents near a particular kind of industrial plants.

5.modelling questions:What if...?

These questions are posed to determine what happens,if certain condition changes or become true. e.g what happens with the coastline if sea level rises.Answering these type of questions requires both geographical and other information.

Proper Environmental Management Programme

In recent years there has been a growing concern an increased general sensivity of water problem.That is why, the engineers and scientist involved hydro-environmental and ecological studies arising from such potential contamination sources as:

- discharge of both domestic and industrial waste.
- sewage sludge disposal at sea.
- industrial and radio-active waste from chemical plants.
- poor flushing or harbours and marinas.

In order to investigation of water-borne pollution and the formulation of ameliorating usually proceed together through the following stages (Fig.1)

In spite of no model however sophisticated may perfectly reproduce reality,an ad-hoc model must be developed.

For example well-mixed compartment models (box models) are known to simulate the behaviour radionuclides in marine systems.

In the present case it is essential to implement (Fig.2).

Hydrodynamics models describing the flow field in fact the space-time evolution of circulation currents determine the solid and liquid transport.

A proper Environmental Management Programme should consist of the following step:

■ Identification of the problem:

Environment has very wide limits that is why, it is necessary to define priorities and to limit the programme with well defined objectives,like protection of water quality ect.

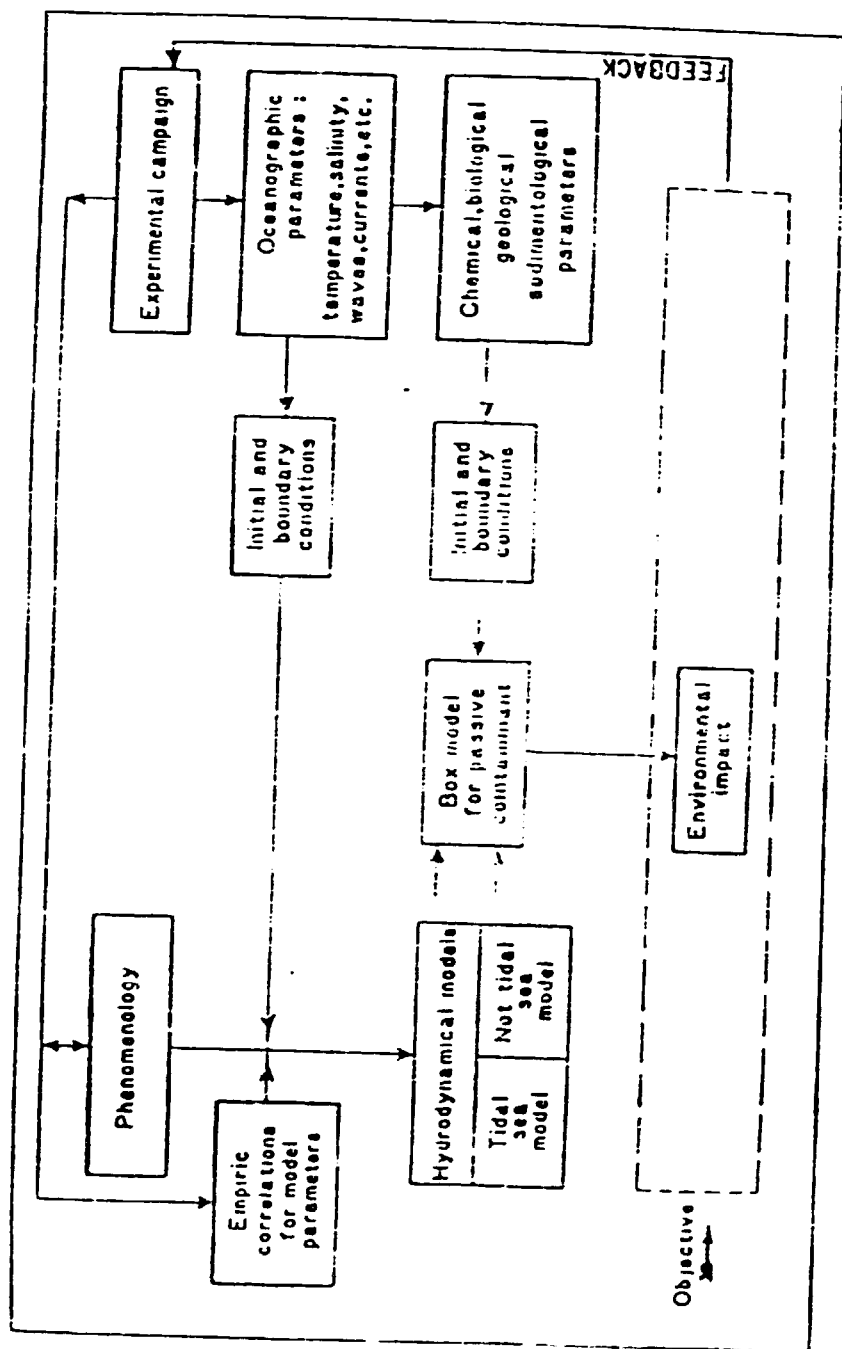


Fig. 2. Simplified conceptual approach to the evaluation of environmental impact in a coastal zone

■Collection of Data-Monitoring:

Availability of data is essential for any sound decision in relation to environmental management. Because of that a monitoring programme should start as early as possible.

■Establishment of Environmental Policy:

Policy decisions should be taken such as;

Prevention rather than treatment preventive measures are cheaper than corrective ones (Lemas,1977)

"The polluter pays" principle, etc.

■Legislation:

This, in the form of laws, by-laws and regulations assist the protection of the environment. Adaptation of legislation prepared for other countries always does not give good results in developing ones.

■Environmental Planning:

This phase of environmental management is interchangeable in priority with legislation. A proper planning should be based on cost-benefit analysis and environmental impact studies it is only after this phase that effective action from the protection of the environment can be taken.

■Implementation:

Monitoring, legislation, planning, etc do not have any effect on the management of the environment. If they are not followed by the proper implementation. This phase, however, is the most difficult and the most expensive one.

■Monitoring, Enforcement and Modification:

This is the last step of an environmental management programme. Monitoring is essential to ensure proper application of the planned and implemented programme. Modifications on the original programme may be according to the data obtained.

Environmental Management In Turkey

Environmental awareness in Turkey was the result of pollution disturbing the every day life of citizens. When the pollution in some areas like the Golden Horn, İzmir Bay and İzmit Bay reached an unbearable level.

Although, there is some main problems today in Turkey which as indicated below: (Curi,1984)

■ The organizational scheme is not the most appropriate. Instead of having regional authorities, a model based on "municipality level control" is preferred.

■ Implementation of plans related to the protection of the environment is very slow. For example "İzmir Bay" project related to the wastewater disposal of İzmir is not realized yet, the project begun about ten years ago, although it wasn't completed yet. The wastes are continuously discharged in the "İzmir Bay" and its pollution increases everyday while the studies on the modification of this project continue.

■ Although qualified engineers and scientists exist in Turkey, there is a lack of intermediate level technicians who are capable of operating treatment plants, performing tests, etc.

Although every year more than hundred and fifty environmental engineers are graduated from the Universities, there is still no attempt providing the so much needed technicians. Lack of any motivation for activities like waste recycling, use of alternative energy sources, etc. which will contribute to the well management of natural resources.

Application of GIS in İzmir Bay

The use of GIS is presented through a case study concerning the management issues of the İzmir Bay which is interesting location to see the negative results of an inadequate management because the efforts aiming to set up an integrated management scheme is very recent although the pollution of the sea has been evidenced for many years.

İzmir is the third largest city located at the innermost part of a natural bay around which dense industrial, commercial and social activities take place.

Especially during the last three decades, the bay has significantly been polluted due to such activities. Pollution is created mainly by the domestic and industrial waste waters which contain significant amount of organic materials, nutrients, heavy metals and pesticides, etc. and reach the bay without any treatment.

The fresh water inflows through the Gegiz river and a number of creeks are the other dominant sources of the pollutants. The present status of the İzmir Bay in this respect is explained by Uslu and Akyarlı (1993) in detailed manner.

Hardware and Software used

As mentioned above (GIS) and (MIS) is developed become crucial parallel to the electronic sector. In a last decade, hardware and software technology developed enormously. Consequently, it would be easy to store, handle, manage and retrieve large amount of data in the system.

The main hardware components of our system summarized as below:

- INTERGRAPH INTERACT 2020 workstation with 16 MB RAM capacity
- 252 MB disc drive & 150 MB INTERGRAPH tape drive
- VDO video display unit: 19 inch monitor with 1280*1024 resolution
- A₀ size INTERGRAPH digitizer and plotter

On the other hand software packages consist of the following five modules.

1. Data input and verification.
2. storage and database.
3. data output and presentation.
4. data transformation.
5. interaction with the user.

Conclusion

Environmental Management is a must for all the countries. The developing world, however, should try to develop the "appropriate technology" instead of fancy and expensive solutions.

An appropriate technology with minimum expenditures will prevent the detrimental effect of pollution on the environment.

It is the duty of the governments as well as of the international management programme, because the detrimental effects of the improper management of the environment are valid for the whole humanity.

ANNEX

Some output samples can be seen in figure 1-10 evaluated by Çalışkan (1994)

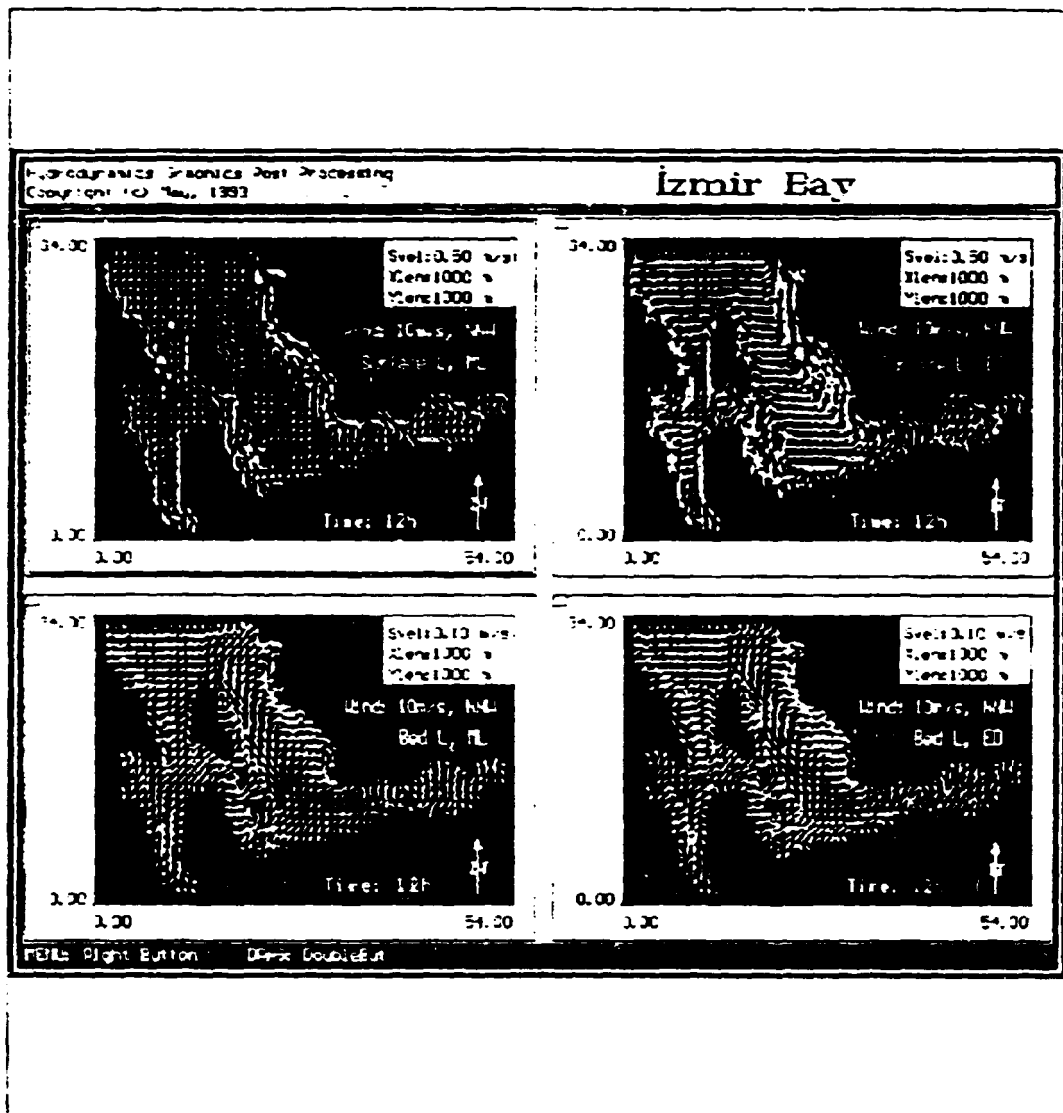


Fig.3. Wind driven surface currents for "Izmir Bay"

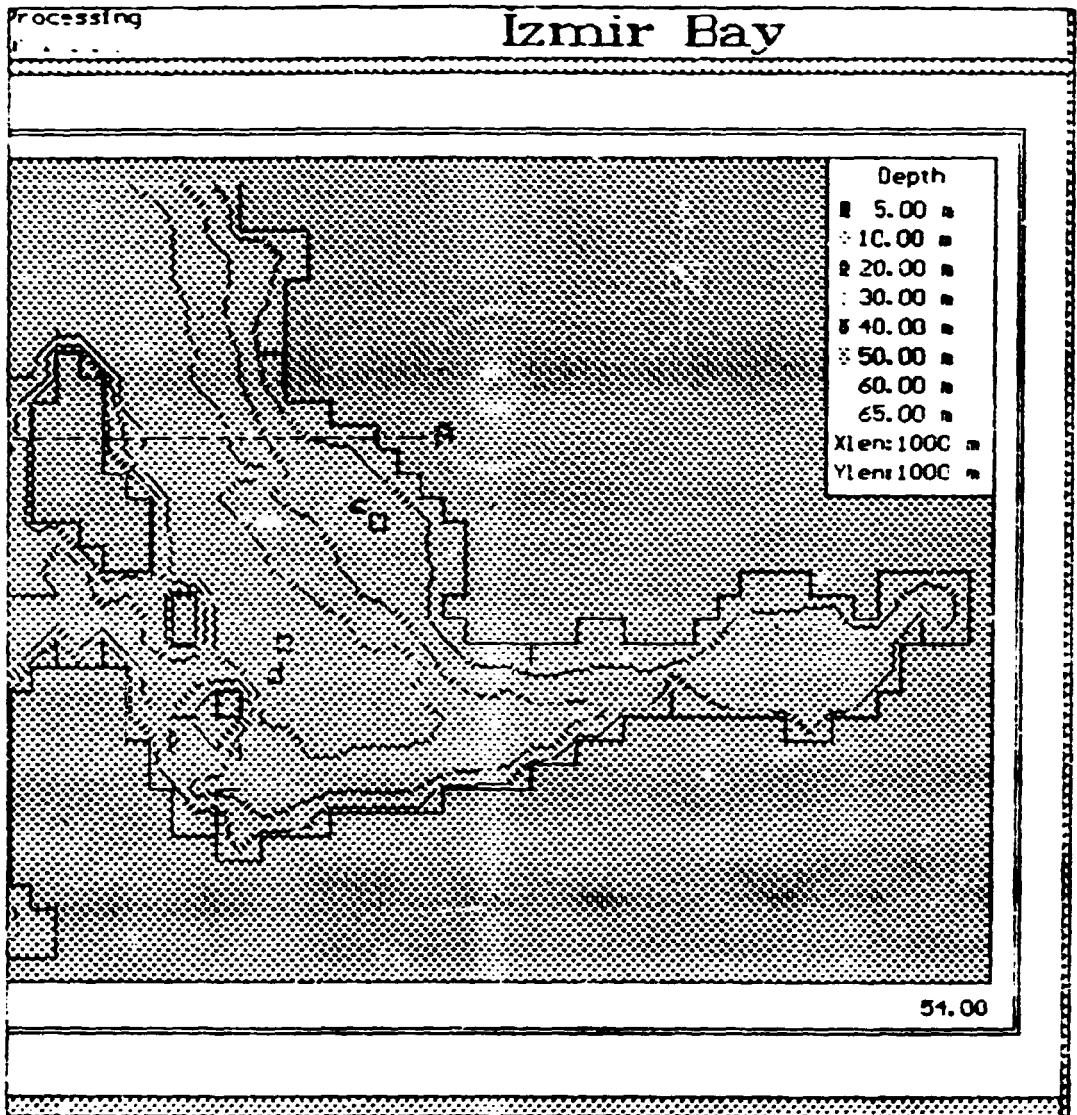


Fig.4.Depth contours in meters for "İzmir Bay"

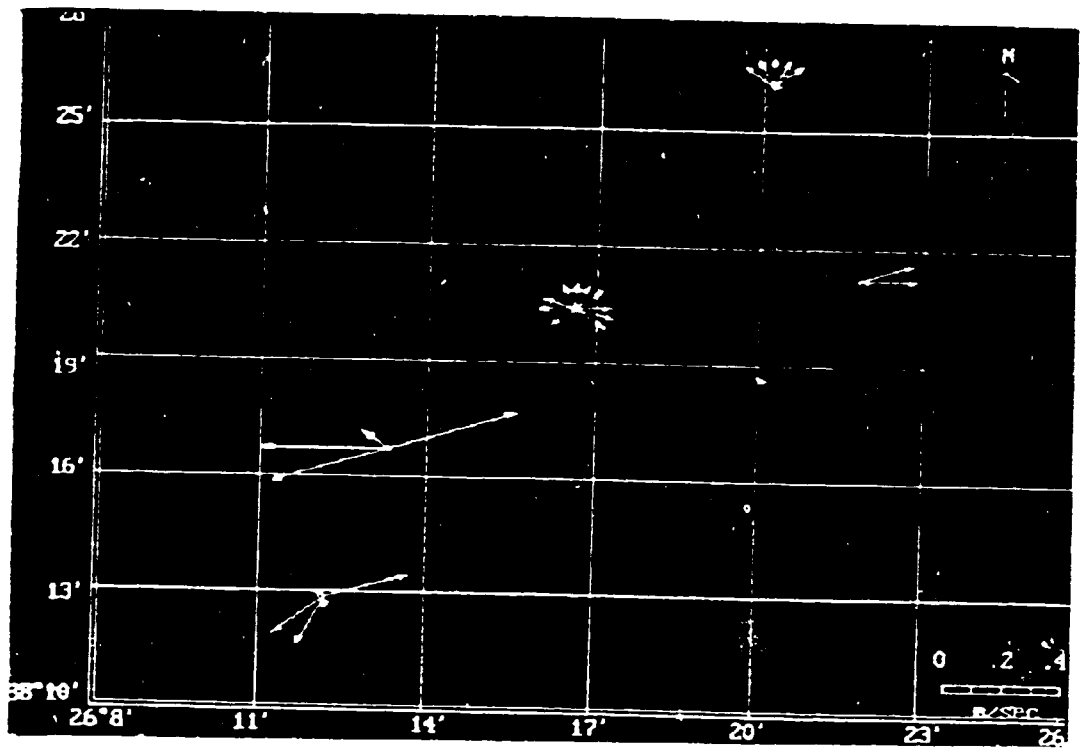
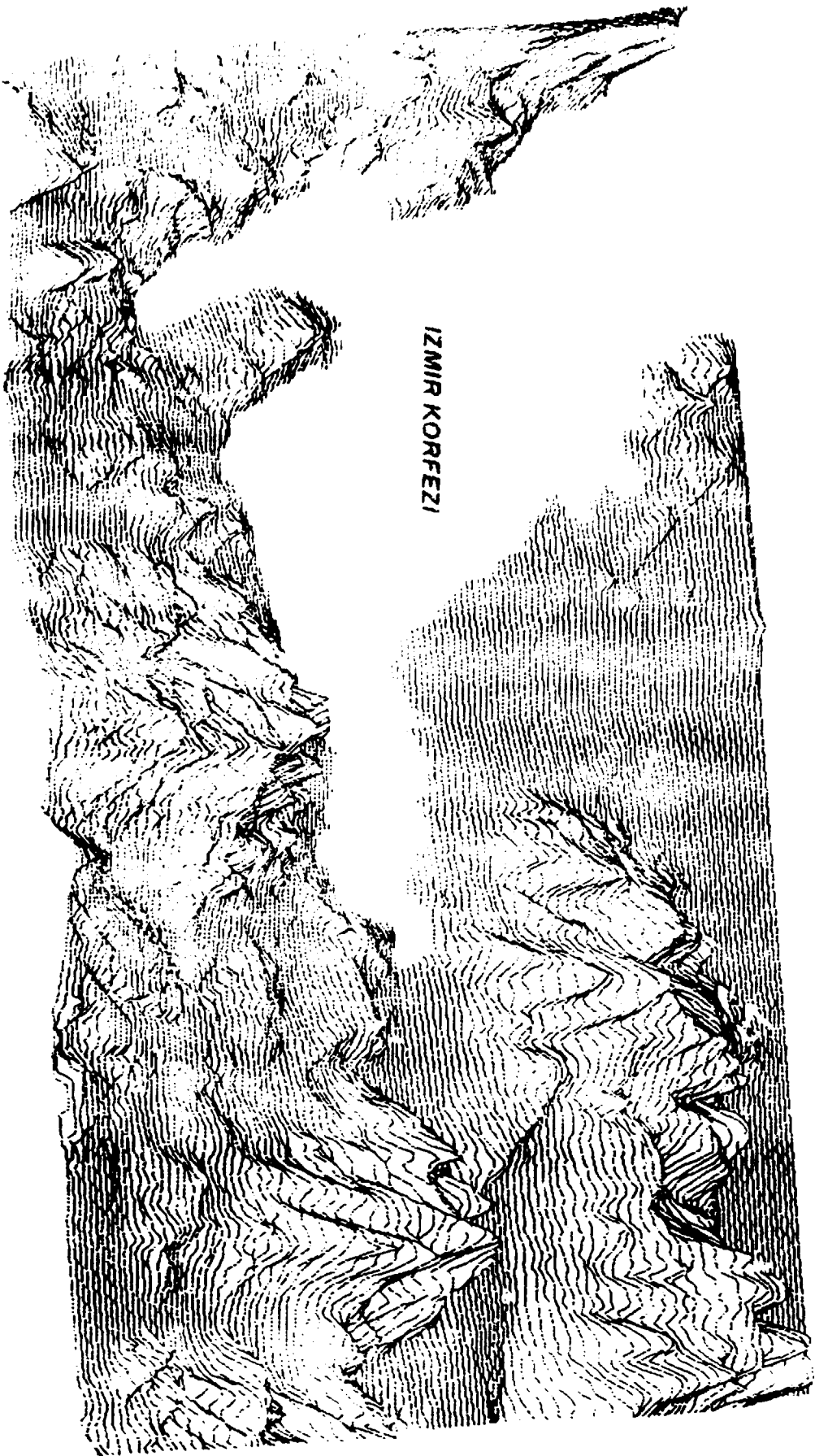
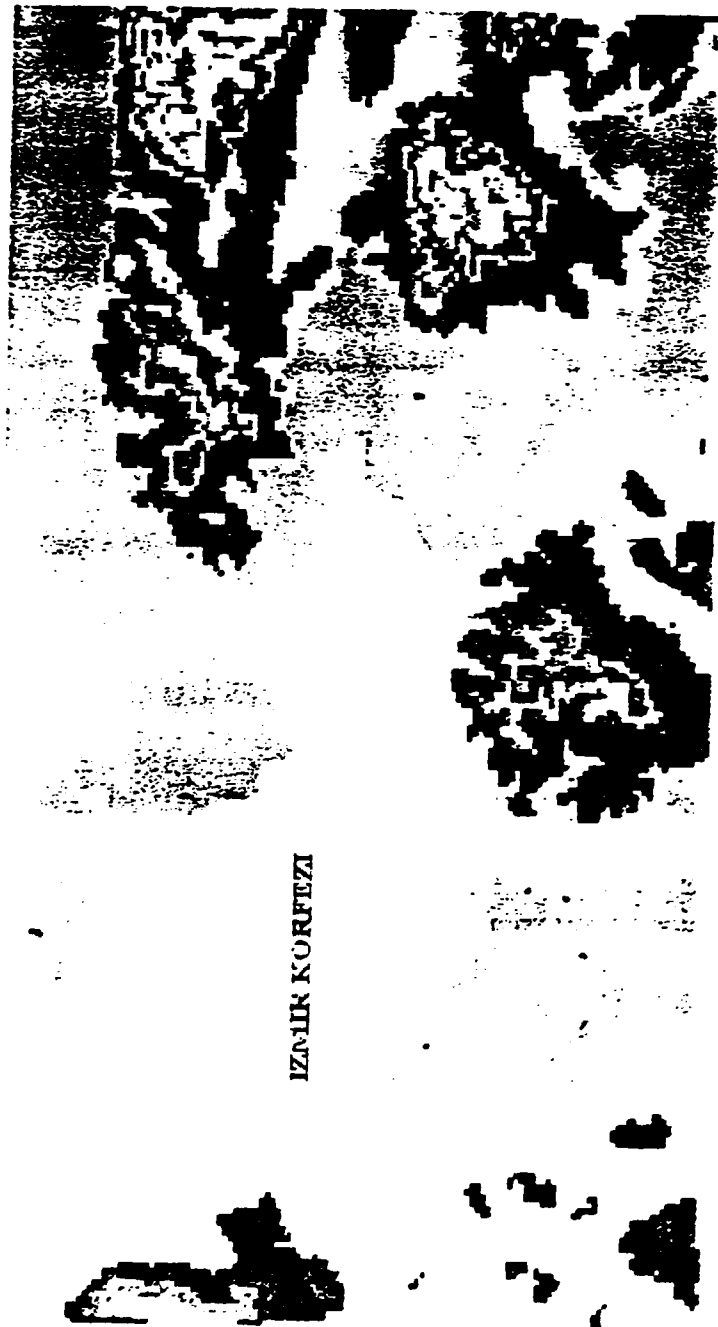


Fig.5 Vector diagram of currents respect to the direction of Çeşme Peninsula-Izmir(Taşpınar,1995)

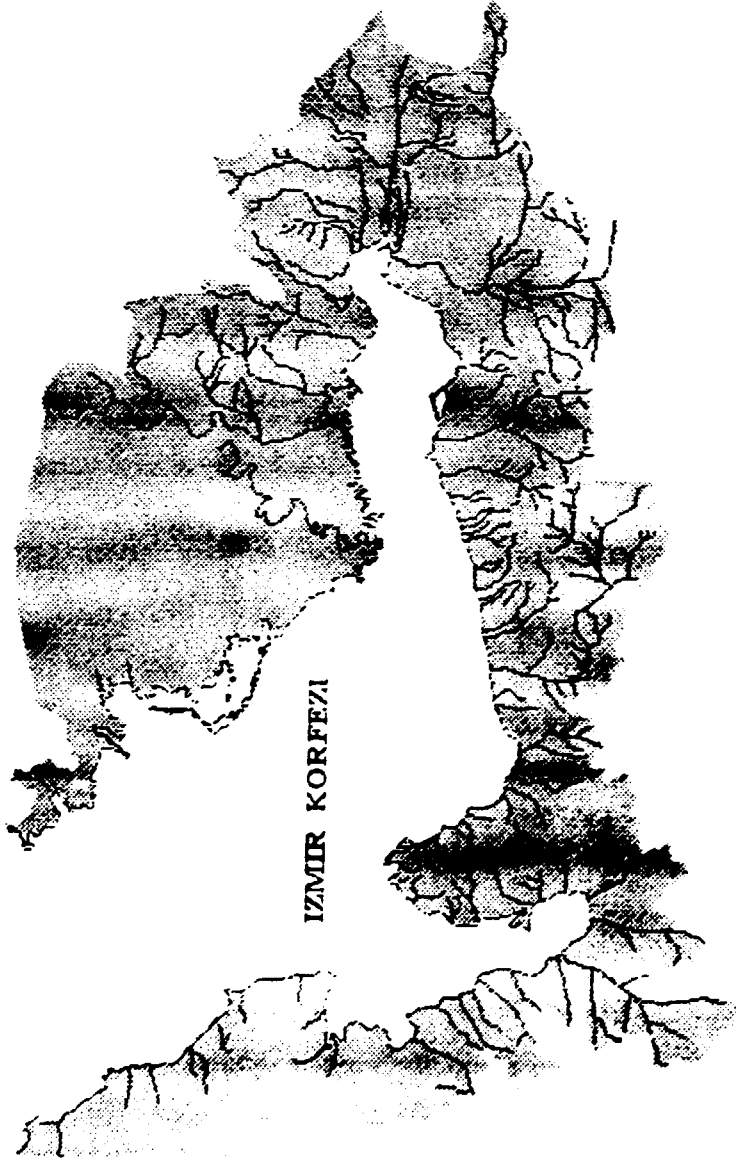




İZMİR KÖRFEZİ

- 100 - 201 M
- 201 - 301 M
- 301 - 401 M
- 401 - 501 M
- 501 - 602 M
- 602 - 702 M
- 702 - 802 M
- 802 - 902 M
- 902 - 1001 M
- 1001 - 1101 M
- 1101 - 1201 M
- 1201 - 1301 M
- 1301 - 1404 M
- 1404 - 1504 M

ŞEKİL 5.5.1.1.: DEM (DIGITAL ELEVATION MODEL) GÖRÜNTÜSÜ



DERELER



SU TOPLAMA HAVZASI



Grid



North

metre's

719.2676

İdrisi

SEKİL 5.5.1.3. : İZMİR KORFEZİ SU TOPLAMA HAVZASI

*Workshop on Environmental Impact
Assesment and Siting of Industrial Activities
Using Geographic Information Systems
In Coastal Zone Management(CZM) an Application
to Izmir Bay and Çeşme Peninsula*

by
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Gozo..Malta
2-6 October.1995

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Ladies and Gentlemen,

The Workshop on "Environmental Impact Assessment and Siting of Industrial Activities Using Geographic Information Systems" which was held on September 2-6 ,1995 in Gozo.

I believe we have been very helpful in studying many problems and finding out solutions there of.

Now we are going to deal with the items in our study program for five days' time.

I am sure,we will reach at very useful conclusions.

The items of our agenda,such as,Environmental Impact Assessment,Geographic Information Systems and Remote Sensing and Training is very important problems.

I'll try to emphasize on GIS in Coastal Zone Management and Application İzmir Bay and Çeşme Peninsula.

I believe that Prof.A.Fabbri,Dr.Patrono and Prof.E.Feoli are going to deal with this matter through their demonstrations and they will tell us many important things on things on this subject.

I recommended to these concerned,that they must pay great attention on their suggestions.

Thank You

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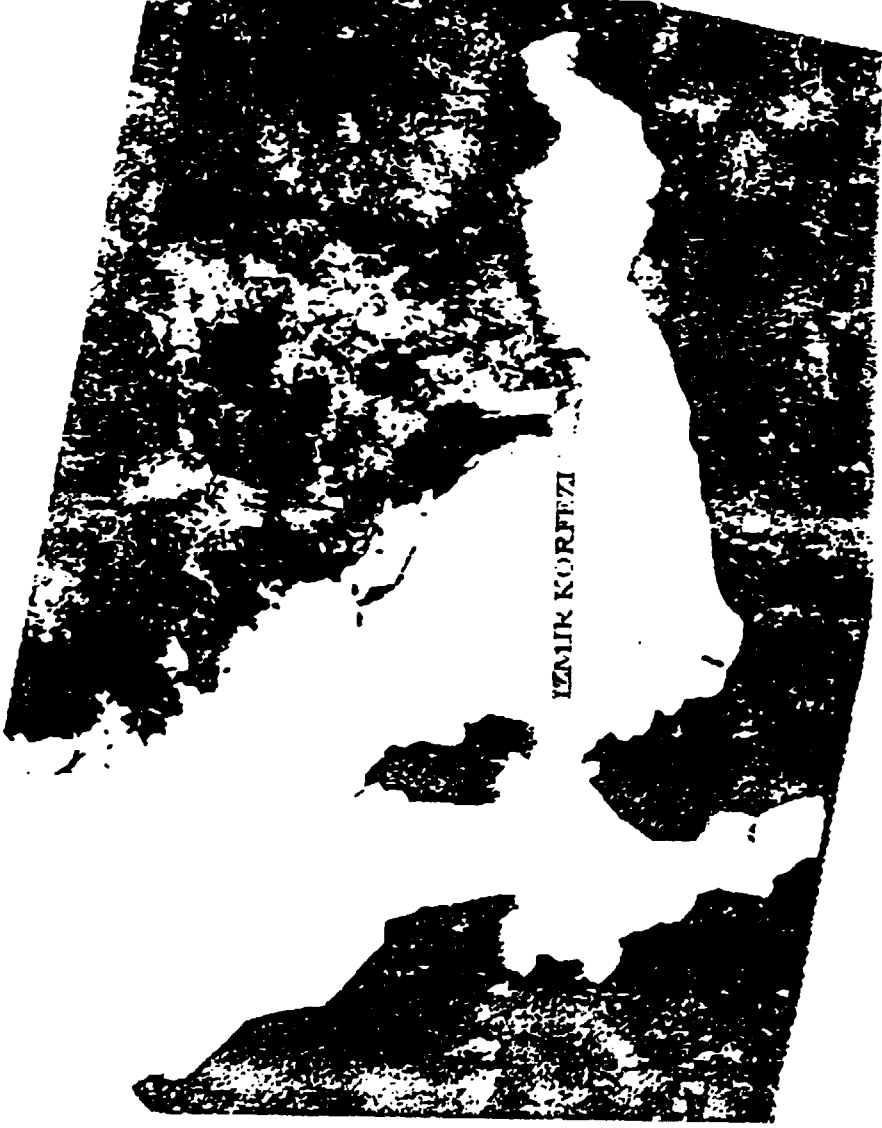
Phone : (00 90-232-388 10 47) Office
: (00 90-232-388 28 17) Home
Fax : (00 90-232-388 78 64) Office



ŞEKİL 5.5.2.1 İZMİR NÜFUSPOLİTAN ALANI ARAZİ KULLANIMI HARİTASI



SERII. S.S.2.2. : 1984 YUJJA AIT LANDSAT TMUYUUGORUNTUSU



- YERLEŞİM ALANLARI
- TARIMSAL ARAZİLER
- DOĞAL BİTKİ ÖRTÜSÜ

ŞEKİL 5.5.2.3. : SINIFLANMIS UYDU GÖRÜNTÜSÜ



İZMİR KÖRFEZİ

- Yüksek yoğunluklu yerleşim
- Orta yoğunluklu yerleşim
- Düşük yoğunluklu yerleşim
- Sarıya sızması
- Sanayi bölgesi
- Organize sanayi bölgesi
- Tarımsal bölgeler
- Doğal bitki örtüsü
- Havza



İZMİR KORFEZİ

- 77608 100 Yil (yuk yug yer)
- 161893 100 Yil (ow la yug yer)
- 15334 100 Yil (his yug yer)
- 7521 100 Yil (sanayi bolg)
- 7523 100 Yil (sanayi bolg)
- 7523 100 Yil (sanayi bolg)
- 242949 100 Yil (farmarastleri)
- 3331 100 Yil (dogal miktet)
- 400000 100 Yil (Gazli Nehri)

ŞEKİL 5.5.7.1.: İZMİR KORFEZİNE NOKTASALAMA YAYGIN KAYNAKLARDAN GELEN TOPLAM AKMI YUKLERİ

Şekil 5.5.7.1. Şekil 5.5.7.1.

İZMİR KORFEZİ

33993	İnn-yıl (ylık, yug yri)
38940	İnn-yıl (orta yug yri)
4395	İnn-yıl (ilim, yug yri)
20352	İnn-yıl (sanayi boig)
20352	İnn-yıl (sanayi boig)
20352	İnn-yıl (sanayi boig)
136	İnn-yıl (harım azalirri)
88	İnn-yıl (dögal hikki nri)
7848	İnn-yıl (Qeddi Nehri)

ŞEKİL 5.5.7.2 : İZMİR KORFEZİNE NOKTASAL VE YAYGIN KAYNAKLARDAN GELEN TOPLAM BOY YÜKLERİ



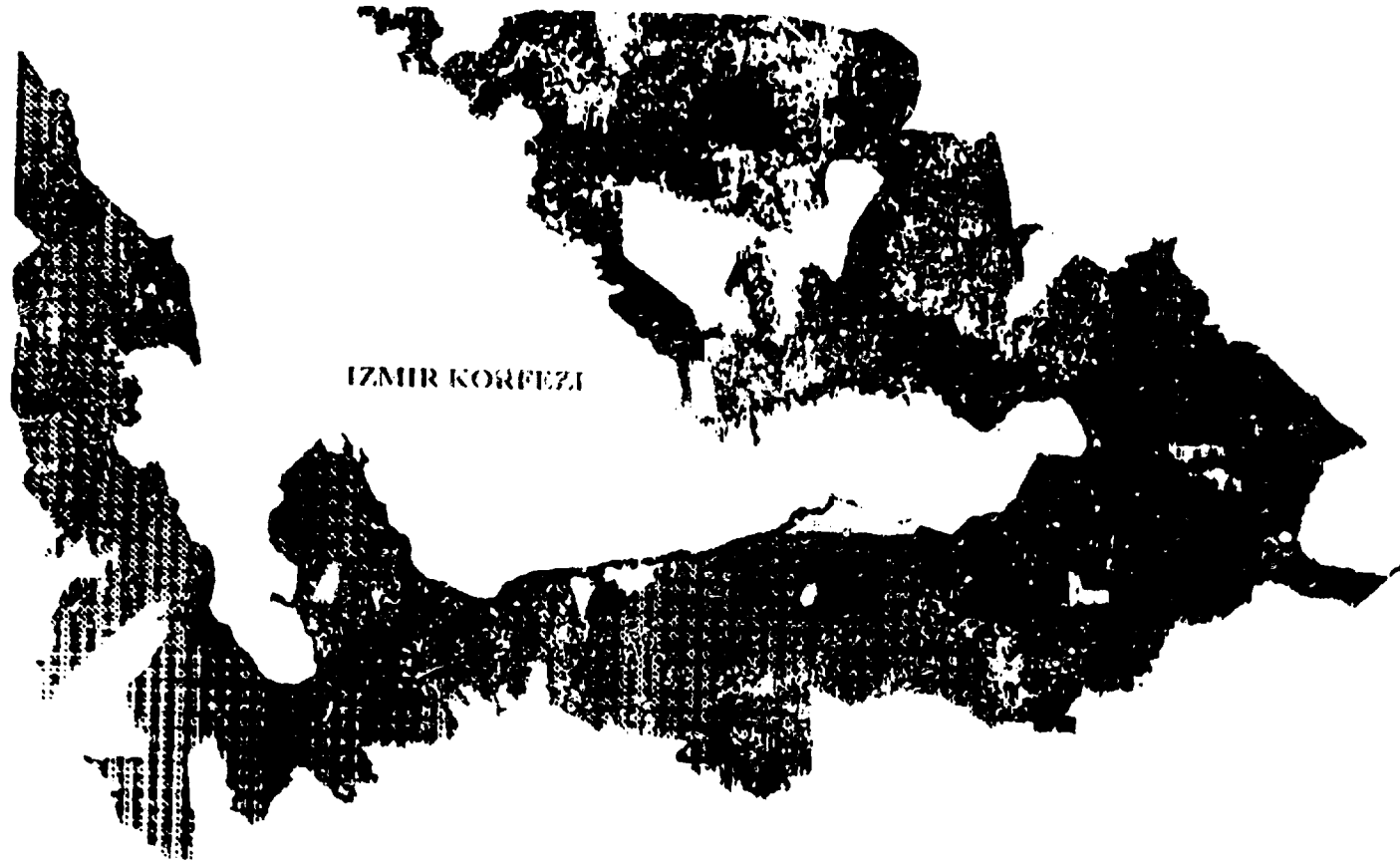
İZMİR KÖRFEZİ

40246	ton/yıl (yük. yag. yer.)
72915	ton/yıl (orta yag. yer.)
5500	ton/yıl (düs. yag. yer.)
40161	ton/yıl (sanayi bölg.)
40461	ton/yıl (sanayi bölg.)
40461	ton/yıl (sanayi bölg.)
272	ton/yıl (arzu aradığı)
241	ton/yıl (deng. bikişi net.)
1350	ton/yıl (Gediz Nehri)



4753	(mıfı.yog.yer.)
9147	(mıfı.yog.yer.)
731	(dus.yog.yer.)
369	(sanayi boğ.)
369	(sanayi boğ.)
369	(sanayi boğ.)
413	(tarım arazileri)
96	(dijal bldki orf.)
3153	(Gediz Nehri)

ŞEKİL 5.5.7.4 : İZMİR KORFEZİNİN NOKTASAL VEYA YAYGIN KAYNAKLARDAN GELEN TOPLAM AZOT YÜKLERİ



- 1827 ton/yıl (yük.yog.yer.)
- 3656 ton/yıl (orta.yog.yer.)
- 365 ton/yıl (düş.yog.yer.)
- 25 ton/yıl (sanayi bölg.)
- 25 ton/yıl (sanayi bölg.)
- 25 ton/yıl (sanayi bölg.)
- 63 ton/yıl (tarım arazileri)
- 25 ton/yıl (doğal birikimler)
- 1007 ton/yıl (Gediz Nehri)

ŞEKİL 5.5.7.5 : İZMİR KÖRFEZİNE NOKTASAL VE YAYGIN KAYNAKLARDAN GELEN TOPLAM FOSFOR YÜKLERİ

Annex IV



*International Centre for Science
and High Technology*

International Environment Institute of the
Foundation for International Studies

*Workshop on Environmental Impact Assessment and
Siting of Industrial Activities through Geographic
Information Systems (G.I.S.)*

2-6 October 1995
Gozo, Malta

Final list of participants



ICS
International Centre for Science and High Technology

**International Environment Institute of the
Foundation for International Studies**

*Workshop on Environmental Impact Assessment and Siting of Industrial
Activities through Geographic Information Systems (G.I.S.)*

Gozo, Malta
2-6 October 1995

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ANNEX V

**ENVIRONMENT IMPACT ASSESSMENT AND SITING OF INDUSTRIAL
ACTIVITIES THROUGH GEOGRAPHIC
INFORMATION SYSTEMS
2 - 6 OCTOBER 1995
GOZO - MALTA**

FINANCIAL STATEMENT

	LM	USD
1 Subsistence Allowance to Participants	2,182.34	6,328
2 Air Tickets	2,089.00	6,058
3 Board & Lodging at Ta' Cenc Hotel	4,592.65	13,317
4 Airport Assistance	18.40	53
5 Title board for conference	48.30	140
6 Transport	716.29	2,077
7 DHL Courier Service	11.00	32
8 Computer Premium Insurance/Rental	132.00	383
9 Administrative Charge:-		
Promotion & Hospitality		
Stationery (Folders, note pads, name tags etc)		
Staff remuneration & Overtime		
Secretarial Assistance	2,500.00	7,250
Handling Charges		
Communications (fax, telephone etc)		
Preparatory Meetings		
Bank Charges		
	12,289.98	35,638

UNIDO CONTRACT REFERENCE: 95/207/IR PROJECT US/GLO/95/105

Ma
29/1/96

[Signature]
27/1/96