United Nations Environment Programme

UNEP(OCA)/MED WG.22/1
24 October 1990

Original: ENGLISH

MEDITERRANEAN ACTION PLAN

First Task Team Meeting on the
Climatic Changes on the Island of Rhodes

Athens, 23-24 October 1990

REPORT

OF THE FIRST TASK TEAM MEETING ON THE CLIMATIC CHANGES ON THE ISLAND OF RHODES

U N E P
Athens, 1990

TABLE OF CONTENTS

BACKGROUND

The greenhouse effect is Man's most pressing environmental problem, one which presents major scientific challenges across a wide range of disciplines. Changes in global climate between now and the middle of the 21st century are likely to be dominated by the influence of global warming due to increasing concentrations of carbon dioxide and other gases in the atmosphere. These greenhouse gases individually and collectively change the radiative balance of the atmosphere, trapping more heat near the Earth's surface and causing a rise in global-mean surface air temperature and as a consequence substantial global warming is virtually certain.

The question of the probable climate warming in the next few decades is a question concerning both the world in general and the Mediterranean in particular.

In spite of uncertainties surrounding predicted climatic changes, greenhouse gases seem to have accumulated in the atmosphere to such a level that the changes may have started already and their continuation now may be inevitable.

There is a consensus in the scientific community that if allowed to continue to build up, a doubling of the greenhouse gases concentration (relative to the pre-industrial era) will occur sometime in the 21st century, possibly as early as 2030 AD. A corresponding global increase of temperature of between 1.5E-4EC is predicted, to become effective 2-3 decades later, in consideration of the lag in homogenization effect.

Cyclogenesis and rainfall are often promoted by land-sea temperature contrasts. Because land and sea have different effective thermal inertias, a large-scale warming could affect this contrast, possibly reducing it in winter months. This could in turn lead to reductions in rainfall and in storminess, particularly in the Eastern Mediterranean Basin. On the other hand, warmer sea surface temperatures both in the Mediterranean and in the North Atlantic could lead to increases in atmospheric moisture and thus precipitation.

Another main consequence of a warmer atmosphere is an acceleration of the current rise of sea level, due to the melting of alpine and polar glaciers and to the thermal expansion of oceanic waters. Sea-level has been rising since the last glacial maximum (120m rise in last 16,000 years at rates as rapid as 8 to 12 mm/year). In recent historical times, the rate has been 0.5 to 1.5 mm/yr. Analysis of tide gauge data, the principal source of evidence for detecting relatively short-term sea level trends, suggest the world-wise rise has been about 10-15 cm in the past 100 years.

Depending on the extent of oceanic thermal expansion and on (especially) the behaviour of the polar ice caps (Greenland and the western Antarctic ice shelf), conservative to moderate estimates of sea level rise range 13-39 cm (by 2025), 24-52 cm (by 2050) and 38-91 cm (by 2075). The Villach 1985 Conference concluded that a global warming of 1.5E-4.5EC would lead to a sea-level rise of 20 to 140 cm. Future sea level rises have been estimated at the UNEP Meeting in Norwich, September 1987. The best estimate of change between 1985 and 2030 is 14-22 cm, the approximate rise of sea level over the past 100 years.

There will be a significant lag in sea level rise, however coupled with oceanic thermal inertia. For example, if greenhouse gas concentrations stopped increasing in the year 2030, warming would continue for many decades. Since the glacial melting and thermal expansion of the oceans would continue, so would sea level rise.

Superimposed on sea level rise will be the effects of local tectonic and sediment compaction. Vertical earth movements in the Mediterranean commonly occur at a rate of 1-5 mm/year averaged over thousands of years, and 3-20 mm/year averaged over 15-20 years. Local subsidence can exceed 5 mm/yr. It follows that in the future the economic cost of protecting or abandoning structures or land on the direction of Mediterranean coast will depend strongly upon the local land movement coupled with sea level rise. Where land is subsiding, the net relative change could be much more than the global eustatic rise of sea level; where land is rising, the relative change will be significantly reduced.

OBJECTIVES AND OUTPUTS OF THE STUDY

1. The objective of the Rhodes Island study is to assess possible implications of expected climatic changes on ecosystems, land-use and sea-use practices and other human activities and to propose suitable management and policy response options.

The study is expected:

- to examine the possible effects of sea level changes on the coastal ecosystems;
- to examine the possible effects of temperature increases on the terrestrial, aquatic and marine ecosystems, including the possible effects on economically important species;
- to examine the possible effects of climatic and ecological changes on the socio-economic structures and activities;
- to determine areas or systems which appear to be most vulnerable to the above changes; and
- to propose suitable management and policy response options.

2. The study will be based on:

- the best available knowledge and insight into the problems relevant to the Island of Rhodes;

- assumptions accepted at the recent UNEP/WMO/IPCC Conference of 1990, i.e. increased temperature of 1.5-4.5EC and sea level rise of 20-100 cm before the end of the 21st century.

3. Main outputs of the study will be:

- detailed information on the physical setting of the Island of Rhodes;

- a database for coastal zone management;

- the identification of the most important current environmental and socio-economic problems;

- the development of strategies for the Island of Rhodes in the changed climate conditions; and

- proposal of management and policy options.

4. The project will be carried out under the auspices of the national and local government authorities in collaboration with the Mediterranean Co-ordinating Unit, experts from Greek Universities and Institutions and international experts.

The Task Team co-ordinator will be a Greek expert nominated by the national authorities.

The Task Team will be established by the national authorities, in consultation with the local authorities and the Mediterranean Co-ordinating Unit. The Task Team will be composed of Greek experts covering most of the subjects appearing in the outline of the report and representatives of local and national governments, the Senior Marine Scientist of the Mediterranean Co-ordinating Unit and an international expert selected by the Unit.

Through the Mediterranean Co-ordinating Unit, cooperation will be established between the Rhodes Project and other relevant UNEP projects.

REPORT OF THE MEETING

1. The meeting was opened under the chairmanship of Mr. L. Jeftic and the co-chairmanship of Messrs Perissoratis and Georgas. Participants (Annex 1) adopted the agenda of the meeting (Annex 2). Messrs. Sestini and Georgas acted as rapporteurs to the meeting.

2. Mr. Jeftic summarized the organization and activities of UNEP's Mediterranean Action Plan and illustrated in particular the purpose and findings of the Blue Plan study, which projects scenarios of population and economic development to the year 2020. He then discussed the involvement of UNEP in climatic change assessment, particularly the impacts of greenhouse warming in the Mediterranean region in general, and in particular on selected deltaic coastal zones. He then presented update estimates of global warming and consequences as contained in the WMO/UNEP/IPCC 1990 assessment, and distributed excerpts of revised models of temperature changes for the Eastern Mediterranean area, produced for UNEP by the Climatic Research Unit of the University of East Anglia, England.

3. Mr. Sestini summarized the approaches and findings of the two case studies: Consequences of climatic changes for the Nile Delta and Po Delta-Venice lagoons, prepared for the UNEP's report "Impact of Climatic Changes in the Mediterranean Region".

He emphasized in particular:

a) the problems encountered in identifying and defining the present physical and socio-economic parameters of the two regions and in evaluating their possible changes in the next decades given their complex inter-relations.

b) The difficulties of making an analysis of impacts of climatic changes that are still undefined, and at best not yet modelled on a sufficiently local scale (the individuality of local climatic conditions is particularly stressed by the analyses of long-term meteorological observations that cover past 50 - 150 years).

The two cases studies have shown that the most important changes involve:

(1) Atmospheric circulation - with consequences for precipitation, and for waves and currents, hence for water resources and coastal stability.

(2) Increased temperature, with consequences for lagoonal and wetlands biosystems, and for arrangement and movement of the water masses in shallow sea (e.g. stratification, currents).

(3) The consequent rise of sea level, which will exacerbate the present trends of coastal erosion due to river damming and to shoreline constructions; threaten the lagoonal ecosystems (even if the rise is small) and increase soil salinities.

The major problem of the coastal zone in the two case study areas is that the coastlines are no longer able to respond and to adjust freely to national changes, being more and more tied by roads, by tourism and harbour infrastructures, and by various shoreline land uses.

(4) Finally, the consequences of atmospheric warming for society need to be evaluated in relation to scenarios of economic and demographic changes.

4. Mr. C. Perissoratis introduced the Thermaikos Gulf case study, explaining why this specific example in Greece was chosen, how it developed and which topics it was decided to investigate. Mr. D. Georgas then illustrated the methodology followed, the problems encountered in data collecting, from published sources and from government authorities. The aim was primarily to define the present state of the environment, on which different scenarios of climatic change could be superimposed. He stressed also the desire to stimulate awareness on the part of decision-makers, especially in regard to long-term planning. Several examples from the case study were given. To conclude, Mr. Georgas mentioned the problem of offering uncertain conclusions in regard to impacts, and of giving policy alternatives at the forthcoming official presentation of the Thermaikos Report.

5. The following general discussion covered several technical problems regarding climate change impact studies, raised by the Task Team members present. Prof. Laskaratos pointed out the utility of comparing the measured variations of sea and air temperatures during the last three decades, with climate warming forecasts and illustrated examples from several stations in the Black Sea, the Adriatic and in the Aegean Sea.

6. Mr. L. Jeftic explained how the Island of Rhodes project of climatic change impact was initiated in collaboration with the Ministry of the Environment, on the basis of the unique features of the Island (Annex 3) and as a part of the comprehensive coastal management project of the Island of Rhodes. Components of the comprehensive project are presented in Annex 4.

7. The project co-ordinators, Messrs D. Georgas and C. Perissoratis proceeded to discuss the workplan of the project and its timetable (Annex 5) and the details of the topical subdivision of the study (Annex 6).

The ensuing discussion covered several subjects. It was agreed that the climatic change assumptions ought to be those of the latest UNEP/IPCC business-as-usual scenario, in their University of East Anglia adaptation to the Eastern Mediterranean.

It was proposed by the Task Team member Dr. Dikaiatos that Cyprus climatic data should be used in order to improve the best climatic prediction.

The Task Team approved the recommendation of Mr. L. Jeftic to obtain results of the scenario for climatic changes relevant to the Island of Rhodes from the University of East Anglia. Such results will be used by the Task Team members for impact analysis. The co-ordinators will undertake to start the official procedures to obtain as quickly as possible official records for the island in order to improve the scenario.

All the Task Team members agreed that there should be close co-operation in the exchange of information.

The help of the Municipality of Rhodes and of Ms. Tsakiri would be beneficial in order to facilitate access to the local data on the island.

The Task Team members stressed that, although most of the data on Rhodes are available in the current bibliography, published by the Mediterranean Co-ordinating Unit, they personally are not familiar with the island. Therefore, the co-ordinators recommended that the Municipality of Rhodes be asked to arrange a field trip for the Task Team members in order to examine first-hand the local environment, as well as to obtain recent data from local official sources.

The co-ordinators recommended that it will be useful to circulate among the Task Team members a list of references relevant to the Island of Rhodes study, as soon as the members of the Task Team prepare their respective lists and the combined list will be compiled.

The outline of the work was discussed with each member and the requirements and description was given. The modified outline appears in Annex 6.

8. The meeting was closed by Mr. L. Jeftic.

ANNEX 1

LIST OF PARTICIPANTS

Ms Maria-Chara Alexiadou
Phylis 12
GR-10433 Athens
Greece

Tel:(1) 82 34 874 or (1) 68 32 501/2

Professor John Dikaiakos
Division of Climatology
Dept of Geology
University of Athens
Panepistimioupolis
GR-15784 Athens
Greece

Tel:(1) 88 35 802 or 72 30 963

Mr Dimitris Georgas
Versi 51
Papagou
GR-15669 Athens
Greece

Tel:(1) 65 23 367

Mr Ljubomir Jeftic
Senior Marine Scientist
Mediterranean Action Plan
United Nations Environment Programme
Vassileos Konstantinou 48
P.O. Box 18019
GR-11610 Athens
Greece

Tel:(1) 72 44 536
Fax:(1) 72 91 160
Tlx:222564 MEDU GR

Professor Alexander Lascaratos
Dept of Applied Physics
University of Athens
Ippocratous Street 33
GR-10680 Athens
Greece

Tel:(1) 36 13 504
Fax:(1) 36 08 518

Professor Nikos Margaris
Research Committee
University of the Aegean
GR-11472 Athens
Greece

Tel:(1) 64 42 727 or (251) 20073
Fax:(1) 64 48 428

Mr Constantine Perissoratis
Institute of Geology and Mineral Exploration
70 Mesoghion Street
GR-11527 Athens
Greece

Tel:(1) 79 95 093 or (1) 77 72 891 or (1) 77 07 942
Fax:(1) 77 52 211
Tlx: 216357

Mr Giuliano Sestini
Viale di Mille 125
I-50131 Firenze
Italy

Tel:(55) 58 88 39
Fax:(55) 24 78 591

ANNEX 2

AGENDA

Tuesday, 23 October 1990

09.00 - 09.15	Opening of the meeting
09.15 - 10.00	Implications of climatic changes (L. Jeftic)
10.00 - 10.45	Po delta and Nile delta case studies (G. Sestini)
10.45 - 11.30	Thermaikos Gulf case study (C. Perissoratis, D. Georgas)
11.30 - 12.30	Discussion
12.30 - 13.00	Introduction to the Island of Rhodes case study
13.00 - 14.30	Lunch break
14.30 - 17.00	Detailed content of Rhodes study

Wednesday, 24 October 1990

09.00 - 13.00	Discussion of workplan and work programme for each task team member

ANNEX 3

BASIC FACTS ABOUT THE ISLAND OF RHODES

The island of Rhodes is situated in the eastern Mediterranean Sea in the SE corner of the Aegean Archipelago, in a short distance from Asia Minor.

The island covers an area of 1398 sq. kilometers, and its coastline has a total length of 220 km. According to the 1981 census its population is 88,000 people with an average density of 64 persons/sq. km. According to the same census the city of Rhodes has a population of 41,425 people.

The major characteristic of the demographic evolution of the island is the inversion of the rate of population change of the island, which from negative in 1971 has changed into positive in 1981, something that has not happened in other districts in the eastern Aegean Sea. Major reasons for that change were the return of the natives and the economic development which encouraged the population to remain on the island and attracted employees from other areas of Greece.

It is estimated that the population will reach the number of 117,000 people in 1991 i.e. 67% of the population of the Dodecanese instead of 60% in 1981.

The distribution of the population into urban, semi-urban and rural is 46.7%, 23.3% and 30.0% respectively. 63.9% of the population lives in the lowlands, 19.02% in the hilly areas and 17.08% are in the highlands.

The climate of Rhodes is Mediterranean temperate and the temperature is high throughout the year, the average being 19.1EC. The highest temperature in 1981 was 34.8EC, whereas the lowest 4.2EC. The average rainfall height is 837.8 mm, the number of rainy days 94 throughout the year. A prevailing high relative humidity decreases the influence of high temperature. The regularly blowing winds and the great number of sunny days during the winter are remarkable.

The morphology of the island is hilly with small valleys where agricultural activities are being developed. The lowlands in the southern part of the island cover 27% of the total area and provide 47% of arable land.

The island complex of the Dodecanese separates the populations of the islands both from the economic and the social point of view. Transport cost erase the price of supplies and products and information is limited resulting to difficulties in new technology training and applications.

The establishment of special customs regulations in the Dodecanese, aiming at the development of the area after its connection with Greece, led to the creation of direct trade links with markets abroad. The gradual abolition of these privileges now causes difficulties in trade development. Another special characteristic is the existence of a 4% municipal tax for all imported goods.

Uneven development of the tertiary economic sector and mainly of tourism has hit the primary production sector. In 1986 food imports reached a cost of 4 billion drachmas in an imports total of 10.5 billion drachmas.

Land distribution on the island is as follows: 16% arable land, 47% pasture land, 25% forests, 8% urban land, roads, etc., 4% uncultivated areas and 2% land covered by water.

An increase in the use of agricultural machinery tends to improve productivity and competitive prices, but the low percentage of irrigated land together with the limited use of improved irrigation methods is a major drawback in intensive cultivation (15% only).

Agricultural production does not cover the needs of the local market leading to the increase of the cost of the products due to higher prices in such transport costs and the profit of intermediaries. At the same time imports are continuously increasing. Lack of capital, lack of training and the advanced age of most of the agricultural population creates difficulties in the realization of projects based on contemporary agricultural concepts. It has to be pointed out that demands created by the tourist market are particularly strong and have serious effects on the development, the form and the development limit of the agricultural sector.

Manufacturing activity in the island is carried out by small enterprises occupying less than 5 persons each. Its contribution to the gross product is 10% approximately. Large industrial units deal almost exclusively with the production of sparkling wines e.g. Cair, Fokiali and Emery.

The great influence of tourism explains somewhat the flourishing of handicraft units which cover the needs of the tourist market and the concurrent decline of the large factories.

The sector of services covers a wide variety of activities, which are directly or indirectly influenced by the tourist market. Retail and wholesale trade, restaurants, transport, banking and other economic activities, car rentals, public health services and recreation activities influence and are influenced too by the tourism and hotel business. The variety and the quality of these services contribute to the development of tourism.

Tourism is the decisive economic factor with important contribution in the gross product. The tourist industry is the more dynamic agent with a heavy influence on demand and supply in the wider tertiary sector of services and on the primary and secondary sectors too.

The economy of the island, based completely on the tourist market which is influenced by external factors (international political and economic conditions), shows a one-sided development).

ANNEX 4

COMPONENTS OF THE COMPREHENSIVE COASTAL ZONE MANAGEMENT PROJECT IN THE ISLAND OF RHODES

Land-Based Sources and Dumping Protocols

Liquid Waste Management

Emergency Protocol (Contingency Plan) and MARPOL Convention

Monitoring of Pollution in Rhodes Coastal Region

General Water Resources Master Plan

Implications of Expected Climatic Changes on the Island of Rhodes

Programme of Environmentally Sound Energy Planning

Programme of Protection of Historic Settlements

Training Programme on GIS

Environmental Impact Assessment (EIA)

Development Scenarios

Training Programme on Integrated Planning

Integrated Planning Study for the Island of Rhodes

Specially Protected Areas

ANNEX 5

WORKPLAN

-	Nomination of project co-ordinators	April 1990
-	Establishment of the Task Team	July 1990
-	Preparatory Meeting of the Task Team	23 - 24 October 1990
-	Provisional data collection and relevant documentation	February 1991
-	Analysis and evaluation of the data and documentation collected	April 1991
-	Submission by the Task Team members of individual draft reports	May 1991
-	Presentation and discussion of draft reports at Task Team Meeting	June 1991
-	Preparation of the final draft report	October 1991
-	Presentation of the final draft report at the Task Team Meeting	November 1991
-	Finalization and publication of the final report	January 1992
-	Presentation of the report to national and local authorities	March 1992

ANNEX 6

IMPLICATIONS OF EXPECTED CLIMATIC CHANGES FOR THE ISLAND OF RHODES

1. INTRODUCTION

2. PHYSICAL ASPECTS

2.1. GEOGRAPHY AND GEOLOGY

2.1.1. Geographic setting and geology
2.1.2 Geomorphology and soils
2.1.3. Evolution of lowlands and subsidence
2.1.4. Coastal processes and stability (coastal dynamics in collaboration with Prof. A. Lascaratos)
2.1.5. Discussion of the climate changes implications

2.2. CLIMATE

2.2.1. Temperature
2.2.2. Humidity
2.2.3. Precipitation
2.2.4. Winds
2.2.5. Bioclimatic indicators
2.2.6. Extreme events and other meteorological events
2.2.7. Discussion of the climate changes implications

2.3. HYDROLOGY AND WATER RESOURCES

2.3.1. Rivers
2.3.2. Ground water
2.3.3. Management of water resources
2.3.4. Quality of surface and ground waters
2.3.5. Discussion of the climate changes implications

2.4. MARINE PHYSICAL PROCESSES

2.4.1. Temperature/salinity
2.4.2. Currents
2.4.3. Waves
2.4.4. Sea level
2.4.5. Discussion of the climate changes implications

3. ECOSYSTEMS

3.1. TERRESTRIAL AND AQUATIC (e.g. FOREST, SCRUBLAND, WETLAND, FARMLAND, ETC)

3.2. MARINE

3.3. ECOSYSTEMS PERTURBATIONS (e.g. OVERGRAZING, FOREST FIRES, ETC)

3.4. POLLUTION

3.5. DISCUSSION OF THE CLIMATE CHANGES IMPLICATIONS

4. SOCIO ECONOMIC ASPECTS

4.1. POPULATION
4.2. TOURISM
4.3. INFRASTRUCTURE
4.4. MARINE TRANSPORT AND HARBOURS
4.5. INDUSTRY
4.6. AGRICULTURE
4.7. FISHING AND AQUACULTURE
4.8. DISCUSSION OF THE CLIMATE CHANGES IMPLICATIONS

5. IMPACT OF CLIMATIC CHANGES

5.1. INTRODUCTION

5.2. PHYSICAL ASPECTS

5.2.1. Temperature
5.2.2. Precipitation and humidity
5.2.3. Extreme events
5.2.4. Hydrology and water resources
5.2.5. Hydrography
5.2.6. Sea level
5.2.7. Coastal stability

5.3. ECOSYSTEMS

5.3.1. Terrestrial
5.3.2. Aquatic
5.3.3. Marine

5.4. HUMAN ACTIVITIES